THREADS, TINTS, AND EDIFICATION
PAPERS IN HONOR OF
GLENNA DEAN

Edited by
Emily J. Brown,
Karen Armstrong,
David M. Brugge,
and
Carol J. Condie

CONTRIBUTORS
Kurt Anschuetz
Jeffrey L. Boyer
David M. Brugge
Carol J. Condie
Linda S. Cordell
Nicholas E. Damp
Glenna Dean
Heather Edgar
Catherine S. Fowler
Hayward H. Franklin
Dody M. Fugate
Stephen A. Hall
David Kirkpatrick
Richard Loose
James Moore
Jesse B. Murrell
Anna Rautman
Tammy M. Rittenour
Cordelia Thomas Snow
Regge Wiseman

Papers of the Archaeological Society of New Mexico 36

—2010—
Statements and interpretations presented in the articles are those of the author or authors and do not necessarily reflect the opinions of the Archaeological Society of New Mexico or its individual members.

Published by the Archaeological Society of New Mexico
P.O. Box 3485, Albuquerque, NM 87110

Copyright: Archaeological Society of New Mexico 2010
Printed in the United States of America
ISSN: 0587-1719
TABLE OF CONTENTS

List of Figures and Tables ........................................ iv
Preface .......................................................................... ix
Carol J. Condie
Glenna Dean .......................................................... 1
Kurt F. Anschuetz
Women are Corn, Men are Rain: Agriculture and Movement Among the Tewa in North-Central New Mexico Between A.D. 1250 and 1598 ................. 7
Jeffrey L. Boyer
Identifying Volcanic Material Sources in the Taos Valley......................... 21
David M. Brugge
El Gran Tequayó and Trans-Great Basin Trade................................. 33
Carol J. Condie
Costilla Grande—Where a Bison Made a Fatal Mistake on the Sandia Gravel Tongues in 365 B.C. ........................................ 39
Linda S. Cordell and Nicholas E. Damp
Adobe Melt-Down................................................................ 49
Catherine S. Fowler
Bertha P. Dutton and the Girl Scouts in the Southwest, 1947-1957......................... 61
Hayward H. Franklin and Jesse B. Murrell
Ceramic Artifacts from Sites at Cerro de Los Lunas and Albuquerque’s South Valley, with Observations on Pueblo III Pottery in the Middle Rio Grande Valley................................. 73
Dody M. Fugate
Pueblo Dogs: The Oldest Companions................................. 91
Stephen A. Hall and Tammy M. Rittenour
Optical Dating and New Mexico Prehistory..................................... 101
David T. Kirkpatrick
Metal Projectile Points from the Cimarron District, Northeastern New Mexico ......................... 111
Richard Loose
Archaeoaoustics: Adding a Sound Track to Site Descriptions..................... 127
James L. Moore
Classic Period Farming in the Ojo Caliente Valley............................. 137
Anna Rautman and Heather Edgar
Attractions, Museums, and Responsibilities: A Case Study of the Million Dollar Museum................................. 149
Cordelia Thomas Snow and Glenna Dean
Out on a Limb: Cochineal Production in Spanish Colonial New Mexico?................................. 159
Regge Wiseman
Mesita Lagunitas: Prelude to Ethnogenesis?................................. 165
LIST OF FIGURES AND TABLES

CAROL J. CONDIE

Figure 1. Glenna Dean, age 5. .........................1
Figure 2. Glenna and Dr. Vaughn Bryant, coprologists, Texas A&M. .....................2
Figure 3. Glenna and Tim on their wedding day. ..........3
Figure 4. Glenna presiding over the raffle drawing at the Aztec Archaeology Fair. ................4
Figure 5. Glenna spinning with Navajo women at Tohatchi, 2008. .........................5

KURT F. ANSCHUETZ

Figure 1. The Late Pre-Columbian Pueblo World (A.D. 1300-1598) showing villages with 50 or more rooms (n=96) ................9
Table 1. Summary of Large Late Pre-Columbian Tewa Basin Village Room Count Estimates by District .....................10

JEFFREY L. BOYER

Figure 1. Quarry-collection sites in the Taos Valley. .........................23
Figure 2. XRF results: Silicate by potassium. ..........25
Figure 3. XRF results: Barium by rubidium. ..........26
Figure 4. XRF results: Strontium by rubidium. ..........27
Figure 5. XRF results: Barium by strontium. ..........28

CAROL J. CONDIE

Figure 1. Sketch map, Costilla Grande, LA 37631. A, B, C and D refer to sub-areas within the site. (Note: FCR = fire-cracked rock.) ..........40
Figure 2. Sketch of Hearth 1 in vertical section. ..........41
Figure 3. Hearth 2. (a) sketch of Hearth 2 in plan section; (b) sketch of Hearth 2 in vertical section. ..........42
Figure 4. Projectile points from Costilla Grande. (a) incomplete quartzite projectile point; (b) complete chert projectile point, length: 32.5 mm, width: 29.8 mm; (c) incomplete chert projectile point. ..........43
Table 1. Sequence of Visits to Costilla Grande, LA 37631. .....................45

LINDA S. CORDELL AND NICHOLAS E. DAMP

Figure 1. Map of Middle and Northern Rio Grande Region with Tijeras Pueblo and other locations mentioned in the text (map courtesy of Nicholas E. Damp). ..........50
Figure 2. GIS map of Tijeras Pueblo showing excavated structures of all time periods, including Mound 4 excavated by Peckham in 1986 and AS10a and AS10b reported by the Albuquerque Archaeological Society in 1989 (map courtesy of Glenda Deyloff). ..........52
Figure 3. Stone and adobe wall-footings (and corner) under a layer of adobe melt in Block B, Tijeras Pueblo, as excavated in 1976 (Neg. No. 1013 courtesy of the Maxwell Museum of Anthropology, University of New Mexico). ..........53
Figure 4. Distribution of all tree-ring dates from Tijeras Pueblo, showing numbers of cutting dates (solid gray) and non-cutting dates (hatched) by decade from A.D. 1190 to A.D. 1399. ..........54
Figure 5. GIS map of Tijeras Pueblo. Rooms with tree-ring dates before 1370 from architectural features (roof beams and roof support-posts) are shown in sold grey. Note: dates in this range were obtained from dispersed mounds and the circular kiva. ..........56
CATHERINE S. FOWLER

Figure 1. Dr. Bertha P. Dutton in field clothes, likely in the Galisteo Basin, ca. 1951. Courtesy of the Laboratory of Anthropology, Museum of New Mexico. ...............61

Figure 2. Example of Mobile Camp vehicle, 1950s. Bert Dutton and Jack Stacy, Santa Fe, seated; three unidentified Senior Girl Scouts on the left. Courtesy of the Laboratory of Anthropology, Museum of New Mexico. .............................63

Figure 3. The cooks prepare a meal from the chuckbox on Girl Scout Archaeological Mobile Camp at the Bilbo Ranch, Los Pilares, Cebollita Mesa, NM, 1951. Photo by Bertha Dutton. Courtesy of the Laboratory of Anthropology, Museum of New Mexico. .........................64

Figure 4. Girl Scouts excavating at Pueblo Largo (LA 183), Galisteo Basin, N.M., ca. 1954. Courtesy of the Laboratory of Anthropology, Museum of New Mexico. . . .66

Figure 5. Excavation crew, Pueblo Largo, with Bert Dutton in center, 1956. Courtesy of the Laboratory of Anthropology, Museum of New Mexico. . . .67

HAYWARD H. FRANKLIN
AND JESSE B. MURRELL

Figure 1. Decorated pottery at P III sites in the Albuquerque area, in approximate time order. (Bar data is in percentages within sample; sample totals are at the right.) ............82

Table 1. Decorated pre-P IV Ceramic Types of the Middle Rio Grande Area. .......................74

Table 2. Pottery Type Frequencies at Cerro de Los Lunas, LA 161967. .........................75

Table 3. Pottery Type Frequencies at LA 161967. . . .78

Table 4. Munsell Colors of Refired Sherds from LA 161967. .................................80

Table 5. Decorated Ceramic Frequencies at P III Sites in the Middle Rio Grande District. . .83

DODY M. FUGATE

Figure 1. Large Indian dog from White Dog Cave. Long-haired, tan 1-1.5 yrs old, male, Late Archaic. Peabody Museum, Harvard, #A2997. .............................95

Figure 2. Pueblo short nosed dog from White Dog Cave. Marked like a Border Collie, 8 mos old, female, Late Archaic. Peabody Museum Harvard, #A2994. ........95

STEPHEN A. HALL AND TAMMY M. RITTENOUR

Figure 1. OSL-dated stratigraphic sections of eolian sand with associated archaeology; site age range shown in italics. .................102

Figure 2. Development of site footprint in eolian sand, based on archaeological geologic studies in New Mexico. A recent A horizon soil post-dates the site but merges and blends with the anthroposol. The stable surface may be 5000 years old based on case studies of OSL dating. Because of disturbance, sand in the site footprint and anthroposol may not be suitable for OSL dating. .............................................104

Figure 3. Core area of the Mescalero Sands, Eddy County, with parabolic dunes, blowouts, and sand pedestals formed by twentieth century deflation. The four- to five-meter thick eolian sand in this area is OSL-dated 9000 to 5000 years old. Archaeological sites are locally buried by twentieth century sand but are deflated and exposed in blowouts such as these. The sand sheet is partly stabilized by shrubs of shinnery oak (Quercus havardii) (Hall 2002a; Hall and Goble 2006, 2008). Archaeological sites in areas of thick eolian sand such as this are difficult to inventory. ............105
DAVID KIRKPATRICK

Figure 1. Cimarron area with Slate Hill and Dean Canyon to the north and Chase Ranch Headquarters north of Ponil. .................111

Figure 2. Mouth of Dean Canyon with the Poñil Canyon, looking west (David T. Kirkpatrick June 2009). .........................112

Figure 3. Hand drawn map by Frank Alpers to Larry Murphy showing Cimarron Indian Agency location and recovered artifacts (Courtesy of New Mexico Farm and Ranch Heritage Museum) ..................114

Figure 4. Alpers sketch map of locations for metal points and blanks (Courtesy of New Mexico Farm and Ranch Heritage Museum) .........117

Figure 5. Metal point A: front. .....................117
Figure 6. Metal point B: front. .....................118
Figure 7. Metal point C. .........................118
Figure 8. Profile of metal point C showing curved blade. .........................118
Figure 9. Metal point D: front ......................118
Figure 10. Metal point E: front .....................119
Figure 11. Metal point F: front .....................119
Figure 12. Detail of stem and filed notches on metal point F. .................119
Figure 13. Detail of blunted tip on metal point F. ..................119
Figure 14. Metal point G: front with straight edge on the bottom of the image. ..................120
Figure 15. Detail of stem and filed notches on metal point G. ..................120

Table 1. Chronology of the Cimarron District (after Glassow 1972a:Table 1). .................115

Table 2. Data from Metal Points in the Alpers Collection. .................116
Figure 1. The arc of Tse’ Biinaholts’a Yaki lies between Pueblo Bonito and Chetro Ketl. Note what appears to be a rectangular enclosure in front of the Amphitheater. Photo courtesy of Rich Friedman. ..........................129

Figure 2. 3D computer model showing the Amphitheater’s toric curve. Image courtesy of Jack Crouch ..................130

Figure 3. Stone seating disks in the great kiva at Aztec Ruins. Photo by the author. ..........131

Figure 4. A restored roof support column in the great kiva at Aztec Ruins with the internal structure exposed. Photo by the author. ..............132

Figure 5. Winter solstice sunset at the great kiva at Aztec Ruins. The sun appears through a set of four aligned windows, two on the west wall and two on the east wall. Photo by the author. ..............132

Figure 6. The alcoves (Ojos Tecolotes) in the cliff face at Casamero. Photo by the author. ...133

Figure 7. The Amphitheater (Tse’ Biinaholts’a Yaki) at the geometric center of the Chaco Canyon architectural complex. Note that the Casa Rinconada mound falls on the north-south axis of symmetry. Photo courtesy of Rich Friedman. ..............134

Figure 1. An example of an intricate checkerboard of small cells in a mulched field. ..............143

Figure 2. Excavated section of long, narrow cobble-bordered rows. ......................143

Figure 3. Random pattern of cobbles set into gravel mulch. ..........................144

Figure 4. Pattern of evenly spaced but noncontiguous cobbles and boulders in a gravel-mulched field. ......................144

Table 1. Pottery Tabulations for the Mesita Lagunitas Sites. ......................168
Very often archaeological inquiry relies on the techniques of other disciplines as its practitioners seek to answer questions that can only be addressed through the results of analysis using chemistry, physics, biology, geology, or any of a number of other fields. With her formal training in both archaeology and botany, Glenna Dean exemplifies how multidisciplinary specialization can be achieved and put to remarkable use by a single person. But then, Glenna has always been one to innovate. From her early explorations in experimental archaeology to her development of new laboratory techniques and protocols, Glenna has had the vision to see what was needed and the skills to develop the means to get there.

But Glenna’s vision and skills go well beyond the laboratory. In addition to the archaeobotanical work she has done privately through her own consulting firm, much of her career has been in the public realm, including the offices of the state archaeologists in Texas and New Mexico. Here, she had the vision to push for a law mandating the creation of burial grounds where unmarked burials and their associated artifacts from private land could be securely reburied. Here, she excelled in the third vocation for which she should be recognized—education. Whether helping train law enforcement officers in appropriate techniques for dealing with the above-mentioned unmarked burials or demonstrating ancient dyeing techniques to children at a New Mexico Archaeology Fair, her dedication to educating all members of the general public about archaeology and the importance of archaeological preservation has been unwavering.

It is this conviction that the archaeological and historical heritage of our country is of value to everyone that makes her a natural fit in her latest position as Associate Director of the Northern Rio Grande National Heritage Area (NRGNHA). As much as we miss her in her previous role as State Archaeologist for New Mexico, we look forward to the results of her work with the NRGNHA and any other undertakings, which we know will be carried out with the same vision, innovation, leadership, and sense of community that have exemplified her past endeavors.

Emily Brown
Glenna was born in Texas but spent the second half of kindergarten and all of elementary school in Wichita, Kansas when her father’s company transferred him there. This move, and her Kansas-raised mother, ensured that Glenna never developed a Texas accent. The second half of seventh grade and the rest of her growing up were in Austin, after her father’s company transferred him back. Sandwiched between two brothers, Glenna spent her childhood doing tomboy things like playing sand-lot baseball, having dirt-clod fights, and building forts out of scrap lumber scrounged from home construction sites. Her mother never attended college and her father never finished high school. Nevertheless, she gained a lifelong fascination with archaeology engendered partly from *National Geographic* magazines, the few other books in the house like *Daily Life in Ancient Times*, and partly from her brothers’ arrowhead hunting success, but also from the few details her mother remembered of her own grandmother’s Cherokee childhood. Although she was certain of what she wanted to be when she grew up, pictures in magazines and books in the 1950s and 1960s seemed to limit the field of archaeology to men. A chance discussion with a University of Texas archaeology professor encouraged Glenna to enroll in her first archaeological field school on her eighteenth birthday, one week after she graduated from high school, with money she had saved from summer jobs (and without her parents’ knowledge).

As an undergraduate, she held work-study jobs as a secretary in the Department of Classics at the University of Texas (typing Latin and Greek exams) and as research assistant at the Texas Archaeological Survey and the Texas Archaeological Research Laboratory (washing and labeling artifacts, typing technical reports), which she supplemented with selling baked goods on the sidewalk across from the University. Archaeology mentors importantly included Dr. Dee Ann Story, Dr. David S. Dibble, and Elton Prewitt. A class in pollen analysis charmed her with the beauty of the little critters and she defected across the Brazos to Texas A&M University to continue studying pollen as an archaeological tool with Dr. Vaughn M. Bryant. She served as a graduate assistant in both anthropology and biology at Texas A&M, alternating field research with teaching. She was elected to Phi Beta Kappa, Phi Kappa Phi, and Phi Sigma.
Glenna received a B.A., with honors, in anthropology from the University of Texas at Austin in 1973, an M.A. in archaeology with a botany minor from UT-Austin in 1975, and a Ph.D. in botany, with a focus on palynology, from Texas A&M University in 1978. Her M.A. thesis, *Pollen Analysis of Prehistoric Human Coprolites from Antelope House Ruin, Canyon de Chelly National Monument, Arizona*, focused on Ancestral Pueblo-era coprolites. Her Ph.D. dissertation, *Ethnobotany and Cultural Ecology of Prehistoric Man in Southwest Texas*, focused on the analysis of pollen, bones, seeds, insects, and fur in 7500-year-old human coprolites. As part of her dissertation study, she tracked pollen grains ingested with food from modern fecal specimens—beginning a pattern of experimental archaeology that has continued to the present day. Glenna jokes that she went from kindergarten to a Ph.D. in 22 years with only one semester off. She also jokes that she has pondered the Zen of poop for a significant part of her adult life.

After she completed her Ph.D., she spent four years in Washington, D.C., first as a research associate with the American Anthropological Association researching the status of federally owned archaeological collections in non-federal repositories, and then as an archaeologist at the Interagency Archeological Services, National Park Service, notably serving as the Technical Project Officer for the famed Ozette Village Project. Then came four years in Austin as the Assistant State Archaeologist in a program that was repeatedly recognized as “highly innovative” by the U.S. Department of the Interior. She met Timothy Seaman there, after he was hired by the State Archaeologist to write National Register nominations for Texas archaeological sites. Tim and Glenna married in 1985 and moved to Albuquerque the next year. Glenna established a still-active one-person consulting firm, Archeobotanical Services, although she no longer contracts pollen and macrobotanical analyses. “Folks would call me up, promise me money, and send me dirt,” she recalls. In addition to her archeobotanical consulting, she experimented with replicating ancient spinning and weaving techniques as well as reproducing the dyes used on prehistoric cotton and other textiles. Then she began working with plant and insect dyes used on Churro sheep wool in Spanish Colonial times.

An inveterate experimenter, Glenna has been working most recently with Sandia Laboratories to identify the
residues of corn-kernel beer in pots she made to compare with pottery sherds from New Mexico, Mexico, and Peru. Glenna and her consulting firm received the 2008 “Award for Outstanding Innovation” from Sandia National Laboratories/New Mexico Program for designing a laboratory protocol to identify the residue of the corn-kernel beer in prehistoric sherds.

From 1987 to 1993, she also held a position at the Castetter Laboratory for Ethnobotanical Studies at the University of New Mexico as a Research Associate Professor of Biology. While with the Castetter Lab, she identified pollen grains that provided the first evidence of in-situ pre-Columbian cotton farming at high elevations in northern New Mexico and published a quantification technique used in the effort to find rare pollen types.

Glenna and Tim moved to Santa Fe in 1989, after Tim became Program Manager for the Archeological Resources Management Section of the Historic Preservation Division, Department of Cultural Affairs. In 1994, Glenna accepted a position as Staff Archaeologist at the Historic Preservation Division, primarily to conduct reviews under the state’s new Mining and Reclamation Act, but also to review acequia and other projects. In October 1997, she became the New Mexico State Archaeologist. Among her myriad responsibilities as the State Archaeologist were public outreach activities—including innumerable speeches and public presentations. She also worked with state and federal agencies and the Office of the Medical Investigator, notably helping to train law enforcement personnel in appropriate field techniques to be employed when unmarked burials are discovered. Under her leadership, unmarked burials received much greater protection. Before she decided in 2008 that she had had all the fun she could stand at the state, Glenna fostered the creation of a state law mandating the creation of unmarked burial grounds where human remains removed from private land could be securely reburied along with their associated artifacts. This law took effect in July 2008, but as of this writing, Glenna is unsure whether any reburial grounds have actually been created.

During her 14 years at the Historic Preservation Division, she participated in and later staged the annual New Mexico Archaeology Fair (invented by Lynne Sebastian), which was held in cities and towns throughout the state and was always well attended. Teachers often brought their students to the Fair on Friday and the children then enthusiastically came back, bringing their parents, the next day. In fact, the Fair became so popular that several families from various parts of the state set aside two days to attend, wherever the Fair was held and regardless of distances they had to drive to get there. Another measure of Glenna’s impact is that Tucumcari felt the Fair had contributed so much to the esprit de corps of the town and the surrounding community that they began holding their own annual fair. Santa Fe’s Sun Mountain Gathering and Grants’ Cultural Fair were also preceded by the New Mexico Archaeology Fair.
Figure 4.
Glenna presiding over the raffle drawing at the Aztec Archaeology Fair.

Still holding the title of adjunct professor in the Department of Biology at the University of New Mexico, Glenna has served on the boards of several organizations, including the Archaeological Society of New Mexico, the Santa Fe Archaeological Society, Native Seeds/SEARCH, and the Chihuahuan Desert Research Institute. From 1987 to 1997 she conducted 81 technical analyses (including pollen, macrobotanicals, parasites, and textiles) of samples recovered from archaeological sites. —And, somehow, she still found time to write for both popular and professional publications. Between 1975 and 2009, she published 24 book chapters and articles in professional journals, and designed and organized a public service short on archaeological preservation that was broadcast in all Texas television markets.

Glenna has demonstrated her willingness to devote herself tirelessly to the profession and to the public over many years. She has been a major asset in every position she has filled. Her leadership as State Archaeologist will be keenly missed. As Associate Director of the Northern Rio Grande National Heritage Area, Inc. (NRGNHA), a non-profit chartered by the U.S. Congress in 2006, Glenna now works with governments, tribes, and communities in Rio Arriba, Santa Fe, and Taos counties to use federal funds to help preserve and sustain tradition, heritage, language, and environment into the future. She reminds readers that “three people can constitute a community,” and that archaeology and historic preservation can address the NRGNHA mission (see www.nps.gov/norg for more information).

Perhaps a few personal remarks would not be inappropriate here. In 1996 we (Quivira Research Center) asked Glenna to identify charred plant remains from two small hearths on the floor of a pit house we had excavated on Sandia Pueblo land. Because their appearance was strange, she felt uncertain of their exact species. Typical of her thoroughness, she made a special trip to the Rio Grande Nature Center State Park in Albuquerque and, in order to verify her suspicions, asked them to show her all of their saltbush and greasewood plants. After looking at each and every one, she concluded that our specimens were indeed saltbush and/or greasewood but that the unusually large fissures present indicated the plants were green when they burned, which suggested that more suitable material was not available. This played directly into our hands since the characteristics of the pit house fill and the peculiar placement of the hearths had led us to conclude that the two little fires had been kindled after the pit house was abandoned and the roof had partially disintegrated. Glenna’s conclusions vastly strengthened our fancy that passersby had been hit by sudden intense storms and rushed to shelter in the pit house, frantically snatching whatever they could find for fuel as they ran for cover.

Glenna’s focus on authenticity extended even to the annual Archaeological Fair. Textile demonstrations had been restricted to spinning, weaving, and other fabric techniques because the Fair was usually held in a shopping mall. When Silver City offered us the town plaza
a few years ago, Glenna decided we could safely dye wool yarn with natural dyes. Someone offered us a half-cord of wood, so she decided dyeing the yarn in big washtubs over wood fires would be a great help in recreating historical dyeing conditions. Since all children are apparently born with a natural affinity for fire, the dyeing demonstration became inordinately successful, with little wide-eyed kids (and several wide-eyed adults) standing three-deep—at a respectful distance—around the dye vats.

Finally, it must be said that as much as New Mexico archaeologists lament her absence as State Archaeologist, her enthusiasm, her intelligence, knowledge, and skills, and her wonderful contagious laugh will serve the Northern Rio Grande National Heritage area in an equally meaningful way.

Figure 5.
Glenna spinning with Navajo women at Tohatchi, 2008.

SELECTED PUBLICATIONS
OF GLENNA DEAN


2007  The Simulated Excavation: An Alternative to Archaeological Site Destruction (book chapter). In *Archaeology to Delight and Instruct: Active Learning in the University Classroom*, edited by Heather Burke and Claire Smith. Left Coast Press, Walnut Creek, California. (with Bradley Bowman)


1988 Archaeological Investigations at Sites 030–3895 and 030–3900, Dona Ana County Fairgrounds, New Mexico Office of Contract Archaeology, University of New Mexico, Albuquerque. (with Timothy Seaman and Peggy Gerow)


1986 The Prehistory of Trinity County. In Trinity County Beginnings (P.B. and J. W. Hensley, Coordinators), pp. 2-5. Trinity County Historical Commission, Groveton, Texas.


1984 The Past is in Your Hands. Four and one-half minute PBS-style public service announcement broadcast in all Texas television markets. I conceived the project, arranged for site visits and interviews, and designed the general flow of images in the final product. Camera work and post-production performed by a local (Austin) video production company.


1975 A Preliminary Report of Hinds Cave, Val Verde County, Texas. Texas A&M University Anthropology Laboratory Reports No. 8. (with Harry J. Shafer, Phil Dering, and Vaughn M. Bryant, Jr.)

WOMEN ARE CORN, MEN ARE RAIN: AGRICULTURE AND MOVEMENT AMONG THE TEWA IN NORTH-CENTRAL NEW MEXICO BETWEEN A.D. 1250 AND 1598

FOREWORD

Glenna Dean and I collaborated in writing a small article, which, among other things, contrasted the worldviews upon which Pueblo, Hispanic, and Anglo-American communities have traditionally relied in motivating and organizing their interactions with the northern Southwest’s cool, high deserts (Anschuetz and Dean 1994). In our discussion of the cultures and histories of the diverse Pueblo communities, we noted, “In their many understandings of the cosmos, the different Pueblo peoples consider the substance of corn, the souls of humans, the spirit of the supernatural beings who inhabit the underworld, and the clouds to be composed of the essence: water” (Anschuetz and Dean 1994:123). This statement, which is stamped with Dr. Dean’s influence, contributes to the conceptual framework upon which my essay now builds.

INTRODUCTION

The archaeological record of the late pre-Columbian (ca. A.D. 1250-1598) landscape of the Tewa Basin in north-central New Mexico is richly textured with the traces of nearly 100 large (50-2,000+ rooms) villages and literally thousands of hectares of agricultural fields. The distribution of the field remnants is widespread. They extend from the banks of the localities’ streams high into the pinyon-juniper woodland habitat, and they sometimes cover the entire tops of large mesas. Nevertheless, consideration of the dynamic ecological constraints differentially imposed upon the Tewa Basin’s many settings, the material needs of the people to sustain their families and communities, and the relative agricultural potential of the land based on the Tewa’s traditional farming technologies indicates that there is an overabundance of residential architecture. If the number and size of the Tewa Basin’s great pueblos are poor estimators of late pre-Columbian population size, then it is reasonable to suggest that some cultural mechanism must have contributed to formation of the fascinating archaeological patterns that we see today.

This paper examines the proposition that patterned population movements in response to, as well as in anticipation of, shifting ecological opportunities and constraints in the late pre-Columbian Tewa Basin landscape underlie the formation of the big villages and their associated fields. My discussion consists of five parts. The first considers factors that contributed to the development of the aboriginal Tewa agricultural system at a landscape scale. The second estimates the architectural investment represented by the Tewa Basin’s 96 great pueblos. The third and fourth sections look at the behavioral and ideational implications of the analogy “people are to villages as corn is to fields” (Ortman 2009:19, emphasis in original) and women are corn and men are rain, respectively. In the final section, I review steps already taken toward building a framework for an anthropological archaeology of Tewa agricultural and residential movement.
OUTSTANDING IN THEIR FIELD (BY KNOWING WHEN TO LEAVE IN ORDER TO RETURN)

The past two decades have witnessed considerable research examining the agricultural strategies and tactics employed by late pre-Columbian Tewa Basin populations to make their living. Much of this work originates from within the academy (Anschuetz 1998a; Dominguez 2000; Hudspeth 2000; Maxwell 2000). A number of cultural resource management (Anschuetz 1998b; Anschuetz et al. 2001; Scheick and Deyloff 2004) and water rights case studies (Anschuetz et al. 2000; 2006) have contributed additional information about the scale, structure, and temporal systematics of Tewa farming practices dating between circa A.D. 1250 and 1598.

Practical constraints prohibit comprehensive review of this large body of research in this essay. Examination of several principal findings, however, provides much needed context.

Agricultural features often appear to be small and spatially isolated phenomena because of a variety of site formation processes that simultaneously are hostile to the preservation of old field works and hinder the recognition of the traces that survive over the passage of centuries. The reality is that the aboriginal Tewa agricultural system, consisting of diverse technologies to harvest and conserve direct precipitation, intermittent rain and snowmelt runoff, groundwater, and moisture from rivers and springs, was a landscape phenomenon that covered immense geographic expanses (e.g., Anschuetz et al. 2006; Scheick and Deyloff 2004).

The wide distribution of agricultural features is, in small part, a product of the Tewa farmers’ traditional need to diversify their crop locations during a growing season to buffer the threat of localized crop failures because of frost, plant disease, insect predation, etc. (after Ford 1980). This pattern is, to a greater extent, the result of the interplay of four factors, two of which operate at field-specific scales, while the other two are broad-scale, systemic variables.

This first is the Tewa’s dependence upon a nested series of short- and long-term fallow cycles to buffer downturns in crop yields because of soil depletion in fields kept in continuous cultivation over a span of years (Anschuetz 1998a; 2001, after Minnis 1985). The second consists of high-frequency changes in local hydrological contexts of fields planted in runoff-dependent but geomorphically active settings, such as the great bajadas flanking the Rio Grande Valley and its larger tributaries (Anschuetz et al. 2006, after Bull 1997).

The third issue concerns the relatively high per capita farmland acreage that the Tewa people needed to sustain their families and communities. Controlled experiments of the Tewa’s aboriginal farming technologies have not yet been completed to quantify the Tewa Basin landscape’s agricultural productivity. A qualitative modeling exercise based on a variety of ethnohistorical, historical, and experimental data sources has considered the people’s nutritional, textile fiber, storage, and short-term fallow needs (Anschuetz 1998a:405-408). It suggests that aboriginal Tewa populations would have needed to maintain, on the average, upwards of 0.7 ha/person in active (or near-active) cultivation per year. To provide a more comprehensible context, a hypothetical population of 20,000 Tewa people would have needed between 6.3 and 8.8 percent of the total acreage occupied historically by Native American and Hispanic groups within Tewa Basin at any given point in time (Anschuetz 2007:184).

The final factor involves fluctuations in the complex of relationships among inter- and intra-precipitation patterns (Schoenwetter and Dittert 1968), seasonal temperature regimes, and the physiologies of domesticated cultivars that periodically redefined the suitability of narrow valley and upland settings for farmland use (Anschuetz 1998a; 2001). Successful long-term agricultural strategy under these conditions required people to maintain the flexibility to relocate their fields and homes as their perceptions—both realized and anticipated—of ecological conditions warranted. Survey evidence shows...
that the Tewa added to and reorganized their field complexes in the very settings most susceptible to temperature fluctuations over time (e.g., Anschuetz 1998a; Anschuetz et al. 2000). These findings, in view of the fluctuating residence patterns, suggest that the people returned to areas from which they had withdrawn as conditions once again became suitable for resumed agricultural use. The archaeological record (see Anschuetz and Scheick 2006) also shows that Tewa Basin populations began withdrawing from the Chama and Santa Cruz valleys following the onset of the Little Ice Age (Lamb 1977) after about A.D. 1430. This movement was a likely consequence of the cooler annual average temperatures and the accompanying increased risk of late spring and early fall frosts that characterized the Little Ice Age climate (Anschuetz 1998a). Consequently, the Tewa would have needed to replace this lost production by developing new fields in combination with an intensification of their extant farmland efforts in their remaining productive settings.

Further evaluation of ARMS site data and newly reported survey findings (e.g., Marshall and Walt 2007) using ArcView GIS 9.3 software applications, resulted in the identification of 96 large, late pre-Columbian (A.D. 1250-1598) Tewa Basin pueblos (Anschuetz 2009) (Figure 1, Table 1). The settlements vary in size from 50 to

---

**A BOUNTIFUL HARVEST OF HOUSES**

Figure 1. The Late Pre-Columbian Pueblo World (A.D. 1300-1598) showing villages with 50 or more rooms (n=96).
more than 2,000 rooms. Although 55 (57.3 percent) sites have components dating to the late thirteenth century, all were the foci of significant occupations during the Classic period (A.D. 1300-1598/1600). Additionally, anthropologists working among the Tewa during the preceding century (e.g., Harrington 1916) documented that half (n=51 [53.1 percent]) of these settlements are remembered in the stories, songs, and prayers recited in at least one of the living Tewa Pueblos (Ohkay Owingeh, Santa Clara, San Ildefonso, Pojoaque, Nambe, Tesuque, and Tewa Village [on the Hopi First Mesa]).

Investigators offer room count estimates for 62 (64.6 percent) of these sites. The sum of these estimates ranges between 24,435 and 28,770 rooms (Table 1). Importantly, however, the Mesa Prieta, Black Mesa, Santa Cruz, Nambe, and Tesuque districts account for most (n=27) of the 34 settlements for which estimates are unavailable. Moreover, four of these locales, the Mesa Prieta, Black Mesa, Nambe, and Tesuque districts, represent areas in which Spanish explorers reported seeing significant habitation during their sixteenth-century entradas. For example, Gaspar Castaño de Sosa (in Hammond and Rey 1966) wrote of visiting Nambe, Tesuque, Pojoaque, and Cuyamunque. He also refers to possibly seeing Jacoma and either San Ildefonso or San Juan (Ohkay Owingeh).

With respect to available historical documentation, a large amount of architectural investment is unaccounted for in the archaeological records of the poorly known 34 villages. In the attempt to begin addressing this significant data gap, I follow a precedent established by Eiselt (2008:8-9) when she estimated the sizes of three Santa Cruz district pueblos for an evaluation of the watershed’s Classic period demographic history. She applied the averages of the available roomblock size and room count estimates for the seven other area villages at the time of her study to her missing cases. Eiselt (2008:8-9) concluded that her average room count estimate—238 rooms (178 ground floor and 60 upper story chambers)—was reasonable for use in her subsequent calculation of population size.

Use of Eiselt’s 238-room constant in the present examination of the late pre-Columbian architectural investment in the Tewa Basin as a whole is a practical and conservative approach for two reasons. First, the Mesa Prieta, Black Mesa, Nambe, and Tesuque districts clearly

<table>
<thead>
<tr>
<th>Tewa Basin District</th>
<th>Minimum Room Estimate</th>
<th>Maximum Room Estimate</th>
<th>Pueblos without Room Estimates</th>
<th>Pueblos with ≥50 to 99 Rooms</th>
<th>Pueblos with ≥100 to 499 Rooms</th>
<th>Pueblos with ≥500 to &lt;999 Rooms</th>
<th>Pueblos with ≥1,000 Rooms</th>
<th>Total Number of Pueblos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesa Prieta</td>
<td>1,450</td>
<td>1,450</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Chama</td>
<td>14,090</td>
<td>17,860</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Santa Cruz</td>
<td>1,730</td>
<td>2,245</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Black Mesa</td>
<td>unknown</td>
<td>unknown</td>
<td>4</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>4</td>
</tr>
<tr>
<td>Nambe</td>
<td>unknown</td>
<td>unknown</td>
<td>7</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>7</td>
</tr>
<tr>
<td>Tesuque</td>
<td>unknown</td>
<td>unknown</td>
<td>2</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>unknown</td>
<td>2</td>
</tr>
<tr>
<td>Northern Pajarito</td>
<td>4,300</td>
<td>4,350</td>
<td>3</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Santa Fe</td>
<td>2,865</td>
<td>2,865</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24,435</strong></td>
<td><strong>28,770</strong></td>
<td><strong>34</strong></td>
<td><strong>17</strong></td>
<td><strong>27</strong></td>
<td><strong>5</strong></td>
<td><strong>13</strong></td>
<td><strong>96</strong></td>
</tr>
</tbody>
</table>

Note:
* If the 34 sites without room count estimates averaged 238 rooms (following a modeling exercise by Eiselt [2008:8-9]), then the total room count estimates would range between 32,527 and 36,862 rooms.
were foci of significant sixteenth century Tewa occupation. Second, the average number of rooms (431, with a standard deviation of ±552) at the 62 better-known Tewa Basin villages is much larger than the average calculated for the subset of seven archaeologically confirmed Santa Cruz district settlements (306, with a standard deviation of ±309). For these reasons, the architectural footprint of the 96 large late pre-Columbian Tewa Basin villages likely represent a minimum cumulative architectural investment on the order of between roughly 32,527 and 36,862 rooms (Table 1).

**AGRICULTURAL FIELDS ARE TO CORN PLANTS AS ADOBE PUEBLOS ARE TO TEWAIN PEOPLE**

After having defined the “Pajaritan culture” during their work on the Pajarito Plateau, Dr. Edgar Lee Hewett and his students, including Sylvanus G. Morley, discovered numerous villages, some of which covered entire mesa tops, belonging to a pre-ceramic civilization when they visited the Tewa Basin’s Chama district in 1910. Morley (1910:24) described these “pueblos” in his journal in terms that express he was clearly impressed with the density and scale of their construction.

Archaeologists soon realized that these “pueblos” were actually the remnants of gridded Tewa fields dating to late pre-Columbian times. Ignoring for the moment that Adolph F. Bandelier (1890) had correctly identified these same traces as field remnants based on his interviews with Tewa farmers more than two decades earlier, Hewett and Morley’s confusion is understandable given their preoccupation with the superficial physical resemblances between the Chama district’s agricultural features and the villages that they had studied on the Pajarito Plateau. While their misidentification belies a parochial view that caused them to favor their findings over the contributions of others, Hewett and his students, nonetheless, unwittingly recorded archaeological observations that fulfill some of the material expectations of a model informed by a fundamental principle documented in Pueblo ethnography to which Glenna Dean and I (Anschuetz and Dean 1994) referred to long ago: The Pueblos, including the Tewa, view themselves and the corn plants upon which they depend in terms of one another.

Scott G. Ortman (2009) cogently discusses the behavioral and ideational implications of the similarities between the field and house construction and organization in the lives of the late pre-Columbian Tewa people. He suggests that by the beginning of the fourteenth century, the Tewa “began to extend relationships between people and buildings to corn and fields,” and by about A.D. 1350, these “symbolic connections between village architecture and agricultural fields actively-structured thought and action in Tewa communities” (Ortman 2009:19). Ortman maintains further that through their reinterpretation of traditional metaphors, which link people, corn, and water into a coherent system of meaning and referent within their evolving landscape, “the analogy people are to villages as corn is to fields developed” as the Tewa and their corn plants together “confronted new experiences with plaza-oriented settlements and farming in the Tewa Basin” (2009:19, emphasis in original).

**WOMEN ARE CORN AND MEN ARE RAIN**

Further unpacking of the traditional metaphors that link people, corn, and water is needed to complete the background needed for my evaluation of Tewa Basin archaeological evidence. Richard I. Ford (1994:513) observes that corn creates Pueblo culture, sustains life, is the authority for social action, and mediates cultural oppositions at all levels. Because corn is imbued with so many layers of meaning and reference, the idea that people are corn represents a relatively base level abstraction, which signifies, in part, the indispensable unity that exists between human and nonhuman dimensions of the Pueblo’s Natural World. A higher-level abstraction, corn is our mother, which is found at every Pueblo in the northern Southwest today (Ford 1994), signifies the people’s absolute dependency on this plant for their existence.
While people in general, and women in particular, are equated with corn, men alone are specifically associated with water in Tewa metaphor (Ortman 2009). In a system of complementarity founded on the signification of oppositions, women (just as corn) bring forth and nourish life in their communities. Men (just as water), in comparison, give life. Importantly, men do not only give life to their communities as fathers, they give life to the land upon which their communities depend as farmers. At the beginning of the planting season, the land’s fertility exists only in the terms of unproven potential. The men not only need to plant their seed in the ground, but they must also engage their landscape in intimate relationship throughout the year. The men give life to the earth, thereby making the land’s fertility a reality, by providing their seeds with the water that they need to germinate and flourish through their physical labors as farmers and their participation in ritual as community members. Within this system of complexly interwoven cultural logic, the many levels of water metaphor can be sequentially unpacked to allow comprehension that men are not just cloud-beings, men are rain.

TOWARD AN ANTHROPOLOGICAL ARCHAEOLOGY OF TEWA AGRICULTURAL AND RESIDENTIAL MOVEMENT

Although the Tewa Basin’s great fourteenth, fifteenth, and sixteenth century pueblos’ final construction footprints convey the sense of sustained occupations and unified social groups, such appearances can be misleading (after Cordell 1998:27). For example, excavation showed that Arroyo Hondo (LA 12) had two major, albeit comparatively brief, occupation episodes (Shapiro 2005). The first, which lasted only about 45 years (A.D. 1300-1345), saw the establishment of a 1,000-room pueblo, whose occupation peaked during its third decade of existence. The second, which persisted another 45 or 50 years (A.D. 1370-1415/1420), consisted of a settlement of 200 ground level rooms imposed largely on top of the original mound.

The well documented Arroyo Hondo case study (Shapiro 2005) complements what is known about the broad outline of the Chama district’s very large pueblos (Anschuetz and Scheick 2006) and the various factors that required the Tewa to develop ways to maintain access to an expansive land base needed to cope with ever-changing agricultural potentials among the Tewa Basin contrasting localities (see above). In combination, these diverse data sets underscore Linda S. Cordell’s observation that the people were “part of a larger but much more open social world in which the notion of abandoning a dwelling or a site may have been of minimal importance, perhaps something to have been embraced rather than resisted” (1998:91). They also underlie the recent observation that the Tewa raised movement, as a landscape theme, to a high-level organizational response to mediate sources of discord among their homeland’s matrix of environmental, economic, social, and ideational relationships (Anschuetz and Wilshusen 2008; see also below). With respect to their primacy in the Tewa’s system of corn metaphors, fields and houses together were at the front and center of these oppositions.

These archaeological observations and ideas about the fluidity of village life, although relevant and interesting, alone are insufficient. They represent only the first steps in the examination of movement. A compelling question persists: How did the Tewa organize their communities such that village residents could come and go at frequent intervals by forming and reforming social relationships that crosscut the physical boundaries defined by their architecture?

In their comparative evaluation of how the different late pre-Columbian Tanoan communities (the forbears of the Northern Tiwa, Southern Tiwa, Tewa, and Towa pueblos) coped with the challenge of incorporating their peoples into large villages, James L. Moore and Jeffrey L. Boyer (2009) offer keen insights into the flexibility built into the Tewa’s moiety system. As known through ethnographic study (Ortiz 1969), the northern Rio Grande Tewa social system includes a layering of seasonal (Summer-Winter) and directional (North-South) moieties,
which feature more elaborate organizational and structural roles in comparison to the moieties used by their Tiwa and Towa counterparts. In addition to the oversight of seasonal ceremonial functions, the Tewa’s Summer and Winter moieties involve the transfer of social and organizational authority within the community over the span of the annual cycle (Ortiz 1969).

In addition to possessing Summer and Winter moiety societies, Tewa social system has six nonaligned societies whose members are recruited without regard to their moiety membership. These nonaligned moieties, in turn, mediate between the seasonal moieties (Ortiz 1969:82). Importantly, too, Ortiz (1969) reports that before about 1900 nearly every Tewa adult belonged to one or another of the societies (and occasionally two when there were too few candidates who were not already members of some other society available for recruitment) at some time in their life. The open recruitment of people to the nonaligned societies needed for community-wide observances, the traditional cultural ideal that all community members participate in society functions, and the flexibility built into the social system that enabled individuals to serve in multiple societies in the advent that critical positions were left unfilled, signify that Tewa social organization could cope with at least some degree of the uncertainty posed by the movement of people among multiple villages. Until out-movement surpassed some critical population level (potentially as few as 52 adults who were qualified to fill the required minimum number of society positions [Ortiz 1969:81]), Tewa dual organization could facilitate fragmentation without inflicting irreparable harm on autonomously functioning residential communities.

Speaking of the pre-Columbian past, Moore and Boyer (2009:135) suggest that the early Tewa elaborated upon the base Tanoan moiety system by amplifying incipient organizational characteristics embedded in the existing structural moieties and assigning them to newly defined seasonal moiety subdivisions. They argue that the superimposition of the seasonal organizational moieties upon the traditional directional structural moieties and the creation of the nonaligned societies facilitated the coalescence of larger numbers of people into the great villages whose archaeological footprints dominate the pre-Columbian Tewa Basin landscape.

Moore and Boyer (2009) emphasize the processes of assimilation and aggregation in their examination of how the northern Rio Grande’s pre-Columbian Tanoan communities grew through the addition of (unspecified) “incoming people.” Their use of these terms, however, is inappropriate in context of the systematics of dual organization (Ortiz 1969). Assimilation implies the existence of social inequalities and aggregation suggests a stable social cohesiveness. With respect to the factionalism that underlies Tewa society and the likelihood that pre-Columbian villages regularly fractured and reformed (Moore and Boyer 2009), neither assimilation nor aggregation might have been fully realized during major spans of Tewa history, but this may have been true most particularly during the interval between A.D. 1250 and 1450 when Tewa movement is most strongly expressed in the archaeological record (e.g., Anschuetz and Scheick 2006). In fact, Moore and Boyer acknowledge, although almost in passing at the end of their paper, that late pre-Columbian Tewa social organization might have facilitated movement and the social redefinition of communities while maintaining essential cultural continuities. “The layered moiety system of the Tewa may have been designed to allow constituent groups to fragment if necessary without irreparably damaging the duality of the Tanoan social structure” (Moore and Boyer 2009:136). Considering the material (as discussed above) and ideational (as discussed by Anschuetz and Wilshusen 2008) bases of movement in Tewa culture and history, I suggest that Moore and Boyer’s observation not only is crucially important, but it also occupies a prominent position in a comprehensive explication of Tewa social organization.

Discussion

Before continuing, it is worth reiterating two key points. First, the Tewa Basin’s archaeological record suggests that the rich assemblage of great pre-Columbian villages dis-
tributed widely across the landscape is the material product of people having moved (Anschuetz and Scheick 2006; Shapiro 2005), likely in accord with the changing productivity of their agricultural lands over time. Second, Moore and Boyer’s (2009) review of Tewa ethnography offers valuable insights toward answering the question of how the people organized their communities within a “more open social world” (Cordell 1998:91) to accommodate movements among villages. This said, I now turn to an examination of other archaeological and ethnographic data, which inform about other social factors that further structured the choreography of movement of the Tewa across their landscape.

The late pre-Columbian period of Tewa history was a time of cultural transformation. The interval between A.D. 1250 and 1350, in particular, was the time of Tewa ethnogenesis during which the Tewa began the long process of “becoming” (Anschuetz and Wilshusen 2008). Not only did the Tewa redefine the dual organization upon which their society was based to accommodate movement (after Moore and Boyer 2009), the Tewa, who are the descendents of Ancestral Puebloan peoples from the northern San Juan and the northern Rio Grande alike (Anschuetz 2007; Anschuetz and Wilshusen 2008), collaborated in forging a qualitatively new kind of social organization in the Tewa Basin.

Constructed from hybridity and heterogeneity, with their immigrant and aboriginal forbears each donating selected aspects of their age-old cultural traditions to the mix of negotiations, the Tewa imbued their newly formed community with a distinct cultural identity (Anschuetz and Wilshusen 2008). With readily fractious lineage segments forming their organizational foundations, the Tewa would have needed to mediate whatever tensions arose expeditiously. On the one hand, their complexly layered and crosscutting system of organizational moieties, structural moieties, and nonaligned societies made possible the integration of the Tewa villages’ disparate social constituencies. I suggest, however, that this system is sustainable only up to certain limits with respect to the shifting constraints defined by the Tewa Basin’s dynamic ecological and social systems. When a Tewa village approached its population and material thresholds with respect to its local ecological and social circumstances, the same organizational and structural features that promoted intra-group cohesion under favorable ecological conditions enabled undampened factionalism to reduce the size of the co-resident group through movement. Simultaneously, the people who opted out of the troubled settlements were able to exercise opportunities afforded by the Tewa’s dual organization to find new homes, including at villages elsewhere in the Tewa Basin, where prevailing ecological and social circumstances enabled either new or renewed local population growth.

Other archaeological studies add to our understanding of how the Tewa further reshaped their interactions with one another, as well as with the Tewa Basin landscape. At the regional level, the Tewa Basin’s archaeological assemblages show that the Tewa began to differentiate themselves materially and organizationally from their neighbors, the northern Tiwa and the Keres, during the late thirteenth century (e.g., Fowles 2004a, 2004b). Through a process founded upon intentional impermanency, movement, and renewal, the Tewa created and maintained the boundaries of the Tewa Basin as a distinct cultural province to sustain their community integration and to distinguish themselves from all others in the Pueblo World (Anschuetz and Wilshusen 2008).

As documented through the Arroyo Hondo excavations, architectural evidence indicates that notable organizational change also took place simultaneously at the intrasite level. Two patterns are particularly relevant to this discussion. First, the size and connectedness of household units decreases over time (Shapiro 2005). Second, the publicly accessible, communal grinding rooms that characterized Arroyo Hondo’s earlier occupation were replaced by smaller, solitary chambers placed at the back of household unit near the store rooms (Shapiro 2005).

Importantly, neither of these patterns is exceptional in the Pueblo World (e.g., Ortman 1998; Scott G. Ortman, personal communication 2009); they likely are part of a broad Puebloan cultural process. In the context of the
broad-scale societal transformation that distinguishes the process of Tewa ethnogenesis between A.D. 1250 and 1350, however, their significance should not be minimized because they were common features of Pueblo life. The roles of men and women in the structure and organization of the day-to-day lives of their families, as well as their communities, had clearly undergone profound change. These architectural patterns, in combination with the observation that Pueblo men were increasingly privileging themselves with access to esoteric traditional cultural knowledge and prestige (see Fowles 2004a), imply that the power of men to give life was subordinating the power of women to bring forth and nourish life in the domain of public action.

Men were the prominent actors in the village plazas, which are depicted metaphorically as the interior of the Earth Mother bowl (e.g., Swentzell 1990, see Figures 3-2 and 3-7). Within this cultural logic, the valley and hills where most of the villages day-to-day life play out, similarly are portrayed by the interior of the Earth Mother bowl (e.g., Swentzell 1990, see Figures 3-2 and 3-6). Women, in comparison, were symbolically removed from a position of prominence in the public arena (i.e., the publicly accessible communal grinding facilities) to womb-like chambers in the backs of households alongside the storage bins. Here, just as the corn seed with they were intimately associated, they were dependent on men to bring new life.8

CONCLUSIONS

The choreography of movement of late pre-Columbian Tewa communities among their fields and houses in the Tewa Basin landscape features two principal characters cast in opposing roles: Women as Corn and Men as Rain. Through action informed by patterned cultural perception and belief, the Tewa continuously redistributed their fields and people across their homeland through a web of many tiered environmental relationships.

Men, who were the dominant actors of the public domain of the village plaza and the farmers who tended the family fields, led their families in pursuit of the clouds and rain that cycled endlessly, and in forever changing patterns, across the landscape. Tewa families moved among multiple villages and widespread farms for access to productive land in a pattern of use, rest, and renewal.

Women, who occupied a less visible position in the back of stage in the household nearby the stores of corn, nonetheless, retained a quiet, subtle, and essential power of their own, which is as easily overlooked in the grand performance of a community’s dance of life as it is in the archaeological record. Just as the corn with which they had become conceptually equated, the women simultaneously were the past, present, and future of the Tewa people. They offered their families and community essential continuity across their landscape and over the passage of time despite the many changes wrought by the people’s frequent change in residence.

Just as in all other oppositions defined in Tewa culture, corn mediated the interplay of women and men in late pre-Columbian Tewa society. Women and men together recast the idea of community from a place of common residence to a broad network of engaged and negotiated social relationships. They also used the architecture of the homes and fields that they repeatedly cycled through to create, sustain, and extend the distinct sense of their Tewa identity within their landscape. In the landscape that they constructed through their ideas and actions, corn, people (both living and deceased), the supernatural beings and clouds, rain and all other forms of water are essential for giving and bringing forth life.
ACKNOWLEDGMENTS

Glenna Dean is a source of ideas and information about Pueblo agriculture and ethnobotany. She also readily lends a patient ear (and a ready laugh) for ideas that are in their infancy, a gift for which I am grateful as I sort my way through the chaff to find the kernel of idea that I might someday actually use. Linda S. Cordell, Samuel Duwe, Richard I. Ford, Scott G. Ortman, Tessie Naranjo and Richard H. Wilshusen have shared insight with me over the years in ways that have influenced this essay immeasurably. While Glenna and the others have contributed to the good in my argument, I am alone in the responsibility for whatever errors, faulty logic, and, yes, bits of chaff that remain.

END NOTES

1. The Tewa Basin is in no way unique in the Pueblo World for having landscape-scale agricultural phenomena. Complexes covering hundreds, if not thousands, of hectares, are documented elsewhere in the northern Rio Grande, including the Pueblo of Zia (Anschuetz 1995; Ellis and Dodge 1987), La Bajada Mesa (Herhahn 1995), and Taos (Greiser et al. 1992). For example, Herhahn (1995) reports that the La Bajada complex, which borders the Tewa Basin, covers approximately 20 sq km.

2. The seven pueblos which Eiselt (2008) used to calculated the average room count estimate (n=238) cited in this essay are: Ojo Negro (LA 57, 80 rooms), Wiyo (LA 158, 970 rooms), K'ate Owungeh (LA 245, 358 rooms), Tabipanga (LA 254, 202 rooms), Ojo del Zorro (LA 255, 80 rooms), Pueblo Sarco (LA 264, 180 rooms), and La Caja Pueblo (LA 10999, 275 rooms).

3. During plaza ceremonies, men move among the women dancers, who represent corn plants, as clouds. The patowa, men belonging to the preeminent level of the Tewa religious hierarchy, become oxua, or cloud beings, upon their deaths (Ortiz 1969:96). Ortman also documents the directional pattern of linguistic markers (rising and falling tones) in metaphors associated with the patowa and their roles in the cyclical movement of life’s energies (i.e., water in all of its material and ethereal forms) “up” (rising tone) and “down” (falling tone) the Mountains of Cardinal Direction over the span of their natural and supernatural lives. The patowa ascend these mountains as men on the outgoing leg of pilgrimages and as cloud beings following the deaths of their mortal selves via trails or paths (p’b, with retroflex tone). As men, the patowa descend the mountains during their return from their pilgrimages as the real-world counterparts of the cloud-beings following the same streams (p’a, with low tone) down which water, which the cloud-beings bring in the form of rain and snow, flows to the pueblo communities and their fields (Ortman 2009:10-11).

4. Employing a question as a powerful rhetorical device, a Hopi conveyed the meaning of corn among Pueblo people. He asked Elsie Clews Parsons, ”Do we not live on corn, just as a child draws life from the mother?” (1996:21).

5. Tanoan moieties are paired social units that have complementary roles within a system of intra-community relationships based on the mediation of culturally defined oppositions. Ortiz (1969) referred to this phenomenon as dual organization, which he defines as “a system of antithetical institutions with the associated symbols, ideas, and meanings in terms of which social organization takes place” (Ortiz 1965:389). Moore and Boyer (2009:125) distinguish between structural and organizational moieties. The former, which are characteristic of the Tiwa and Towa pueblos, are neither prominently expressed within a community nor apparently serve to organize people or their activities in a consistent manner. Organizational moieties, which are distinctive among the northern Rio Grande Tewa pueblos, are both prominent and effective mechanisms for coordinating the interrelations and activities of community members.
6. Assimilation refers to the process by which a minority group adopts the customs and attitudes of the dominant culture that they join. Complementarity between two opposing social institutions, which is the essential attribute of dual organization, is not the same as subordination and absorption wherein one part is explained in terms of another (see Ortiz 1969). Ethnography teaches us that Pueblo communities are often dynamic and fractious organizations, with people actively shaping and reshaping their social institutions and relationships. Investigators need to demonstrate, rather than merely assume, that Pueblo people formed inherently cohesive, stable wholes when they assembled together in large villages during the pre-Columbian past.

7. Anschuetz and Wilhusen (2008) define ethnogenesis as the process of becoming, which is faithful to both J. D. Hill’s view that ethnogenesis refers to the construction of “enduring identities in general contexts of change and discontinuity” (Hill 1996:2) and the Tewas’ view of themselves (Ortiz 1969).

8. The system of Tewa corn metaphors includes the idea that children are corn (Ortman 2009). Ortman (personal communication 2009) suggests that this idea is comparatively later than the metaphors of women are corn and men are water [rain]. The subordination of women’s power during the early Classic period through the association of women with corn and womb-like chambers in the backs of the household compounds also carries the connation that women are children.

REFERENCES CITED

Anschuetz, Kurt F.

1995 Cultural Resources Survey of Lines 1, 2 and 3 within the Vastar Resources, Inc. 2D-Seismic Project Area Near Zia Pueblo, Santa Ana Pueblo, and Jemez Pueblo, Sandoval County, New Mexico. Southwest Archaeological Consultants Research Series 358d, Santa Fe.


2007 Room to Grow with Rooms to Spare: Agriculture and Big Site Settlement Systematics in the Late Pre-Columbian Tewa Basin Pueblo Landscape. Kiva 73(2):173-194.


Anschuetz, Kurt F., Eileen L. Camilli, and Christopher Banet

2006 Documentation of Pre-Columbian Pueblo Farmland Irrigation on the San Juan Pueblo Grant near the San Juan Airport within the Geographic Scope of New Mexico v. Abbott. Prepared for U.S. Department of Justice, Denver, CO, and USDI Bureau of Indian Affairs, Regional Water Rights, Southwest Region, Albuquerque, NM. Kurt F. Anschuetz, and Ebert and Associates, Albuquerque.

Anschuetz, Kurt F., and Glenna Dean

Anschuetz, Kurt F., Steven R. Dominguez, and Eileen L. Camilli


Anschuetz, Kurt F., and Cherie L. Scheick

Anschuetz, Kurt F., and Richard F. Wilshusen

Bandelier, Adolph F.
1890 Final Report of Investigation Among the Indians of the Southwestern United States, Carried on Mainly in the Years from 1880 to 1885. Papers of the Archaeological Institute of America, American Series 3, Cambridge.

Bull, William B.

Cordell, Linda S.

Dominguez, Steven R.

Eiselt, B. Sunday

Ellis, Florence Hawley, and Andrea Ellis Dodge

Ford, Richard I.


Fowles, Severin F.

Greiser, S. T., T. W. Greiser, and D. Putnam

Hammond, George P., and Agapito Rey

Harrington, John Peabody

Herhahn, Cynthia L.

Hill, J. D.

Hudspeth, William B.

Lamb, H. H.

Marshall, Michael P., and Henry Walt

Maxwell, Timothy D.

Minnis, Paul E.

Moore, James L., and Jeffrey L. Boyer

Morley, Sylvanus G.

Ortiz, Alfonso


Ortman, Scott G.

Parsons, Elsie Clews

Shapiro, Jason S.

Scheick, Cherie L., and Glenda Deyloff

Schoenwetter, James, and Alfred E. Dittert, Jr.

Swentzell, Rina
IDENTIFYING VOLCANIC MATERIAL SOURCES IN THE TAOS VALLEY

INTRODUCTION

Many archaeological projects have recorded and examined sites in New Mexico’s Taos Valley and most note that chipped stone assemblages are often dominated by a dark gray to black volcanic rock that is variably identified as basalt, rhyolite, diorite, glassy andesite, or simply “black stone” (e.g., Bryan and Butler 1940; Renaud 1942, 1946; Rule 1973; Seaman 1983, 1987; Seaman and Chapman 1993; and innumerable management reports, including by this author). Visually this material resembles basalt or glassy andesite, and some mineralogical studies suggest that is rhyodacite (Lipman and Mehnert 1979; Newman and Nielsen 1985).

In 1999, the Museum of New Mexico’s Office of Archaeological Studies (OAS) conducted data recovery investigations at two sites along NM 522 near San Cristobal in Taos County. Both sites, which are located on the northwest slope of a small volcanic cone called Cerro Negro, consist of scatters and concentrations of chipped stone artifacts made of dark gray to black volcanic rock. In addition, one site also showed evidence that on-site outcrops of dark gray to black volcanic rock had been quarried. In 2000, the OAS joined with the Geology/Geography Department at Middle Tennessee State University in a project to use x-ray fluorescence (XRF) to identify the geochemical compositions of quarried material from the NM 522 quarry site and of other locations in the Taos Valley where similar volcanic rock was quarried.

In the interest of presenting the results of our investigations, I will forego discussing the geologic context of volcanism in the Taos Valley—a subject about which, as an archaeologist, I am only barely familiar anyway. Instead, I will unashamedly refer interested readers to the final report of our investigations along NM 522 (Boyer and Moore 2001) and, more importantly, to references cited therein written by actual geologists.

SITE SELECTION FOR XRF ANALYSIS

We began our geochemical study by using the New Mexico Cultural Resources Information System (NMCRIS) database to identify recorded archaeological sites that have been described as quarries or that have quarry components recorded in their site descriptions. This is an important difference between our project and the earlier work of Newman and Nielsen (1985). Newman and Nielsen (1985:263-264) identified sources of what they called rhyodacite from the survey of regional volcanic features by Lipman and Mehnert (1979). At each source, they collected 20 “in situ source samples” from flows and slopes, so as to minimize or eliminate the possibility of deposit mixing and consequent misidentification of materials. Regarding quarries, Newman and Nielsen (1985:264) state, “quarries and workshops were noted during sample collection at the . . . deposit east of Cerro Montoso [note: the source we named Cerro Sin Nombre], Cerro Negro, and San Antonio Mountain,” but, “[n]o quarries or workshops have yet been located for the Ute Mountain, Tres Orejas, or Guadalupe Mountain sources.” We see, then, that they collected raw materials from volcanic sources, but not necessarily from quarry
locations, and, in three cases, from sources without recorded quarries (Newman and Nielsen 1985:273). They appear to have been unfamiliar with the work of Seaman (1983; see also Seaman 1987 and Seaman and Chapman 1993) at Guadalupe Mountain.

Our contention is that, unless materials are collected and analyzed from known quarry locations, we cannot begin to track human use of materials across space or through time. For instance, Newman and Nielsen (1985:270) observe that no artifacts identifiable as coming from Tres Orejas or Guadalupe Mountain were present in their analyzed assemblages from three sites in the southern Taos Valley. They ascribe this absence to the texture of the materials from these sources: "Tres Orejas Mountain and Guadalupe Mountain appear to have been avoided due to the relatively course texture of their respective deposits" (Newman and Nielsen 1985:270). Similarly, they conclude that San Antonio Mountain and Ute Mountain materials were not represented because of distance from the sites whose artifact assemblages were under investigation. However, because the materials they collected and analyzed were not, with one exception, from locations that were actually exploited as quarries, they cannot know with any certainty that absence of materials in artifact assemblages reflects either suitability for tool manufacture or distance.

With that in mind, by using NMCRIS site records to identify sites that are recorded as quarries or have components recorded as quarries, we were able to identify 20 sites in the valley. Four of those turned out, upon inspection of the actual paper records, not to be quarry locations, and were eliminated from the sample. Two other sites that are recorded as quarries are located on the eastern slope of Cerro Montoso (LA 114104 and 114107; see Figure 1); in-field inspection of those sites did not reveal quarry locations. In one case, we determined that the outcrops that appeared to have been quarried had actually been subjected to natural erosive processes, primarily freeze-thaw action, which has resulted in considerable quantities of debris, but not quarrying or reduction debris. We nonetheless collected raw materials from those two sites for XRF analysis, principally to differentiate between these materials, which actually came from Cerro Montoso, and materials identified by Newman and Nielsen (1985) by the name Cerro Montoso but actually collected at a nearby quarry source we have named Cerro Sin Nombre.3 Dungan and others (1984:164) describe this location as "A vent located west of the Red River gorge and east of Cerro Montoso (UCEM—unnamed cerrito east of Cerro Montoso) is the source of a single large dacite flow which outcrops at or near the top of the west wall of the gorge for a length of 12 km."

There are other volcanic rock quarries in the Taos Valley reported by Renaud (1942, 1946) and Hume (1974), while the actual quarry source(s) of the "glassy andesite" reported by Bryan and Butler (1940) has not been recorded. Because these sites are not recorded in the NMCRIS database and their locations are not securely identified, however, we did not attempt to relocate or collect material from them for this analysis. Relocation of those sites should be a focus of future research.

The 14 sites selected for this project, listed below, are shown in Figure 1. We collected 64 rock samples from these sites for XRF analysis. Only surface samples were collected, with preference given to rocks without obvious quarrying or reduction scars, to preserve the archaeological record at each site. At this point, we have defined source groups by the volcanic features with which they are associated, with the exception of Cerro Negro, for which we defined two source groups because quarries have been recorded on the northwest and southeast flanks of that volcano, allowing us to examine materials from those areas for similarities and differences. In addition to relocating known quarries not recorded in the NMCRIS database, future research should also focus on locating and recording more quarries, both at those volcanic features where quarries are already known, and at those where quarries have not been reported. Additional data from additional quarries will allow increased discrimination between materials from the different features (Latham et al. 1992:82). Increasingly fine-tuned discrimination of materials will, in turn, allow better def-
initiatives and characterizations of the Paleoindian, Archaic, and Puebloan cultural landscapes in the Taos and San Luis Valleys, and beyond (Dello-Russo 2005; Dello-Russo and Walker 2009), of which the volcanic features were clearly significant parts. The 14 sites from which we collected samples are:
Cerro Negro NW Group
LA 115543
LA 115544
LA 115545
LA 115546

Cerro Negro SE Group
LA 49686 (Rule Site)
LA 75751 (Turley Mill Site)

Guadalupe Mountain Group
LA 38422
LA 38424
LA 38427
LA 38429

Cerro Montoso Group
LA 114104 (not a quarry)
LA 114106 (not a quarry)

Cerro Sin Nombre Group
LA 114108
LA 114109

RESULTS OF XRF ANALYSIS

Identification of Quarried Materials

Following Lipman and Mehnert (1979), Newman and Nielsen (1985) identify materials in their analysis as rhyodacite, a material intermediate between and with characteristics of both dacite and rhyolite. Distinguishing between different volcanic rocks is based primarily on the amount of silicate (SiO$_2$) present, and Lipman and Mehnert (1979) define rhyodacite as having 62 to 64 percent silicate. According to standards established by Peccerillo and Taylor (1976) and commonly used by geochemists (W. Cribb, personal communication, 2000), however, the transition from dacite to rhyolite occurs at about 68 percent silicate. Newman and Nielsen (1985:263, 265) state that the materials they examined contained between 62 and 65 percent silicate, although they do not provide actual silicate amounts for their samples. According to the Peccerillo and Taylor standards, materials in this range are andesites if they are below 63 percent silicate, and dacite if they are above 63 percent silicate. Dungan et al. (1984:161) state, “Application of the name rhyodacite to rocks with less than 65% SiO$_2$ would be contradictory to the current usage of this term....” Following Peccerillo and Taylor and Dungan et al., then, Newman’s and Nielsen’s samples are either andesite or dacite.

Figure 2 shows the silicate composition of the materials analyzed during this project. We calculated mean figures for the samples for each site and for each source group. As Figure 2 shows, the samples from the Cerro Sin Nombre source are low-silicate dacite, while the samples from the other sources are high-silicate andesite. The exceptions are the non-quarry samples from the Cerro Montoso sites, which are high-silicate basaltic andesite.

Identifying Source Groups

Newman and Nielsen (1985) assert that three trace elements provide the strongest evidence for discriminating between different materials—barium, strontium, and zirconium. They do not, however, state why these elements are most significant. Our analyses show that these three elements have the highest concentrations in each sample, which may explain their apparent discriminatory power.

We chose another approach to determining which elements may be most useful for discriminating between both materials and sources. Having calculated the mean values and standard deviations for each trace element in the samples from each site and each source group, we determined which of those elements show the least and the most variation about their respective means by dividing the single standard deviation values by the mean values (sd/mean). Those elements that show the least variation about the mean have standard deviation values that are equal to or less than 1 percent of their mean values. Those that show the most variation have standard deviation values that are equal to or greater than 10 percent of their mean values. Our rationale for this procedure is that those elements that show the least variation about their means—that have the smallest ranges of values—are most closely correlated with the materials in which they are found. That is, those elements should most
closely identify and differentiate materials. At the same time, because the low-variation values are very similar between samples, we also consider those elements with moderate and large ranges of values. Those elements and the degrees to which their wider ranges of values overlap between materials reflect compositional similarities. If differences seen in those elements with the least variation about their means are also evident in those elements with more variation, they are more likely to be real differences that can be used to distinguish the materials.

Three trace elements fall in the category showing low variation about their mean values (sd/mean ≤ 0.01): barium (Ba), rubidium (Rb), and strontium (Sr). Two elements fall in the category showing the most variation about their mean values (sd/mean ≥ 0.10): copper (Cu) and yttrium (Y). Three elements fall between these categories, with standard deviation values between 1 and 10 percent of mean values (sd/mean ≥ 0.01 and ≤ 0.10): niobium (Nb), zinc (Zn), and zirconium (Zr).

We plotted the values of the elements in these categories against each other in scatter plots in order to determine whether groups or clusters of materials could be visually distinguished. We chose not to perform statistical tests to determine the statistical validity of groups or clusters for two reasons:

- the different sources examined in this study are represented by differing numbers of sites and differing numbers of samples from each site, precluding strict comparability at this time, and
- statistical examination of patterns observed in these data should await collection and analysis of materials from more quarry sites.
For purposes of this paper, I present the scatter plots for the low-variation trace elements, and will discuss them in more detail than for the moderate- and high-variation trace elements, which I will more briefly summarize.

Low-Variation Trace Elements

Five different clusters of values are evident in Figure 3, which plots barium against rubidium. The clusters correspond to the five source locations and site groups identified during this project. Note that the Cerro Negro SE values are so tightly clustered that the site values are indistinguishable from the group mean value. Note also that the Cerro Montoso samples—which, again, are not from quarry locations—are considerably different from the other source groups in the presence of barium. Finally, note that the Cerro Negro NW, Cerro Negro SE, and Guadalupe Mountain samples are most similar.

The same five clusters of values are evident in Figure 4, which plots strontium against rubidium. The Cerro Negro NE and Cerro Montoso values are so tightly clustered that the site values are indistinguishable from the group mean values, and the Cerro Negro NW values are nearly so. In this case, the Cerro Sin Nombre samples are very different from the other sample groups, while the Cerro Negro NW, Cerro Negro SE, and Guadalupe Mountain samples are still most similar.

Four distinct clusters are apparent in Figure 5, which plots barium against strontium. Again, the Cerro Negro SE site values are not distinguishable from the group

![Source Groups and Sites: Barium (Ba) by Rubidium (Rb)](image)

Figure 3.

XRF results: Barium by rubidium.
mean values. However, in this case, the Cerro Negro SE values are also virtually identical to those from the Guadalupe Mountain samples.

The scatter plots of the three trace elements showing the least variation in compositional values indicate that four, and perhaps, five groups of material samples can be distinguished. The groups correspond to the source locations and their associated quarry sites identified during this project. The three source locations on the east side of the Rio Grande are most similar to each other, but appear to be distinct except when barium is plotted against strontium. In that case, the Cerro Negro SE and Guadalupe Mountain materials appear to be nearly identical. Rubidium may be the trace element that most readily differentiates materials from the different sources, since it is the common factor in Figures 3 and 4, where five clusters of values are most evident.

**Moderate-Variation Trace Elements**

With regard to the moderate-variation trace elements—niobium, zirconium, and zinc—five distinct clusters of value are evident when niobium is plotted against zirconium. Those five clusters correspond to our five source locations and site groups. Four clusters of values are evident when niobium is plotted against zinc. The Cerro Negro NW and SE samples appear to be identical, pointing to expectable compositional similarity between these source groups from the same volcanic feature. Four clusters of values are also present when zinc is plotted against zirconium; again, the Cerro Negro samples are almost identical.
When we plot the high-variation trace elements—copper and yttrium—against each other, three clusters of sample values are apparent, one of which consists only of the Cerro Sin Nombre group. The Cerro Negro SE and Cerro Montoso samples comprise a second cluster, and the Cerro Negro NW and Guadalupe Mountain samples comprise the third. The samples making up that third group show the greatest range of values.

**DISCUSSION**

XRF studies of trace element compositional similarities and differences between samples, groups of samples, and source localities show similarities that are expectable given that the volcanic features involved are part of the same volcanic field. Assessing those similarities should allow us to determine whether they are so pervasive as to preclude differentiation, or whether they can be accommodated while allowing differentiation.

Three scatter plots show the same five clusters of site and group mean values. Two of those plots are for the low-variation trace elements rubidium, strontium, and barium, and suggest that rubidium may be the trace element with the greatest capacity to be used for differentiating sample groups. The third plot is for two of the moderate-variation elements, niobium and zirconium. The five clusters of sample values correspond to the five source and site groups defined archaeologically during this project.
Three scatter plots point to four clusters of site and group mean values. One of these is for two of the low-variation elements, barium and strontium. The other two are for moderate-variation elements, niobium, zinc, and zirconium. One sample group, Cerro Negro SE, is not distinct in these plots; otherwise, the four clusters correspond to source and site groups defined archaeologically.

Finally, one scatter plot points to three clusters of site and group mean values when the two trace elements, copper and yttrium, are compared with the highest ranges of variation.

Two observations can be made from the results of XRF analysis of the collected samples:

- First, the Cerro Negro SE samples may be the most difficult to distinguish consistently. Depending on which trace elements are monitored, the Cerro Negro SE materials may be indistinguishable from materials from the Cerro Negro NW, Guadalupe Mountain, or Cerro Montoso source locations. However, it is probably important to note that confusion between the Cerro Negro SE and NW materials, which may be expectable since the two groups are from the same volcanic feature, is seen only when we compare barium and rubidium and when we determine the silicate composition of the samples. In the other plots for the low-, moderate-, and high-variation trace elements, the two groups of materials from Cerro Negro are distinct. Similarly, confusion between Cerro Negro SE and Guadalupe Mountain materials is seen only when we compare niobium and zinc, two moderate-variation elements, and confusion between Cerro Negro SE and the non-quarry Cerro Montoso samples is seen only when we compare zinc and zirconium, two moderate-variation elements, and copper and yttrium, the two high-variation elements. Otherwise, the Cerro Negro SE materials are consistently different from the Guadalupe Mountain and Cerro Montoso materials. The results of these analyses suggest that the Cerro Negro SE materials are most easily confused with materials from other sources when moderate- and high-variation trace elements are compared.

- The second observation is that the Cerro Sin Nombre material is the easiest to recognize of the materials examined during this project. It is compositionally unlike any of the other materials tested and is distinct in every scatter plot. This should make artifacts from Cerro Sin Nombre dacite easily identifiable using geochemical analysis.

CONCLUSIONS

To summarize, geochemical characterization, using XRF analysis, of volcanic rocks obtained from archaeologically-known quarry locations in the Taos Valley reveals that, with one exception, the materials obtained from those quarries are high-silicate andesite. The exception involves quarried material from a previously unnamed source, which we have named Cerro Sin Nombre; that material is low-silicate dacite. These results are important for at least three reasons:

- First, it is important for archaeologists to accurately describe artifactual materials they recover from sites under investigation. Archaeologists, as a matter of convenience, most commonly identify the dark gray to black volcanic rock that is so ubiquitous on sites all over the Taos Valley as basalt. In fact, basalt, being low in silicate composition, is very hard, generally too hard for effective chipped stone reduction (J. Moore, personal communication, 2000). This is not merely a matter of semantics—one person’s basalt is not another person’s andesite. Admittedly, it may be difficult, particularly at the survey level of investigation, to discern high-silicate andesite from low-silicate dacite, but we can make allowances for those issues. For instance, in my own surveys, I now refer to the ubiquitous dark gray to black volcanic rock artifacts as andesite rather than basalt. I know they most likely are not basalt, and, given our knowledge at this time, they are probably andesite, since there are more recorded andesite quarries than dacite quarries.
Second, while we cannot call into question the geochemical data presented by Newman and Nielsen (1985), it seems clear from the reported silicate contents that the materials they collected were andesite or dacite rather than rhyodacite. This seems to be a matter of differing definitions of the rock types, but, like the first issue, is more than a semantic problem.

Third, and perhaps most important for archaeological investigations, accurate characterization of the materials from these known quarries shows that the materials selected for chipped stone came from relatively few sources. In turn, this suggests that volcanic materials suitable for chipped stone artifact manufacture exhibit a relatively narrow range of geochemical characteristics. Thus, while artifacts made of dark gray to black volcanic rock may be ubiquitous on sites across the Taos Valley, the raw materials needed to make those artifacts are not similarly ubiquitous.

The second conclusion of our analysis is the recognition that, not only are the raw materials available from a relatively small number of sources, but those sources are identifiable distinct, based on geochemical characterization. The most important implication of this conclusion is that it should be possible, using geochemical analyses, to identify the sources of volcanic materials used to make artifacts found on archaeological sites in the valley. To date, attempts to pursue this research direction (Boyer, Moore, and Ooten 2001; Newman and Nielsen 1985) have been too limited in terms of the sizes of artifact assemblages to provide adequate testing of the possibility (but see Dello-Russo 2005; Dello-Russo and Walker 2009).

Earlier, I alluded to directions for fruitful research growing from this project. In order to maximize the potential of future research to add to or revise the results of this project, those directions need to include:

- standardization of sample collection procedures, particularly the number of samples from any given location;
- re-location and up-to-date recording of quarry sites observed by earlier archaeologists but not present in the NMCRIS database, including sources in Colorado’s San Luís Valley;
- collection and analysis of materials from those relocated sites;
- systematic survey of volcanic features in the Taos and San Luís Valleys, not limited to those features with andesitic or dacitic outcrops, to find and record additional quarry sites; and
- collection and analysis of materials from those newly recorded sites.

These activities would allow for a fuller understanding of the amount and degree of variation in chipped stone material selection. With that understanding, analysis should then focus on examining artifactual assemblages from sites throughout the valleys. Potentially, data obtained thereby should point to patterns in access to and use of volcanic materials from different sources, at different kinds of sites, across the valley and through time.
ENDNOTES

1. For this paper, the Taos Valley refers to the southern portion of the broad, open plateau in north-central New Mexico and south-central Colorado, often referred to as the Taos Plateau. Bounded on the east by the Sangre de Cristo Mountains and on the west by the Tusas Mountains in New Mexico and the San Juan Mountains in Colorado, the Taos Plateau is the northern end of the Rio Grande Depression or Trough. The northern portion, in Colorado, is known as the San Luis Valley.

2. Our colleagues at Middle Tennessee State University were Lisa A. Ooten, Warner Cribb, and J. Douglas Heffington. Ooten, a student at MTSU at the time, worked with this author to locate sites and collect samples, and performed the XRF analyses under the supervision of Cribb and Heffington. The New Mexico Department of Transportation, particularly Blake Roxlau and Daisy Levine, supported our research by extending funding deadlines even though it was well beyond the scope of the original data recovery project. Steve Townsend at the Archeological Records Management Section spent a good deal of time working with us to identify quarry and possible quarry sites in the valley and helping us find old site forms and reports. Carson National Forest archaeologists Dave Johnson, Maria Garcia, and Bill Westbury extended our permit deadline for the original project and approved visiting sites and collecting non-artifactual materials. Paul Williams, BLM archaeologist, also approved visiting sites and collecting non-artifactual materials.

3. The reader is referred to Boyer, Moore, and Ooten (2001:Tables 9.2-9.6) for XRF elemental compound and trace element data for each sample, site, and group.

4. This may be the source that Shackley refers to as Newman Dome (Dello-Russo 2005). Since we coined the name Cerro Sin Nombre in 2000, I use that name in this paper.

REFERENCES CITED

Boyer, Jeffrey L., and James L. Moore
2001 Chipped Stone Material Procurement and Use: Data Recovery Investigations along NM 522, Taos County, New Mexico. Archaeology Notes 292. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Boyer, Jeffrey L., James L. Moore, and Lisa A. Ooten

Bryan, Kirk, and Arthur P. Butler, Jr.

Dello-Russo, Robert
2005 Recent Work on Late Paleoindian Sites at the Sargent Wildlife Management Area, Chama, New Mexico: Overview and Prospects for the Future. New Mexico Department of Game and Fish, Santa Fe.

Dello-Russo, Robert, and Patricia A. Walker
2009 Late Paleoindian Mobility in Northern New Mexico. Paper presented at the 2009 Annual Meeting of the Archaeological Society of New Mexico, Taos.

Hume, Valerie J.

Latham, T. S., P. A. Sutton, and K. L. Verosub

Lipman, Peter W., and Harald H. Mehnert


Peccerillo, A., and S. R. Taylor

Renaud, E. B.


Rule, Pam

Seaman, Timothy J.
1983 Archeological Investigations on Guadalupe Mountain, Taos County, New Mexico. Laboratory of Anthropology Note 309. Museum of New Mexico, Santa Fe.


Seaman, Timothy J., and Richard C. Chapman (editors)
1993 Guadalupe Mountain, New Mexico: An Inquiry into the Archeology of Place. Office of Contract Archeology, University of New Mexico, Santa Fe.
In 1978 I researched and wrote a paper on a comparative study of Navajo mortuary practices (Brugge 1978). An unexpected finding was a relatively high proportion of shared traits between the Navajos and Pueblos in the Southwest and the Tlingits on the Northwest Coast. This raised the possibility of some sort of contacts between the two regions. In the intervening years I have kept this problem in mind and have concluded that it is deserving of further consideration, although interest in contacts beyond the northern fringes of the Southwest has been slight even since the days of Spanish exploration.

Early Spanish exploration in what is now the American Southwest was long concentrated within the settled areas where Pueblo Indians lived. When expeditions probed outlying regions, they gave the greatest attention to those to the east, the great herds of bison and the tales of large settlements beyond stimulating hopes, and even rumors, of kingdoms of great wealth in that direction. More realistic needs maintained an interest in lands to the south over which all communication with Mexico passed and where traces of mineral deposits were encountered often enough that rich mines might be expected.

Most neglected were the lands lying to the northwest. None of the expeditions prior to colonization penetrated the country in that direction, nor did Oñate’s early and desperate searches for resources to repay his investment extend in that direction.

It may well be that this lack of interest was even encouraged by the Pueblos. Coronado discovered rather too late that the Pueblos had anticipated, erroneously, that his men would be unable to kill bison and would starve to death out on the plains. Despite the fact that the Spanish forces did return as strong and demanding as ever, the stories that originated with the Indians’ stratagem continued to lure Spanish adventurers eastward for generations.

That the Pueblos recognized continuing advantage in this fact is beyond our knowing, but if the Indians could reserve the country to the northwest as a potential refuge that only they knew well, they would have retained an escape route for emergencies. This is, of course, no more than a guess and the secrets of that land were never fully concealed, but Spanish knowledge in that direction was limited and distorted by myths until late in the eighteenth century.

There were reports of a place called Tequayó, a word of uncertain origin, although probably from one of the Tanoan languages of New Mexico, for the accent is on the last syllable as in many Hispanicized Tewa place names, for example Chimayó and Nabajó, and -yo is an augmentative suffix in Tewa while -yu is a locative in Towa (Harrington 1916:572; Harrington 1910:500; Lange and Riley 1966:140). It was said to lie somewhere to the northwest.1

The earliest known use of the term is in 1678 by Diego de Peñalosa (Sanchez 1997:6). A description was written in 1686 by Fray Alonso de Posada who had learned of the place from a Jemez man who had been held captive there for two years. Posada’s account apparently refers to the 1660s when both he and Peñalosa served in New Mexico (Sanchez 1997:7-8; Tyler and Taylor 1958).

Posada equated Tequayó with the Ute country west of Hopi2 in one part of his narrative, but elsewhere located
it to the northwest, reached by crossing both Navajo country and Ute country. It was said to be a place occupied by many different peoples speaking a variety of languages, and the place of origin not only of all the Pueblos, but of the Aztecs and all other peoples as far south as Peru. There is a suggestion in the various accounts of a "longstanding indigenous slave trade" with this nebulous place (Lange and Riley 1966:140, 142, 225-226; Sánchez 1997:5-10; Tyler and Taylor 1958:302-306; and see also Ames 2008).

The earliest recorded journeys in that direction were military expeditions, sent out most often to attack the Navajos. Reeve (1957:39) suggests that the Navajos served as a refuge for Puebloans as early as Oñate's time. Certainly by the 1620s, and probably long before, Spanish forces were campaigning in the Navajo country. The earliest campaigns of which we can be reasonably sure were in 1606 and campaigning continued intermittently into the 1620s (Forbes 1960:108-115; Lange and Riley 1954:45-46). Warfare resumed in later decades and although campaign journals have not been located for these years, by the 1640s there are reports of places called Rio Grande, Nabajó and Casa Fuerte, locations identified repeatedly into the 1670s along with Peñoles and Piedra Lumbre (Reeve 1957:43-50).

These campaigns extended Spanish geographical knowledge into the upper Chama drainage and over the Continental Divide into the upper San Juan drainage, the Rio Grande in the reports being the latter river. The limited familiarity with topography to the northwest lapsed to some degree during the years of the Pueblo Revolt and Reconquest, but when campaigning resumed in the early 1700s, the forces operated over much the same terrain.

The first major eighteenth century campaign against the Navajos was led by Roque Madrid. It set out at the end of July 1705 and returned on 20 August. After crossing the Rio Grande at Pilar, the troops proceeded north and west, traversing the upper Chama drainage to reach the vicinity of present-day Dulce before turning south into the Largo drainage where most of the action took place, one battle being at Los Peñoles. Madrid complained early in his journey of being in country which was unknown to the Spanish, but it was apparently at least somewhat familiar to his Pueblo Indian auxiliaries (Hendrix and Wilson 1996).

There followed several years of warfare with campaigns penetrating Navajo country repeatedly until 1716 (Reeve 1958:217-219). During the ensuing peace, Spanish travel into Navajo country was by missionaries and explorers. One of the former, Fray Carlos Delgado, claimed in 1744 that the Navajos told him of El Gran Tequayó, a settled land ruled by a king who held sway over various nations of that region, some "civilized" and others "heathen" (Hill 1940; Reeve 1959; Sánchez 1997:12). This may well have been the Navajo story of the Great Gambler (Matthews 1994) displaced from Chaco Canyon. Another possibility is that this described a region of powerful chiefs and diverse tribes on the Northwest Coast. These incursions seem not to have ventured beyond the San Juan River, however.

By the 1760s there was some trade between the colonists and the Utes. Ultimately a major effort to blaze a trail through Ute country to the settlements in California led to the discovery that Tequayó was nothing more than the vast region of abandoned pueblos in the San Juan country (Sánchez 1997).

Despite the exaggerated accounts, there appears formerly to have been an active trade beyond this Tequayó and across the harsh land of the Great Basin to some less forbidding country. That country was probably that of the salmon-bearing rivers and Pacific coast of present-day Oregon and Washington. When the Mesa Verde Branch extended well into Utah and the Virgin Branch thrived even into Nevada, the northwestern peoples were not so distant, although even then most contacts may have been indirect. Intervening peoples of the Fremont Culture and perhaps Apachean groups such as the Promontory Point Culture were probably the carriers of goods, ideas and even captives. Certain of the traits, however, if they actually are related, must date from late prehistoric or even early historic times, as the case of the Jemez captive suggests.
There are substantial indications that the Navajos' Athabaskan ancestry derives from more than one source and that a part of that ancestry migrated from the Pacific coast.

First, of course, is the Navajo tradition of the Western Water Clans, said to be descended from people created by Changing Woman after she settled on an island off the western coast. Most reconstructions of the route east taken by these clans would indicate migration from a point directly west of what is today Navajo country, but if they joined the more easterly clans at an early date, a more northerly starting point would be indicated. According to the tradition, the two groups recognized each other as relatives because the clothing and the designs on their tobacco pouches were the same and they spoke the same language (Klah 1942:114-121; Matthews 1994:148-155).

There are two hypotheses as to the origin of the Navajo clan system, one that they brought it with them from the north, the other that it is derived from the clan system of the Pueblos. If a northern origin is accepted, Athabaskans from the Pacific slope must have joined the Navajos, for the northern clan system is restricted to those bands, probably developed under the influence of coastal tribes (VanStone 1974:52). It should be noted that of surviving Apachean tribes, only the Navajos and the Western Apaches of Arizona have clans.

In terms of language, the well known t-k isogloss that separates the eastern Apacheans from those to the west also occurs in the north (Kraus and Golla 1981:80).

While none of these indications are definitive, taken in conjunction with the similarities between the Navajos and the Tlingits, plus the Promontory Point Culture remains at Great Salt Lake, the probability of an Athabaskan migration across the Great Basin deserves serious consideration, especially as one vehicle for late contact between the Northwest and the Southwest (Gunnerson 1956; Steward 1937).

Other resemblances appear more Puebloan in character or too early for Athabaskan participation. Some of the parallels seem no more than faint echoes of each other, the ultimate source being as elusive as the possible relationship. Only in their totality are they persuasive of a connection of any significance.

One apparently early influence appears in the masking traditions of the two regions. While the art styles and ways in which the masks were used remained distinct, a few traits suggest that some sort of communication stimulated innovations across the cultural distance. A general similarity appears in the degree to which masks enclose the wearer's head. In the Southwest the entire head is concealed under many of the masks. On the Northwest Coast several masks encircle the head on at least three sides, generally if not always somewhat less than in the Southwest. (Colton 1949; Dockstader 1954; Stevenson 1970, Pls. XVI & LXI; Suttles 1990:403, Fig. 9). A more specific resemblance is the use of masks with movable beaks, the movable portion always the lower portion. This is true of Shalako and Ogre masks in the Southwest and of many masks on the Northwest Coast (Colton 1949:27, No. 29; Fitzhugh and Crowell 1988:337, Fig. 470; Stevenson 1970:192, Pl. LXI; Suttles 1990:318, Fig. 5, 403, Fig. 96, 469, Fig. 12, 632, Fig. 24). Another masking parallel is the use of masks with movable beaks, the movable portion always the lower portion. This is true of Shalako and Ogre masks in the Southwest and of many masks on the Northwest Coast (Colton 1949:27, No. 29; Fitzhugh and Crowell 1988:337, Fig. 470; Stevenson 1970:192, Pl. LXI; Suttles 1990:318, Fig. 5, 403, Fig. 96, 469, Fig. 12, 632, Fig. 24). Another masking parallel is the use of strongly projecting eyes (Colton 1949:14, Figs. 5, 7, 8, 13, 19; Dockstader 1954:142, Pl. XVb; Stevenson 1970:192, Fig. LXI; Suttles 1990:468, Fig. 11). A more tenuous connection is the use of a feather fan behind a mask, a very common feature on Kachina and Ye'ii masks, but apparently present only rarely and then with feathers carved of wood in the Northwest (Colton 1949; Dockstader 1954; Stevenson, Pls. XVI, LXI, LXXIa, CIIa, CXV; Suttles 1990:469, Fig. 12). It is worth noting here that the use of carved wooden feathers is known archaeologically for the Navajos (Brugge 1996:37-39).

Cloudblower pipes appear in the Northwest as well as in the Southwest, at an early date in both regions (Haury 1957; Suttles 1990:345, 348, 351-352, 521, 556-558).

An interesting late trait is bird drawings with tails depicted with widely spaced feathers. In the Southwest
this feature is seen on historic period pottery from the Rio Grande pueblos, the earliest examples being simply arrays of feathers dating back to about A.D. 1650, while owls on a house panel from the Ozette site on the Olympic Peninsula date between 300 and 500 years ago (Harlow 1973:89-104; Makah Nation Museum, exhibit, 1997).

It is in the production of cloth that a most interesting series of correspondences are to be seen. A progression from southwest to northwest from true vertical looms among the Pueblos and Navajos to vertical fixed warp frames among the Salish and some neighboring tribes to the free-warp frames on which Chilkat blankets are produced would seem to indicate an ever diminishing response to a northward moving influence. There are also similarities in spinning and weaving tools (Amsden 1934; Gustafson 1980; Reichard 1936; Wessen 1990:416-417).

Both the Northwest Coast weavers and some Zuni Pueblo weavers made use of dog hair in their fabrics (Fugate 1998; Gustafson 1980). A perhaps less striking trait, possibly no more than coincidence, is the use of white clay as a fuller and whitener by both the Salish and the Navajos (Gustafson 1980:88; Reichard 1936:47).

A blanket recovered from the Ozette site had stripes of dark blue, a color most likely to have resulted from the use of indigo, first brought to the New World by the Spanish. This plus the presence of iron used sparingly in some tools suggest that the Ozette houses were probably occupied well after A.D. 1500 (Gustafson 1980:25; 95; Wessen 1990:416-417). While shipwrecks might have brought these materials to Ozette, knowledge of how to dye with indigo would require human contact that might be more likely if trade from a more southerly Spanish colony reached the site, passing only through Indian hands or indigo-dyed yarn from a raveled fabric. These suggestions of trans-Great Basin communication should raise the visibility of the region to the northwest. It is an area that has been generally neglected in Southwestern thinking. It would be good to know more about relationships between the Fremont and the Anasazi, how early there was contact between Puebloans and the approaching Athabaskans and just what that contact involved. Similarly, with the expanding Numic peoples, it would be good to know who carried trade goods into and across the Basin, where captives were traded, and where fugitives and refugees found succor. And, perhaps most fascinating for historians, was the lackluster attitude of the Spanish toward exploration to the northwest simply a matter of the greater attractions to the east or did the Pueblos actually discourage travel in that direction? Why do several traits and complexes seem to skip across so vast an expanse? Perhaps the Fremont Culture, still known primarily from open sites, was a richer and more complex way of life than we surmise. Certainly the rock art would suggest this possibility. Might some of them have been speakers of Kiowa-Tanoan languages, some pushed south by advancing Athabaskans, others eastward by Numic pressures? If so, this linguistic relationship to Tanoan speaking Pueblo people might have facilitated communication across the Great Basin. These and a host of other questions arise from viewing the country between the Southwest and Northwest as a dynamic region where events and processes of culture change helped shape the lives of peoples on either side.

In retrospect, it appears to me that we in anthropology have been as slow as the Spanish explorers to seriously look to the country to the northwest of New Mexico.

ACKNOWLEDGMENTS

Thanks are due to Dody Fugate who provided me with information on the use of dog wool and to Lauren Rimbert for careful and expert typing of the final text. All errors or omissions are my own darn fault.
ENDNOTES

1. Another Tewa place name in New Mexico with this suffix is Cundiyó (Julyan 1996:103).

2. In New Mexico Spanish usage, yuta or lluta was applied to all Ute bands, all Paiute bands, and the Chemehuevi.

3. For the locations of the Virgin Branch and the Fremont culture, see John C. McGregor, 1965, Figure 152, p. 309.

4. For the location of the Promontory culture, see Julian H. Steward, 1937.

REFERENCES CITED

Ames, Kenneth M.

Amsden, Charles A.

Bandelier, Adolph F.

Brugge, David M.


Colton, Harold S.
1949 Hopi Kachina Dolls with a Key to their Identification. University of New Mexico Press, Albuquerque.

Dockstader, Frederick J.
1954 The Kachina and the White Man. Cranbrook Institute of Science, Bloomfield Hill, MI.

Dockstader, Frederick J.
1954 The Kachina and the White Man. Cranbrook Institute of Science, Bloomfield Hill, MI.

Fitzhugh, William W., and Aron Crowell (editors)

Forbes, Jack D.

Fugate, Dody

Gunnerson, James H.

Gustafson, Paula

Harlow, Francis H.
1978 Matte-Paint Pottery of the Tewa, Keres and Zuni Pueblos. Museum of New Mexico, Santa Fe.

Harrington, John P.


Haury, Emil W.
Hendrix, Rick, and John P. Wilson  
(translators and editors)  
1966  

Hill, W.W.  
1940  
*Some Navaho Culture Changes During Two Centuries (with a Translation of the Early Eighteenth Century Rabal Manuscript).* Smithsonian Institution Miscellaneous Collections 100:395-445.

Klah, Hosteen  
1942  
*Navajo Creation Myth: The Story of the Emergence.* Museum of Navajo Ceremonial Art, Santa Fe.

Kluckhohn, Clyde, W.W. Hill, and Lucy Wales Kluckhohn  
1971  

Kraus, Michael E., and Victor Golla  
1981  

Lange, Charles H., and Carroll L. Riley (editors)  
1966  

Makah Nation  
1997  
Exhibit, Makah Nation Museum, Neah Bay, WA.

Matthews, Washington  
1994  
[1897] *Navajo Legends.* University of Utah Press, Salt Lake City.

McGregor, John C.  
1965  

Reeve, Frank D.  
1957  

1958  

1959  

Reichard, Gladys A.  
1936  
*Navajo Shepherd and Weaver.* J.H. Augustin, New York.

Sanchez, Joseph J.  
1997  
*Explorers, Traders, and Slavers: Forging the Old Spanish Trail, 1678-1850.* University of Utah Press, Salt Lake City.

Stevenson, Matilda Cox  
1970  

Steward, Julian H.  
1937  

Suttles, Wayne (editor)  
1990  

Tyler, S. Lyman, and H. Daniel Taylor  
1958  

VanStone, James W.  
1974  

Wessen, Gary  
1990  
COSTILLA GRANDE—WHERE A BISON MADE A FATAL MISTAKE ON THE SANDIA GRAVEL TONGUES IN 365 B.C.

Costilla Grande, LA 37631, is one of 27 sites on Sandia Pueblo property in an area of approximately 685 acres in T11N R3E, Secs. 1 and 2, and T12N R3E, Sec. 36. Nineteen of the sites were identified by Keesling in 1980. All 27 sites are located on the first terrace gravel tongues on the left bank of the Rio Grande a few miles north of Albuquerque. The gravel tongues contain cobbles of quartzite, basalt, obsidian, chert, and lesser amounts of other rock, which probably constituted their appeal to prehistoric people. Quivira Research Center’s (QRC) presence on the Sandia gravel tongues from 1982 to 1997 was occasioned by the existence of a gravel lease. We excavated the site in 1991 (Condie and Smith 1992), and bits and pieces of this paper are from the site report. Smith analyzed the lithics, Jack Bertram conducted the faunal analysis and calibrated the radiocarbon date, Kent Stout prepared the illustrations, and Condie was responsible for the remainder of the report.

The rationale for the site’s name, Costilla Grande (big rib), will become evident as the contents of the site are revealed.

THE CULTURAL ENVIRONMENT ON THE SANDIA GRAVEL TONGUES

Of the 27 sites on the gravel lease, several are multi-component, the components ranging from Early Archaic to Pueblo IV. Not all sites have been tested or excavated, but a rough tally, based on both real information and on assumptions (some “components” consist only of a sherd or two), indicates the following components: one Early Archaic, one Late Archaic, two Basketmaker III, seven Basketmaker III-Pueblo I, one Pueblo II-III, seven Pueblo III-IV, two Pueblo IV, two Anasazi of unknown time period, and 12 of unknown cultural and temporal affiliation. QRC suspects, but cannot prove, that several of the “unknown” sites are Archaic, based on numerous U-shaped roasting pits filled with cracked and uncracked quartzite cobbles and charcoal-stained earth (which, unfortunately, lacked the chunks of charcoal then required for radiocarbon dating). It should also be noted that Peckham (1957) excavated three sites that contained Basketmaker III-Pueblo I/II components immediately south of the lease in what is now the Tramway Boulevard/Roy Road right-of-way.

The 27 sites, plus Peckham’s three, exhibit a clear land-use pattern. Habitation sites and campsites are restricted to the terrace edges above the Rio Grande and consist only of Archaic, Basketmaker III-Pueblo I and Pueblo I-II sites. With two exceptions on the lease, Pueblo III and IV sites occur only on the floodplain. (The exceptions—one genuine, the other probably not—are LA 54784, a Pueblo IV quarry site on the terrace edge where a flintknapper discarded his debitage and the corncobs from his presumed lunch in a small pit, and LA 51716, which consisted of a lithic scatter, rock alignments, and a single Rio Grande Glazeware sherd. QRC believes the “structures” may have been the work of children.) Even though Pueblo III and Pueblo IV people apparently never inhabited the terraces, they left a few sherds scattered about, presumably from flint knapping visits or as they traveled to and from the mountains or upstream and downstream.
COSTILLA GRANDE, LA 37631

Costilla Grande is a multi-component lithic/ceramic scatter that measures about 26,000 sq m. It contains clusters of fire-cracked rock and two hearths, but no structures, middens, or other cultural deposits. The site is concentrated primarily along the edges of the gravel tongues, extending roughly 215 m northeast-southwest (Figure 1). Because of the numerous components the site contains, attested by obsidian hydration, radiocarbon, and ceramic dates, Costilla Grande mimics what QRC believes to be the true nature of many of the sites in the 685-acre lease, even though too few sites yielded datable samples.

In comparison with many of the other excavated lithic/ceramic sites on Sandia land, Costilla Grande contained remarkably few hearths and stained areas—only two hearths (one in Area A, one in Area B) and two faint stains (in Area D). Although a scatter of fire-cracked rock was present in Area C, neither hand testing nor blading revealed stains.

Hearths

Hearth 1. Situated in an area of fire-cracked rock, Hearth 1 (Figure 2) measures 106 cm in dia. at the top (4 cm below modern grade), 85 cm in dia. at the quartzite cobble floor, and 30-32 cm deep at the center. Staining and small bone fragments had sifted to 34 cm deep. The dark, friable hearth fill is sharply demarcated from the light-colored calcareous, pebbly soil that surrounds it.

Structurally, Hearth 1 differs from hearths identified at other sites on the gravel lease, which typically are U-shaped hearths filled with charcoal-stained soil and a jumble of cracked and uncracked quartzite cobbles. Hearth 1, instead, had been excavated to a basin shape and the floor and lower wall of the basin lined with quartzite cobbles. Only one complete and one cracked cobble occurred in the above-floor fill. The only other stone was a piece of presumably intrusive obsidian debris (dated at A.D. 900) from 10 cm above the hearth floor.

Figure 1.
Sketch map, Costilla Grande, LA 37631. A, B, C and D refer to sub-areas within the site. (Note: FCR = fire-cracked rock.)
However, even more unusual than the shape were the faunal contents of Hearth 1. Four large bison ribs had been placed on the cobble floor before the dark fill was replaced (Figure 2). Fragments of an additional rib or two were scattered through the fill. A radiocarbon date derived from bone collagen places the ribs at 2240 +/- 80 B.P.:365 B.C. (Beta-51276). Jack Bertram identified the ribs as either Bos or Bison (the radiocarbon date later demonstrated that they are bison). Bertram also provided the calibration for the radiocarbon date.

Hearth 2. Hearth 2 is actually two superimposed hearths (Figure 3). The hearth appeared on the surface to constitute a fairly regular cobble ring, 85 cm north/south by 80 cm east/west. However, after grass and topsoil were removed and the cobbles were exposed from the top, the arrangement was revealed as a half circle of clustered rocks (45 cm east/west by 85 cm north/south) at approximately 10 cm below modern grade and five outlying rocks to the east that formed a partial continuous arc with the denser cluster but lay approximately 10 cm below it (20 cm below modern grade).

Subsequent excavation showed that the cobble scatter associated with the lower hearth measured approximately 60 cm in dia. We could discern no outlines of an excavated pit, but the faintness of the stained soils associated with the lower hearth suggests that it was shallow and that it had probably lain open for a time after use. No artifacts or bone were associated.

The upper hearth was more definite, even though the stained soil never exceeded a medium- to dark-gray intensity. The eastern one-half of the cobble layer had eroded downslope, but the excavated cooking pit itself, 20 cm in dia. by 22 cm deep, appeared to be intact. A collection of 41 bone fragments and a chert knife were lodged at the hearth center underneath the cobbles covering the top of the hearth. In addition, one bone fragment was recovered from screening the top 10 cm of soil above the hearth. None of the bone was identifiable to species, but Bertram believed the bone from above the hearth to represent a very large mammal and the 41 fragments from the hearth itself to represent a very large artiodactyl and thought it was very likely bison. See Bertram’s discussion under Bone, below.

One of the most beguiling questions raised by Hearths 1 and 2 is whether they were contemporaneous. Unfortunately, we could not answer the question definitively because the amount of bone in Hearth 2 was not adequate for derivation of a radiocarbon date. Nevertheless, even though we cannot prove the bones in Hearths 1 and 2 were contemporaneous, to posit two bison kills on two separate occasions with their bones left in two hearths only 60 m apart in an area where not even one bison has been reported before seems a little too fanciful to reflect reality.
ARTIFACTS

Ceramics

Fifty-one sherds, all from the surface, represent 42 to 44 vessels (20 to 22 bowls, eight jars, and 14 undetermined forms). The time periods represented begin at A.D. 500-900 with Lino Gray and continue, with breaks, to A.D. 1400, but not beyond. Types present include the following (dates, where specific, are from Oppelt [2008]): four Lino Gray (A.D. 500-early 900s), five Chaco Corrugated (A.D. 1050-1100), four Gallup Black-on-white (A.D. 1040-1150), 13 Socorro Black-on-white (A.D. 1050-1300), three Los Lunas Smudged (A.D. 1150-1370), one Kwalee Black-on-white (A.D. 1050-1250), two San Ignacio Black-on-white (A.D. 1250-1275—see Table 1 footnote, below), and three Wiyo Black-on-white (A.D. 1300-1400). In addition, unidentified wares include one black-on-white sherd, one black-on-white sherd with mineral paint (pre-A.D. 1200), two black-on-white sherds with carbon paint (post-A.D. 1200), nine gray or brown sherds, and three buff sherds with extraordinarily thick (13 mm) walls (historic?).

Lithics

Landon Smith analyzed the lithics. Of a total of 272 lithic items, 18 are formal tools. Except for five aberrant items (for a description, see Condie and Smith [1992:17-18]), the remainder are debitage, which Smith analyzed according to the methodology developed by Sullivan and Rozen (1985). All lithics are chipped stone (chert, quartzite, obsidian, and basalt). There is no ground stone. The tools, which are both complete and fragmentary, are all from the western portion of the site (Areas A and B) and consist of five typical Archaic flare-shouldered corner-notched projectile points (for three examples see Figure 4), four bifaces, two scrapers, one drill, one knife, one core tool, one chopper, one chisel, one flake tool, and one unidentified tool, possibly a hoe fragment.

Smith’s debitage analysis indicated that Areas C and D were devoted primarily to core reduction and that (no surprise) tool production occurred in Areas A and B.
Jack Bertram identified the faunal remains from the site, all of which were recovered from Hearths 1 and 2 and all of which represented one or more very large artiodactyls, which Bertram initially labeled as either *Bos* or *Bison*. The radiocarbon date resolved the uncertainty for Hearth 1. Because it is important to know whether the bison was killed on the spot or was killed 10 or 20 mi east of the Rio Grande and pieces transported to Costilla Grande, it is worth quoting portions of Bertram’s remarks at length:

**Observations: Hearth 1**

From Hearth 1 were recovered nine distinct collection samples. Of these, six were labeled by excavation bone identification letters referring to four separate bones (Bones A, B, C, and D). The remaining three collection samples were identified by recovery method and context, recovery depth, and/or FS Lot number.

*Hearth 1, Bone A; and Hearth 1, FS Lot 2 Bone A Fragment.* These two collections contained a total of six fragments, all surface-exposure weathered, split, leached, and rootlet-etched. All fragments refit to form the shaft of a left 8th, 9th, or 10th rib of a *Bos/Bison*. The surfaces of these fragments were too weathered to preserve evidence of processing or other modification.

*Hearth 1, Bone B.* This collection was partly fragmented; it refit to form a posterior rib shaft, almost surely a left and probably referable to *Bos/Bison*. Its condition was comparable to that of Bone A (above).

*Hearth 1, FS Lot 3 Bone B Fragments.* This collection of eight fragments was not successfully refitted to Bone B. None were clearly burned, although mild roasting may be present on one or two fragments. Overall condition was as described for Bone A (above).

*Hearth 1, Bone C.* This collection of 16 fragments refit entirely to form a left 9th or 10th *Bos/Bison* rib. Additional refits were found in Hearth 1 Bone D (neck), Hearth 1 FS Lot 4 (neck), and Hearth 1 FS Lot 8/9 (distal blade end). The overall rib remnant after refitting measured 50 cm in length, indicating an original intact rib of about 55 cm total. Only the articulatory apparatus at the proximal end and the last centimeter or two of the distal end are missing from the collection. The shaft appears either to have experienced no thermal alteration or to have been mildly roasted. The refitted ventral (thoracic interior) break line between the parts found in Bone D and Lot 8/9 and the main rib shaft appeared to be an old break, which may have been scored with a knife and then snapped. Preservation, which was slightly better than for Rib A (above), was still too poor to be certain of this observation.
**Hearth 1, Bone D.** Of this collection of three moderately weathered fragments, two refit to each other but not to other fragments in the assemblage. They appeared to compose a segment of a left 10th or 11th *Bos/Bison* rib. The third fragment refitted to Bone C (above).

**Hearth 1, FS Lot 4 (20-30 cm).** This collection came from screening of the fill associated with Feature 2 [Hearth 1]. It contained 49 fragments, of which three were burned black/white. The only other burned fragments from this assemblage were from FS Lot 5 (see below). The remaining 46 fragments were unburned; their condition agreed well with Bones A, B, and C. Of these last, three fragments refit to Bone C (above).

**Hearth 1, FS Lot 5 (30-34 cm).** This collection of 50 definite and probable rib fragments, refitting to no more than 36 pieces, was anomalous in two important ways. First, all fragments were variably burned, with degree of burning ranging from moderate roasting to full burning verging on calcination. Secondly, it appeared to contain a high proportion of rib neck fragments, most of which were from the right posterior ribs. Two refitting roasted fragments were identified as the proximal neck of a right 9th, 10th, or 11th *Bos/Bison* rib. It appears that fragments of two or three ribs, at minimum, are present in this sample, which was relatively well-preserved on account of burning.

**Hearth 1, FS Lot 8/9.** This collection contained eight definite or probable rib fragments. One was refit to the distal end of Bone C (above). Two others refit, but could not be confidently matched to any other items in the collections. These and the remaining five much smaller fragments were all weathered to the degree described for Bones A, B, and C.

**Observations: Hearth 2**

From this feature were recovered two samples.

**Hearth 2, FS Lot 2.** This collection came from the soil above Hearth 2. It consisted of one unidentifiable fragment of cancellous and compact tissue from a very large mammal (e.g., bison), most probably from a vertebra or third phalanx (hoof core). It was badly eroded and damaged by rootlet etching; it probably had been exposed on the soil surface at some period of time in the past, since it also was surface-exposure weathered.

**Hearth 2, FS Lot 3.** This collection came from 5 cm below the upper deposit. It included 41 fragments of no more than 35 bone pieces, none of which were identifiable, but all of which were morphologically consistent with skull, pelvic, and vertebral bone from a very large artiodactyl (again, e.g., bison). The specimens were all weathered to a degree slightly less than that observed in FS Lot 2; all were coated with a fine gray-tan ash/silt/clay deposit. None appeared to have been burned. Due to the poor preservation of these specimens, no evidence of modification was discovered, and the cause of their extreme fragmentation could not be ascertained.

**Discussion...**

Little can be said regarding the materials from Hearth 2, except to note that there was surprisingly little difference in condition between the specimens from above the hearth vs. below the hearth. All materials could have come from no more than one or two fragmentary bison (or similar-sized) bones.

The Hearth 1 collections include at least five and probably more ribs or large rib fragments, definitely identifiable on anatomical and size grounds as being from domestic cattle or bison. On the basis of a late Archaic radiocarbon date, the identification of these items as *Bison* is secure. Only the right ribs evidence any clear thermal processing. It is likely that much of one posterior rib rack (i.e., ribs 8-12 or so) from each of the left and right sides of perhaps only one animal are present. The left and right ribs cannot be demonstrated to have come from the same individual large bovid, but they may well have done so. Only the right ribs appear to have been significantly broken up in the course of processing; only the proximal halves of these ribs may be present. The left ribs, which are surprisingly complete, may never have been fully processed at all.
### CHRONOLOGICAL SEQUENCE AND ACTIVITIES AT COSTILLA GRANDE

In the large aspect, as at many other sites on the gravel tongues, activities at Costilla Grande break into short-term residence and flint knapping. The earliest demonstrable visit was in 4200 B.C. and presaged numerous additional visits that did not end until perhaps A.D. 1400.

Several types of information are present for help in unscrambling the history of Costilla Grande.

1. Areas C and D (Figure 1) are separated from the remainder of the site spatially, by rock type, and by lithic reduction characteristics.

2. Obsidian hydration dates provide another avenue of information to the sequence of usage, although not to carving the site into discrete use areas. Eleven dates from obsidian scattered over Area B indicate a series of visits from 4200 B.C. to A.D. 500, the obsidian flake from Hearth 1 produced a date of A.D. 900, and one flake from Area D produced ventral and dorsal readings of 2900 B.C. and A.D. 1200. (Hydration analysis was conducted by Christopher M. Stevenson and source analysis was conducted by Thomas L. Jackson. Dates have been rounded to the nearest 100.)

3. The radiocarbon date derived from the rib bones in Hearth 1 shows usage of the hearth at 365 B.C.

4. Ceramics indicate visits from Basketmaker III times to Early Pueblo IV.

5. Finally, the few projectile points recovered (Figure 4) seem to indicate visits during Late Archaic times.

### Table 1.
Sequence of Visits to Costilla Grande, LA 37631.

<table>
<thead>
<tr>
<th>Cultural/Temporal Affiliation</th>
<th>Date</th>
<th>Source of Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bajada—4800-3200 B.C.</td>
<td>4200 B.C.*</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>4000 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td>San José—3200-1800 B.C.</td>
<td>2900 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>2700 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>2100 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>1900 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td>Armijo—1800-800 B.C.</td>
<td>no dates</td>
<td></td>
</tr>
<tr>
<td>En Medio—800 B.C.-A.D. 400</td>
<td>600 B.C.</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>365 B.C.</td>
<td>radiocarbon date on bison ribs (raw date = 2240 +/- 80 B.P.[Beta-51276])</td>
</tr>
<tr>
<td></td>
<td>A.D. 300</td>
<td>obsidian, 2 items</td>
</tr>
<tr>
<td></td>
<td>A.D. 400</td>
<td>obsidian</td>
</tr>
<tr>
<td>Basketmaker III—A.D. 500-700</td>
<td>A.D. 500</td>
<td>obsidian, 2 items</td>
</tr>
<tr>
<td></td>
<td>A.D. 500-early 900s</td>
<td>Lino Gray (Oppelt 2008)</td>
</tr>
<tr>
<td>Pueblo I—A.D. 700-900</td>
<td>A.D. 900</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>A.D. 500-early 900s</td>
<td>Lino Gray (Oppelt 2008)</td>
</tr>
<tr>
<td>Pueblo II—A.D. 900-1100</td>
<td>A.D. 500-early 900s</td>
<td>Lino Gray (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1040-1140</td>
<td>Gallup B/W** (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1050-1250</td>
<td>Kwahe’e B/W (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1050-1300</td>
<td>Socorro B/W (Oppelt 2008)</td>
</tr>
<tr>
<td>Pueblo III—A.D. 1100-1300</td>
<td>A.D. 1200</td>
<td>obsidian</td>
</tr>
<tr>
<td></td>
<td>A.D. 1150-1370</td>
<td>Los Lunas Smudged (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1050-1250</td>
<td>Kwahe’e B/W (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1050-1300</td>
<td>Socorro B/W (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1250-1275</td>
<td>San Ignacio B/W*** (Sundt 1987)</td>
</tr>
<tr>
<td>Pueblo IV—A.D. 1300-1600</td>
<td>A.D. 1150-1370</td>
<td>Los Lunas Smudged (Oppelt 2008)</td>
</tr>
<tr>
<td></td>
<td>A.D. 1300-1400</td>
<td>Wiyo B/W (Oppelt 2008)</td>
</tr>
</tbody>
</table>

*Obsidian hydration dates are rounded to the nearest 100.

**B/W = Black-on-white

If the obsidian, radiocarbon, and ceramic dates are grouped into Oshara and Pecos Classification periods (Table 1), the sequence of visits is perhaps a little easier to see.

**WAS THE BISON LOCAL OR IMPORTED?**

The question of local vs. imported bison at this time period merits a discussion. Two issues need to be considered—first, evidence for the presence of an entire bison carcass, and second, the distance of these bison remains from probable prehistoric bison range.

Bison remains have been recovered from numerous prehistoric and historic Pueblo sites in New Mexico and southwestern Colorado (e.g., see Akins [1987] for a brief listing), but faunal remains are often more equivocal than those at LA 37631, making it impossible to determine from a site report whether an entire animal, or only a portion thereof, was present. Even when specific information is available, interpretation can be difficult. For example, bison remains in the third millennium B.C. Archaic deposits at Atlatl Cave were interpreted by Gillespie (1985:32) as indicating that bison lived in the Chaco Canyon area. However, Tom Mathews (personal communication, February and March 1992), who excavated Atlatl Cave and identified the bison bone, believed the bone may have been brought in, noting that the only remains are hoof elements (terminal phalanges). Mathews said he had never before encountered foot elements alone and believed that they may have served some ceremonial purpose.

The second issue—prehistoric occurrence of live bison in the Albuquerque area at the right time period—can be approached through faunal remains in other sites. In her article on prehistoric and historic animal use in the Middle Rio Grande, Akins (1987:165) notes the difficulties of working with site reports that may indicate only presence/absence of a particular species or number of bones with no indication of number of individuals, etc., but an approach can be made. Akins goes on to remark (p. 165) "The Rio Grande Valley has a very complete faunal record in terms of time depth [in comparison with] the Mountain-foothill samples [which are] some of the largest and best documented but are lacking in time depth." She reports one possible bison occurrence (Puaray, LA 717) in Valley sites (her Table 1), but four in Mountain-foothill sites (Two Dead Juniper Village, LA 87432; Coconito, LA 10794; Tijeras Pueblo, LA 581; and Paako, LA 162; her Table 2). Both Valley and Mountain-foothill sites are late, dating to Pueblo III or IV. Two Dead Juniper Village, close to the Manzano Mountains on Kirtland Air Force Base, contained the remains of four to five bison. Akins notes (1987:166-167) "Foot elements and rib fragments were the most common, but at least one individual was represented by other elements such as skull, thoracic vertebra, scapula and a femur. This suggests that rather than transporting meat from the Estancia Basin, people may have hunted herds of bison in the Manzano foothills at least into the occupation of Two Dead Juniper Village, probably in the late A.D. 1000s/early 1200s."

The only early site Akins reports (p. 167) is Comanche Springs, excavated in the early 1970s. In response to our query about updated information on bison in the Albuquerque area, Akins recalled (personal communication, May 29, 2009) that Comanche Springs was "...excavated by Frank Hibben and students (including me or I would know nothing of the site)...[and that it was] a bison kill site with Basketmaker projectile points...." Even though no site report was ever published, at least two versions of a partial manuscript exist (Fulgham and Hibben, ca. 1973), copies of which were graciously provided to us in 2009 by Jacqueline Guilbault of Valley Improvement Association (VIA), current owner of the site and successor to Horizon Corporation, which acquired the Tomé Land Grant in the early 1970s.

Comanche Springs, LA 14904, is a multi-component site located on the uplands near the Manzano Mountains approximately 20 mi southeast of Albuquerque and almost due east of Tomé. Several natural springs that arise in the area attracted people from PaleoIndian through historic times. At least eight components (which Steven Harvath [1987], who wrote the National Register
nomination, termed sites) are present in an area of approximately 100 ac. Two bison bone beds near the springs were radiocarbon-dated. One dated at 2920 +/- 220-230 B.P., the other at 2640 +/- 280-290 B.P. (Fulgham and Hibben ca. 1973:4). (Although there is no indication of which laboratory conducted the radiocarbon analysis or of what substances were dated, the dates echo Akins’ memory of the associated projectile points.) Also included in VIA’s files is a map of one of the bone beds. There are no labels on the map, but two skulls are visible, as are long bones, scapulas, mandibles, ribs, and, apparently, vertebrae—enough bone to verify that Comanche Springs was a genuine kill site.

To answer the question, then, of local vs imported, the nearest bison remains reported to date appear to be at nearby Puaray during Pueblo IV times, but the identification is uncertain and whether bones adequate to constitute a complete skeleton were present seems doubtful. The bison remains at Costilla Grande seem to be another story. Although the rack of ribs in Hearth 1 does not constitute an entire skeleton, it seems to us that the added presence in Hearth 2 of one possible vertebra or hoof core and 35 bone pieces that are “morphologically consistent with skull, pelvic, and vertebral bone from a very large artiodactyl” argues fairly convincingly for a nearby kill (assuming a single individual). The alternative requires envisioning a Desert Archaic band dragging a buffalo rib cage and several hundred pounds of selected pieces 10 mi or more from no closer than Tijeras Canyon before dinner.

SUMMARY

Costilla Grande, LA 37631, a lithic/ceramic scatter containing two hearths but no other subsurface deposits, is a multi-component site representing use from the Early Archaic through early Pueblo IV.

Visits were made to, and artifacts manufactured at, Areas A and B of the site during Bajada (obsidian dates of 4200 B.C. and 4000 B.C.) and San José (obsidian dates from 2900 B.C. to 1900 B.C.), but not Armijo, times. Visits during the En Medio Phase were made in 600 B.C., A.D. 300, and A.D. 400, according to the obsidian dates. At about 365 B.C., a bison was roasted, part of it eaten, the remainder probably jerked (an assumption based on the lack of burning exhibited by much of the bone in Hearth 2), several of its ribs left in Hearth 1, and other parts left in Hearth 2 at the same time. Projectile points and the bison bone suggest that the most intensive use of Costilla Grande as a residential camp probably occurred during En Medio times.

After at least two probable episodes as a camping spot during Early Basketmaker III times (two obsidian dates in the early and mid A.D. 500s), no one slept, cooked, or manufactured artifacts at Costilla Grande. Pueblo people visited the site—possibly during Pueblo I times, certainly during Pueblo II and III times, and possibly during Early Pueblo IV times—but did not stay. Instead, we think they probably used Costilla Grande as a “day bivouac,” a place to leave packs, canteens, food bowls, and other paraphernalia, while they scouted for stone to knap, as they did at Areas C and D, where the chert debitage reflects core reduction. After the late A.D. 1300s, the site was never again graced by visitors who left evidence of their passing.
**REFERENCES CITED**

**Akins, Nancy**

**Condie, Carol J., and Landon D. Smith**
1992 *Data Recovery at Costilla Grande (LA 37631), A Multi-Component Site on Sandia Pueblo Land, Bernalillo County, New Mexico for S & S Aggregates (Cal-Mat)*. Quivira Research Center Publications 198, Albuquerque.

**Fulgham, Tommy, and Frank C. Hibben**
c. 1973 Archaic Bison Hunting Culture of the Comanche Springs Archeological Site, New Mexico. Manuscript on file, Valley Improvement Association, Belen, New Mexico.

**Gillespie, William B.**

**Harvath, Steven**

**Keesling, Henry S.**

**Oppelt, Norman**
2008 *List of Southwestern Pottery Types and Wares (with Dates and References to Descriptions and Illustrations)*. Rev. and updated ed. Norman T. Oppelt, Greeley, CO.

**Peckham, Stewart**

**Sullivan, Alan P. III, and Kenneth C. Rozen**

**Sundt, William M.**
“The evidence of even long occupations in sizable pueblos can essentially disappear.”
—Glenna Dean (2009:191)

INTRODUCTION

Throughout her career Glenna Dean has demonstrated a commitment to looking hard and long at all the facts before making inferences, to questioning the evidence behind interpretations of the past, and to acknowledging, often with wry humor, how misleading archaeological observations can be. She has also devoted her considerable energy to making the processes of archaeological inquiry, and the delight of responsible archaeological discovery, accessible to broad and diverse of audiences. Here we focus on Tijeras Pueblo (LA 581), a fourteenth- fifteenth century Ancestral Pueblo settlement on the grounds of the Sandia Ranger District, Cibola National Forest (Figure 1).

Tijeras Pueblo exemplifies both the endeavors of evaluating evidence used to interpret the past and providing access to the archaeological process for the general public. The interpretations here concern understanding how Tijeras Pueblo was founded as a settlement and in what ways its establishment may have been similar to or different from other Rio Grande region Ancestral Pueblo communities. The observations of interest rely on tree-rings. Dendrochronology, the study of tree-rings, is an acknowledged keystone of southwestern archaeology (Nash 2000).

On November 17, 2005, Tijeras Pueblo was entered in the National Register of Historic Places. A self-guided interpretive trail and a new interpretive center with hands-on activities, some crafted by Glenna Dean, are available for visitors. Public education events that include workshops, lectures, and activities are sponsored by the Sandia Ranger District and the Friends of Tijeras Pueblo, an organization of dedicated volunteers. The Friends of Tijeras Pueblo maintains the on-site interpretive center and a website and participates in the New Mexico Archaeology Fair, coordinated largely by Glenna Dean. Tijeras Pueblo has an entry in the New Mexico Digital History Project, and at this writing (August 2009) yields 1,470 Google hits for “Tijeras Pueblo archaeological site.” Research on Tijeras Pueblo continues through cooperative endeavors among the Maxwell Museum of Anthropology, University of New Mexico (UNM), the Friends of Tijeras Pueblo, and the U. S. Forest Service. Interpreting Tijeras Pueblo exemplifies many of the possibilities and challenges in providing public education about archaeology in general as well as understandings of New Mexico’s past.

BACKGROUND

The history of archaeological work at Tijeras Pueblo is given in Judge (1974), Cordell (1980) and Cordell et al. (2009). The site was visited in the early 1930s by H. P. Mera and W. S. Stallings of the Museum of New Mexico. In 1948, the UNM summer field school in archaeology, directed by Stanley A. Stubbs and Fred Wendorf, worked at Tijeras Pueblo. Tijeras Pueblo was the focus of intensive excavation in the 1970s as a UNM summer field project begun by W. James Judge and continued by Linda S. Cordell (see Cordell et al. 2009 for references).

The fourteenth-century aggregation of Ancestral Pueblo peoples into architecturally distinctive compact villages
Figure 1.
Map of Middle and Northern Rio Grande Region with Tijeras Pueblo and other locations mentioned in the text (map courtesy of Nicholas E. Damp).
(pueblos) is a matter of long-standing and continuing archaeological interest. Whether or not such villages represent coming together of previously dispersed local populations, intrusive communities of migrants, or combinations of both is hotly debated, as is understanding motives for aggregation and explaining the variable longevity of aggregated settlements (Adams and Duff 2004; Snead 2008; Spielmann 2004). To explore aggregation as a process, archaeologists need fairly accurate means of determining population growth of particular settlements (Crown 1991; Hantman and Neitzel 2006). Problems of interpreting population dynamics within Ancestral Pueblo communities may be exacerbated for two reasons. First, archaeologists generally acquire more information about the extent and configuration of more recent, rather than initial, occupations of a site because they usually thoroughly clear and map the surface of a site and excavate more of the top (most recent) than of lower (older) layers of occupation. Second, many relatively early Rio Grande aggregated settlements were constructed of coursed adobe, a substance that, when neglected, deteriorates by melting into the ground.

A. V. Kidder was among the first to use stratigraphic excavation to explore the growth of a Pueblo town in his work at Pecos Pueblo, LA 625 (Kidder 1924). As Dean (2009:191) explains, “insight into the visibility of ancestral Puebloan sites was gained inadvertently when he [Kidder] realized that his field camp had been built squarely on top of Forked Lightning Pueblo four years earlier. More than 100 rooms were eventually excavated.” Forked Lightning (LA 672) was built of adobe that subsequently melted into the surrounding earth.

In addition to Kidder’s eventual inferences about the adobe-walled Forked Lightning Pueblo being ancestral to Pecos Pueblo (Kidder 1926), other studies of adobe-walled sites that are particularly relevant for comparison to and interpretations of Tijeras Pueblo are Richard Ahlstrom’s (1989) study of Pindi Pueblo (LA 1), near Santa Fe, Patricia Crown’s (1991) analysis of Pot Creek Pueblo near Taos, and Winifred Creamer’s (1993) study of Arroyo Hondo Pueblo (LA 12), south of Santa Fe. These studies explore the growth and decline in population of adobe villages by relying on combinations of observations of stratigraphy, wall abutment patterns, dendrochronology, and often ceramic seriation (Ahlstrom 1989; Crown 1991:291). While all of these ultimately will be considered to interpret Tijeras Pueblo, our focus in this paper is on the tree-ring record alone, for reasons we touch upon briefly here.

MISSING CLUES AT TIJERAS PUEBLO

As Stewart Peckham (1968:1) so accurately described it in the 1960s, Tijeras Pueblo is “composed of from ten to fourteen blocks of adobe or masonry-walled surface rooms scattered rather randomly over an area measuring about 500 feet on a side. This dispersion of room blocks contrasts generally with the pattern seen at other contemporary pueblos in the Rio Grande,” (Figure 2). Pottery found on the surface of a site is often used as a measure of the date of its occupation, and variability in pottery types on different parts of the site as a means of internally ordering components of the site. The site survey record for LA 581 (Tijeras Pueblo) entered in the Laboratory of Anthropology, Museum of New Mexico (now Archeological Records Management System or ARMS) files in 1939, notes “one large house group with smaller mounds scattered for several hundred feet to the north and west. Pottery types similar at all mounds.”

Judge (1974:9-10) reported that even after complete excavation of one the mounds (Mound 4, Figure 2) in advance of Forest Service road construction, Peckham found “that the predominant ceramics at the site were Glaze A Red and Galisteo B/W and that he [Peckham] could determine no stratigraphic separation between them.” A similar conclusion was reached by the Albuquerque Archaeological Society after their excavation of two mounds (AS10a and AS10b, Figure 2) in the 1980s (Sundt and Bice 1989). The general similarity of ceramic types on different parts of the site and in successively deeper layers of the site make it difficult (though not impossible) to use pottery to order their occupation over time. That the types involved are relatively long-lived hinders chronological analysis but is not unusual for fourteenth century

The visible surface at Tijeras Pueblo is also misleading. The imposing “main mound,” with its U-shaped, narrow plaza and room blocks on three sides, is architecturally complex, with many underlying and off-set walls. Stubbs and Wendorf reported excavating a pit-house, 22 other rooms, a number of trenches and ten other structures scattered nearby. There had been no surface indications of the pit-house (Judge 1974:10).

Student notebooks from 1948 note shallow rooms with masonry and adobe walls, suggesting to Judge (1974:10) that an entire room block, some 300 feet west of the main mound, excavated in 1948, could be attributed to the more recent occupation of the site.

Believing that shallow rooms with stone-masonry walls were late constructions at Tijeras Pueblo, Judge (1974:10) suggested that Block 6 (Figure 2), which consisted of six shallow rooms with slab-masonry

Figure 2.
GIS map of Tijeras Pueblo showing excavated structures of all time periods, including Mound 4 excavated by Peckham in 1986 and AS10a and AS10b reported by the Albuquerque Archaeological Society in 1989 (map courtesy of Glenda Deyloff).
wall remnants, should be associated with the more recent occupation of the site. Subsequent excavation and analysis indicate that Block 6 relates to earlier construction (see below). In 1971, the UNM field school stripped an extensive area about 300 feet north and east of the site datum and found “no architectural features at all” and low numbers of ceramics (Judge 1974:43). The 1971 crew had not stripped below a layer of adobe melt. In 1976, the UNM Field School removed the melted adobe from this area of the site, and excavated Block 8 (Figures 2 and 3) with an estimated 18 to 20 rooms, six of which were excavated (Simon 1977:228). Remaining wall footings in Block 8 were combinations of adobe and masonry (Figure 3). Finally, during the final UNM Field School season in 1976, a trench through a low area with no visible surfaces features that was thought to be a reservoir revealed the double coursed stone masonry walls of the large circular kiva (Figure 2).

In essence, Tijeras Pueblo is an architectural puzzle of dissolving adobe and crumbling masonry. The stratigraphy is complicated and many of the buildings invisible both on the surface and just below it. The site is further complicated by having been “tested” and excavated over a period of nearly 60 years, with documentation ranging from excellent to mostly lost. Tijeras Pueblo does not register an abrupt replacement of black-on-white pottery by polychromes or glaze paint decorated ware as did happen elsewhere in the Middle Rio Grande region where that change is used as a chronological marker (Eckert and Cordell 2004).

Melted adobe occurred in several stratigraphic tests and was interpreted as evidence of site or at least room block abandonment. For example, Judge (1974) suggested two periods of population decline, if not abandonment, before the final end of permanent occupation in the early fifteenth century (one before the A. D. 1330s and one sometime prior to A. D. 1390) based on correlations of observed adobe melt and red ware vs. white ware ratios. Those continuing to work on the Tijeras Project (i.e., Cordell et al. 2009; Cordell and Damp 2009; and our colleagues) identify three components or occupations of Tijeras Pueblo, although we really do not know either how much overlap there is among the components or precisely which rooms were built or in use during each of these proposed time periods. Here we use tree-ring dates to examine whether or not there were periods during which Tijeras Pueblo was not occupied and the likely extent of the initial occupation of the site.

Figure 3.
Stone and adobe wall-footings (and corner) under a layer of adobe melt in Block 8, Tijeras Pueblo, as excavated in 1976 (Neg. No. 1013 courtesy of the Maxwell Museum of Anthropology, University of New Mexico).
TREE RINGS FROM TIJERAS PUEBLO

Wood used in construction at Tijeras Pueblo is well-preserved. Tijeras Pueblo yielded 461 tree-ring dates, in nine clusters, with the earliest cutting date being A. D. 1262 and the most recent cutting date A. D. 1395 (Robinson and Cameron 1991:26). A spreadsheet of the Tijeras Pueblo tree-ring dates that includes the provenience of each dated specimen, the number assigned to it by the Laboratory of Tree-Ring Research, the species of wood, the inside or pith date, and a coded annotated outside date indicating completeness of outer rings, hence relationship to cutting-date, has been compiled by the authors and is available through the Maxwell Museum of Anthropology. We use these data to address the two questions raised above: Is there evidence of one or more periods of abandonment of the site? Do we know if early occupation of Tijeras Pueblo was dispersed among the various mounds or clustered in one mound?

Several principles are involved in interpreting tree-ring dates. Some of these are described by Ahlstrom (1989) and augmented by Ahlstrom et al. (1991) by comparing tree-ring dates and historic documents relating to the Hopi pueblo of Walpi. The Walpi example is uniquely valuable because there is an abundance of dated specimens (1,189) and historical detail in Hopi traditional history and archival accounts. In part for those reasons, Ahlstrom et al. (1991:641) "hope to apply lessons learned at Walpi to the interpretation of tree-ring evidence from other sites, particularly prehistoric ones." While we agree with the these authors, and we use the interpretive principles they put forward, the Tijeras example, like many other fourteenth century Rio Grande region sites, differs significantly from Walpi. Three differences that emerge as particularly important are that, unlike Walpi, Tijeras Pueblo is relatively close to abundant wood resources; was occupied for perhaps 300 years rather than the six centuries represented at Walpi, and further, unlike Walpi, was constructed primarily of coursed adobe or a mixture of adobe and masonry walls rather than stone.

Figure 4 provides the distribution of tree-ring dates by decade for Tijeras Pueblo, with cutting dates differentiated from non-cutting dates. We have been very conservative in designating as a cutting date only those dates with the symbols b [bark present], g [beetle galleries], c [outermost ring is continuous around the full circumference of specimen], and r [less than a full section is present, but the outermost ring is continuous around available circumference] (Ahlstrom et al. 1991).

![Figure 4](image-url)
Ahlstrom et al. (1991:641) suggest that non-cutting dates reflect re-use of wood from older structures, because the loss of outer rings is caused either by weathering or shaping. Shaping (squaring) beams is not evident at Tijeras Pueblo, so non-cutting dates are most likely wood scavenged from earlier structures. Ahlstrom et al. (1991:634) argue that loose clusters of dates and a relative abundance of non-cutting dates reflect either population stability or population decline. We believe this is true at Tijeras Pueblo as well. At Walpi, Ahlstrom et al. (1991:633) interpret the predominance of non-cutting dates between 1250 and 1679 (Pre-Walpi period) as wood scavenged from a nearby site (Koechaptevela) ancestral to Walpi, with the few cutting dates in the same period arguing for some wood-procurement to construct Walpi. For Tijeras Pueblo, we also consider loose clusters of dates and relatively more non-cutting than cutting dates as evidence of scavenging wood from older structures. As there is abundant wood near Tijeras Pueblo, however we think wood was salvaged from older structures under later construction at the site rather than having been hauled from some distance away. It would be important to know the relative energetic costs of cutting versus salvaging timber for construction at Tijeras Pueblo as well as the relative social value and meaning of re-using as opposed to cutting new timbers.

Figure 4 shows a long lead-up time of tree-ring dates prior to A. D. 1300, beginning with the earliest tree-ring date from the site, which is actually a non-cutting date of A.D. 1199++rb. The loose clusters of dates before A.D. 1300 and the preponderance of non-cutting dates over cutting dates at this time, suggest population stability and re-use of wood from underlying, older structures. Recall that Stubbs and Wendorf excavated a pithouse at the site. There are a scattering of cutting dates prior to A. D. 1300 (one in A. D. 1262, two in A. D. 1284, one each in A. D. 1287 and A. D. 1289, two in A. D. 1294, and one in A. D. 1297), which show that beam procurement was underway in the thirteenth century. The pattern of tree-ring dates, leading up to the establishment of Tijeras Pueblo at about A. D. 1300, is very similar to the pre-Walpi build up at Hopi.

Between A. D. 1300 and A. D. 1395, every decade shows construction activity including cutting timber. There was apparently massive construction from the A. D. 1380s to A. D. 1395. Importantly, there are essentially no gaps in the tree-ring dates throughout the sequence. On the basis of tree-rings alone, there is no evidence for discontinuous occupation at Tijeras Pueblo. We suggest that the slight dip in the number of dates between A. D. 1360 and A. D. 1369 indicates a period of stability, because there are 5 cutting dates in that decade demonstrating that at least someone was at the site. The few dates may also be a sampling problem. These possibilities parallel those given for Walpi, during what is called the Autonomy Period (Ahlstrom et al. 1991:633-634). We acknowledge that analyses of ceramic and architectural data may show that portions of Tijeras Pueblo were allowed to disintegrate during the fourteenth century. There is, however, no strong evidence for significant population decline or complete site abandonment at any time from the 1200s until sometime after the final massive construction episode at the end of the fourteenth century.

**TREE RINGS AND THE “EARLY OCCUPATION”**

We use an approach that combines the tree-ring database with a geographic information system-based (GIS) map of Tijeras Pueblo in order to evaluate the extent of the initial occupation of the site. As the tree rings do not indicate any significant break in the occupation of Tijeras Pueblo, we here refine and re-define early occupation to include all construction before A. D. 1370. This definition expands previous interpretations (Cordell et al. 2009) to acknowledge the finding that wood procurement increased in every decade between A. D. 1260 and A. D. 1370 (Figure 4). We have also adopted a conservative approach to the inclusion of tree-ring specimens. Our interest is in wood used in construction rather than firewood or wood that was recovered from trash deposits and so not related to buildings. We limit our sample to wood that came from roof and floor contexts only, and exclude wood from fill either within rooms or outside rooms. Roof contexts include primary and secondary
Rooms with tree-ring dates before 1370 from architectural features (roof beams and roof support-posts) are shown in sold grey. Note: dates in this range were obtained from dispersed mounds and the circular kiva.
beams. Wood from room floors sometimes included parts of collapsed roofs but is primarily roof-support posts or braces for roof-supports. Our database has a coded notation of provenience (floor, roof, fill) for each specimen allowing us to be sure we mapped only wood used in architecture.

Procedures used to create the original GIS map of Tijeras Pueblo are detailed in Cordell et al. (2009:26). To create the map in Figure 5, all 461 tree-ring dates from Tijeras Pueblo were imported using ESRI’s ArcGIS application and Microsoft Excel. Tree-ring dates were first sorted by room number. Spatial and temporal attribute data were then linked, following unification of the data, and finally matched to their GIS provenience location (room polygon). As a result, a base map designating the locations of all 461 tree-ring dates was created. The base map was then modified to show the locations of wood excavated from structural contexts (roofs and floors) and that also dates between A.D. 1199 and 1369. The rooms in dark gray in Figure 5 are dated by tree-rings to the early occupation defined in this way.

As Figure 5 shows, all room block areas excavated by UNM field schools (Blocks 1, 2, 3, 4, 5, 6, and 8), have some rooms that are tree-ring dated to the early occupation as defined above. The large circular kiva yielded one structural tree-ring date of A.D. 1313w, relating this kiva to the early occupation. We note that both this circular, masonry-walled kiva and Room 108, which is a large rectangular, adobe-walled kiva in the main mound (just southeast of the datum point), are early occupation structures and may have been in use at the same time. The tree-ring dates from architectural features, allow us to answer our second question viz. do we know if early occupation of Tijeras Pueblo was dispersed among the various mounds or clustered in one mound? While there is no evidence of complete abandonment of Tijeras Pueblo at any time prior to A.D. 1396, the architecture of the site from about A.D. 1300 until A.D. 1370 consisted of dispersed blocks of rooms scattered at the site and not restricted to one mound. Understanding if there were consistent orientations of these initial room blocks will require additional analyses.

DISCUSSION

The history of occupation of Tijeras Pueblo, as it is understood so far, appears somewhat less anomalous than previously thought when Peckham (1968) described Tijeras as being more dispersed than other contemporary pueblos in the Rio Grande. The two most often cited comparative examples, Pot Creek Pueblo (Crown 1991) and Arroyo Hondo Pueblo (Creamer 1993), both have more than one superimposed adobe-walled component, with concomitant problems of interpretation. At all three sites, excavation of the upper, more recent, structures has been more extensive than of the initial occupation. In each case, the more recent layers of the pueblo are less dispersed and smaller than the initial occupations. At Pot Creek Pueblo the uppermost part of the site contained ten mounds with from ten-35 rooms. Beneath these lie a series of earlier pueblo rooms, underlain by pithouses. Pot Creek Pueblo “grew by accretion, with no clear ground plan except for the existence of spatially separate room blocks of contiguous adobe rooms surrounding an open plaza area” (Crown 1991:292, 310).

Arroyo Hondo Pueblo may have been more densely inhabited than either Pot Creek Pueblo or Tijeras Pueblo, but its final structures (the second component) was, like those at the other sites, smaller and more compact than its initial occupation. The first occupation at Arroyo Hondo, about which we know far less than the later settlement, has some groups of rooms that appear to have been the result of cooperative construction, “although accretional construction of individual rooms is also apparent” (Creamer 1993:134).

For all three of these Rio Grande region pueblos, the use of space and remodeling exemplify lessons learned from Walpi. At Walpi, “the most common reason for abandoning a structure is probably a change in the requirements for roofed space for a household, lineage, or other social unit. A community should experience such changes almost from the moment it occupies a site” (Ahlstrom et al. 1991:642). Untangling meaningful social space from melted adobe is not for the faint-hearted, but it does seem possible. It will be important to re-eval-
uate Forked Lightning Pueblo and its relationship to Pecos with the lessons from Walpi and adobe-walled pueblos in mind.

Basic analysis of the tree-ring dates from Tijeras Pueblo and the integration of dated architectural wood with maps of the site overturn some of our ideas about the history of occupation of the site. The new findings will require additional analyses, particularly of ceramics and wall-abutments and alignments. Fortunately, these are underway. The new information, however, should inform interpretation of Tijeras Pueblo to its visitors, real and virtual. This will not be easy, at least in part because the remains of rooms, roofs, and walls, are not only invisible on the surface of the site but have largely melted back into the earth. Perhaps developing public awareness of how we come to our revised understandings of the past is one of the best lessons we can impart. The archaeological record is relatively static but archaeology as a discipline is not.

ACKNOWLEDGMENTS

We thank Bill Hudspeth, of Rio Abajo Digital Mapping Services, and Glenda Deyloff, of Southwest Archaeological Consultants, for GIS technical support, and Dave Phillips and Catherine Baudoin of the Maxwell Museum of Anthropology for archival assistance.
REFERENCES CITED

Adams, E. Charles, and Andrew I. Duff (editors)  
2004 The Protohistoric Pueblo World, A.D. 1275-1600.  
University of Arizona Press, Tucson.

Ahlstrom, Richard V. N.  
1989 Tree-ring Dating of Pindi Pueblo, New Mexico.  
Kiva 54:361-384.

Ahlstrom, Richard V. N., Jeffrey S. Dean,  
and William J. Robinson  
1991 Evaluating Tree-Ring Interpretations at Walpi  

Cordell, Linda S. (editor)  
1980 Tijeras Canyon, Analyses of the Past. University of  
New Mexico Press, Albuquerque.

Cordell, Linda S., and Nicholas E. Damp  
2009 Tijeras Pueblo. New Mexico Digital History Proj­ect,  
11, 2009.

Cordell, Linda S., Glenda Deyloff,  
Mark D. Mitchell, and David H. Snow  
2009 Mapping Tijeras Pueblo, a Work in Progress. In  
Between the Mountains Beyond the Mountains, Pa­  
pers in Honor of Paul R. Williams, edited by Emily  
J. Brown, Karen Armstrong, David M. Brugge,  
and Carol J. Condie, pp. 23-32. Papers of the Ar­  chaeological Society of New Mexico, No. 35, Albu­  
querque.

Creamer, Winifred  
1993 The Architecture of Arroyo Hondo Pueblo, New Mex­  
School of American Research Press, Santa Fe.

Crown, Patricia L.  
1991 Evaluating the Construction Sequence and Pop­  
ulation of Pot Creek Pueblo, Northern New  

Dean, Glenna  
2009 Pecos National Historical Park. In Archaeology in  
America, an Encyclopedia, Vol. 3, Southwest and  
Great Basin/Plateau, edited by Frances P. Mc­  
Manamon, pp. 190-193. Greenwood Press,  
Westport, Connecticut.

Eckert, Suzanne L., and Linda S. Cordell  
2004 Pueblo IV Community Formation in the Central  
Rio Grande Valley: The Albuquerque, Cochiti  
and Lower Rio Puerco Districts. In The Protohis­  
toric Pueblo World, A.D. 1275-1600, edited by E.  
Charles Adams and Andrew I. Duff, pp. 35-42.  
University of Arizona Press, Tucson.

Hantman, Jeffrey, and Jill Neitzel  
2006 Modeling Site Occupation Spans and Develop­  
mental History: An Effort to Merge Survey and  
Excavation Data in the U. S. Southwest. In Man­  
going Archaeological Data: Essays in Honor of  
Sylvia Gaines, edited by Jeffrey L. Hantman and  
Rachel Most, pp. 71-84. Arizona State Univer­  
sity Anthropological Research Papers, No. 57, Tempe.

Judge, W. James  
1974 The Excavation of Tijeras Pueblo 1971-1973: Prel­  
iminary Report. Archaeological Report No. 3, Ci­  
bola National Forest, New Mexico. U.S.D.A.  
Forest Service, Southwestern Region. Albu­  
querque.

Kidder, Alfred V.  
1962 [1924] Introduction to the Study of Southwestern  
Archaeology with a Preliminary Account of the Ex­  
cavations at Pecos. Papers of the Southwest Expe­  
dition No. 1. 1962 Facsimile edition. Yale  
University Press, New Haven.

1926 Early Pecos Ruins on the Forked Lightning Ranch.  
Archaeological Institute of America. Papers of the  
School of American Research Notes 16, Santa Fe.

Nash, Stephen E.  
2000 Seven Decades of Archaeological Tree-Ring Dat­  
ing. In It's About Time, A History of Archaeologi­  
cal Dating in North America, edited by Stephen  
E. Nash, pp. 60-83. University of Utah Press, Salt  
Lake City.

Peckham, Stewart  
1968 Proposal for Highway Salvage. Manuscript on  
file, Archeological Records Management System,  
Laboratory of Anthropology, Museum of New  
Mexico, Santa Fe.
Robinson, William J., and Catherine M. Cameron

Simon, Brona G.

Snead, James E.

Spielmann, Katherine A.

Sundt, William M., and Richard A. Bice
My focus is on a facet of the career of a previous Archaeological Society of New Mexico honoree, Bertha Pauline Dutton (Figure 1) who, like Glenna Dean, spent a significant part of her career in the service of public archaeology. Although their challenges were and are different, both Dutton and Dean view archaeology and anthropology from a broader perspective, one that involves an obvious curiosity about and careful documentation of the scientific record, but that is paralleled by a heavy commitment to make that record understood by a broader audience. Glenna, like Bert, works tirelessly through a variety of means to insure that good scholarship and public education go hand in hand to the benefit of both. Both reason that it is an educated public that will be more likely to understand and support our goals, including conservation of significant archaeological resources.

Bertha Pauline Dutton (1903-1994) had a traditional career in anthropology, in that she earned advanced degrees in the discipline (Master of Arts, New Mexico, 1937; Doctor of Philosophy, Columbia 1952), did field work in the Southwest, Mexico and Guatemala, published actively, and held professional positions until her retirement (Bohrer 1979; Morris and Olin 1997). But she is also remembered for her focus on public education through her museum work, popular writing, and a unique program that introduced archaeology and anthropology of the American Southwest to many young women through her Senior Girl Scout Archaeological Mobile Camps and excavations (see also Babcock and Parezo 1988; Parezo 1993). Between the years of 1947 and 1957, 283 teenage girls from 39 states, and one foreign country, a number of them repeat campers, traveled through New Mexico, Arizona and Colorado visiting Pueblo villages, Navajo homesteads, ongoing archaeological excavations, national monuments and parks, and museums, in a unique experiment in directed learning. For 11 years, Dutton de-
voted the better part of six weeks to three and one-half months per summer to these enterprises, and to the girls dubbed “Dutton’s Dirty Diggers.” Dutton’s philosophy, summarized in her often used phrase, “Experience, while a tough teacher, is always the speediest one,” served her girls well, as many went on to professional careers in anthropology and many other fields. “Bert,” as she was known by all, always claimed that she had more than 200 daughters, a legacy matched by few but the envy of many. In this review, I will outline the genesis, philosophy, activities and demise of this program, while highlighting Dutton’s unique contributions to it and to other areas of public education in anthropology.

The impetus for the Senior Girl Scout Archaeological Mobile Camp program apparently came in 1946, when Ed Ferdon, who had been “rewarding” his Boy Scout troop in Santa Fe with a camping tour of archaeological sites in the region, described this activity at a general meeting of scout leaders in El Paso (Dutton 1985). In the audience was a Girl Scouts of America (GSA) official from Region IX (Southwest) of the organization, headquartered in Dallas, who asked him if such a camping tour might be offered for Girl Scouts. Ferdon referred her to his boss, Sylvanus G. Morley, the Director of the Museum of New Mexico (MNM), in Santa Fe. She and Morley met and discussed the idea for some type of outing involving Senior Girl Scouts, and Morley referred her to Bertha Dutton as a good possibility to lead such a tour (Dutton 1985). At this time, Bert was Curator of Ethnology and Associate in Archaeology at the Museum, having been hired first by Edgar Lee Hewett who was also her teacher and mentor at the University of New Mexico. She was a veteran of Hewitt’s Jemez Field School and Chaco Canyon digs, and was well aware of and supportive of his ideas on the importance of public education in archaeology (see Fowler 2003).

In the fall of 1946, Bert and Ferdon, who had been students together at the University of New Mexico (UNM) under Hewett, and now were colleagues at the Museum, took a reconnaissance trip to see what they could cover logistically in the space of 10 days to two weeks while camping. At that time, many if not most of the national monuments and parks such as Chaco Canyon, El Morro, Canyon de Chelly, Aztec and Mesa Verde, as well as the Hopi villages and some of the Rio Grande Pueblos, were on unimproved roads, or had to be accessed by them. Ed then took his Boy Scout troop on the entire route as an experiment. Bert then proposed that the Girl Scouts follow suit in the summer of 1947. National Girl Scout headquarters in Washington, D.C. as well as the Dallas regional office concurred, and on July 6, 1947, the first group of seven senior Girl Scouts and three scout executives assembled in Santa Fe. Girls came from Texas, New Mexico, and as far away as Illinois (Dutton 1947:191). Vorsila Bohrer, later to become a prominent paleobotanist and teacher for many years at Eastern New Mexico University, was among that first group of girls. After two days of orientation lectures by MNM Director Morley, Marjorie Lambert, Kenneth Chapman, Bert, and officials from the Soil Conservation Service, National Park Service, and Forest Service, the group spent the remainder of the two weeks on the road with stops at Coronado State Monument, Chaco Canyon, Aztec, Mesa Verde, Canyon de Chelly, El Morro, trading posts on the Ute and Navajo reservations, and the pueblos of Acoma and Laguna. Along the way they visited ongoing excavations by Gordon Vivian at Chaco Canyon, and Deric O’Bryan at Mesa Verde, and heard talks by ethnologists William Kelly and Evon Vogt on Navajo ethnology and culture change (Dutton 1947).

In the following years, routes were changed to encourage girls to repeat the trips and add more experiences, but an effort was made to keep the travel to roughly 1,200 miles per session (Dutton 1950). The first year, the expedition proceeded with a 15 passenger bus pulling a small trailer for the camping and cooking gear, and the staff included only Bert and the three Girl Scout executives. In subsequent years, transportation was provided by Jack Stacy of Santa Fe, who furnished the cars (a mix of 6 to 9 passenger vehicles), served as driver and general mechanic, and was the only male member of the expeditions (Figure 2). In 1948, in addition to Stacy, and with the group now up to 15 girls, a cook was added; and the following year, a
naturalist who could handle identifications of plants and animals and also generally instruct in Southwest natural history. At least one and sometimes two adult Girl Scout representatives traveled with the group each year, also serving as drivers and bringing the crew to five adults. Only the cook was paid; all others were volunteers (Figure 3; Dutton 1950). The Museum of New Mexico, a co-sponsor with the GSA, paid Bert’s salary, and allowed her released time for a yearly reconnaissance of the routes (Laboratory of Anthropology: 89LA5.063). Beginning in 1950, she also listed as a co-sponsor the School of American Research (SAR), where she held an appointment as Research Associate (Dutton 1950). Small amounts of funding were obtained for equipment from donations by various Santa Fe businesses, women’s clubs and individuals. A fee charged the campers, either paid by each girl or by her sponsoring local Girl Scout Council, covered the transportation, food costs, and salary for the cook. In 1951 the fee was $37.50 for the two weeks, with girls being responsible for their own transportation to and from Santa Fe and any incidental expenses, such as purchases of indigenous arts and crafts, film, etc. (Dutton 1951). By 1955 it was $70 (Dutton 1955).

In 1949, a second two-week mobile camp was added to the schedule, and by 1955, the count was up to three mobile sessions each summer. Each of these subsequent sessions, with the exception of 1956 and 1957 took 16 girls by national application, and slots filled quickly. In 1956 and 1957 there was agitation by National Girl Scout Headquarters to take as many as 24 girls per session, something Bert did not condone as it was more difficult logistically and did not allow her time to get to know the girls and personally mentor them as she wished (89LA5.065). In 1951, a two-week excavation session was added at the request of repeat campers, and that continued for six years.

Bert’s intentions for the Girl Scout Archaeological Mobile Camp program were broad based, and geared toward the general educational theme of “Man and Nature in the Southwest” She summarized the approach as follows (Dutton 1950:367):

> Not only is archaeology stressed, but all of the disciplines of anthropology, and such related subjects as geology, botany, biology, art (particularly that of the original Americans), Southwestern history, Spanish,
etc. The importance of conservation of natural resources is brought to attention; and consideration is given to Southwestern industries and businesses. Traveling some 1,200 miles during each camp, to places of archaeologic, historic, scenic, and industrial importance, the girls are given a broad view of the cultural backgrounds of the region, and of the vocational opportunities offered.

This philosophy and plan is remarkably like that practiced by her mentor, Edgar Lee Hewett, at his UNM Field School at Jemez Canyon, which Bert attended and from which she benefitted greatly. Hewett (1933:58) described his vision as follows:

There has long been criticism of the fact that college education has become too much campus-bound, a matter of study from books and in classrooms. At Battleship Rock camp, there has been a partial breaking away from these traditions and a substitution, instead, of education in the open, where students study under a minimum of restrictions the subject of man and nature [emphasis added], the methods by which every civilization has been built in the process of humanity's adjustment to its environment.

Students at the Jemez camp learn by doing and observing at first hand. In company with experienced archaeologists, anthropologists, ethnologists, biologists and geologists they explore the small world of which their camp is the center, study its resources capable of supporting human life, the dependence of that life upon the natural elements, and the means by which the Indians who have inhabited that region since long before the coming of the White Man, have adjusted themselves to these conditions and achieved a satisfactory way of life. It is the kind of learning which enlarges the vision and gives a view of the meanings of life which cannot be obtained in any other way.

Over the years, and with the addition of the two-week excavation camp, Bert’s overall plan became more ambitious, so that the high school girls would be getting the equivalent of a college-level experience. As noted by Mary Anne Stein, one of the campers in 1955, “the purpose of the camps was to have girls go on three mobile trips [one each year, different areas covered] and one archaeological dig to provide them with the equal of a summer course in college archaeology” (Dutton Collection, Box 26: letter, M.A. Stein, Aug. 12, 1955). Bert assembled some statistics in
1956 on the number of repeat campers, noting that of the 89 girls who had attended the excavation camps up to that point, all were repeat campers; and that of the remaining girls, 49 had attended two camps, 19 girls three camps, six girls four camps, three each five and six camps, and one each seven and 11 camps (89LA5.065). Response to the program had been gratifying.

The mobile camp program, with its accompanying lectures, was thus not seen as a “fun in the sun” approach, but rather as a serious attempt to teach something about ethnology, archaeology and science, as well as about the region and its peoples through time. Dutton expected the girls to learn the basic Ancestral Puebloan sequence, including its dating and characteristics, basic ethnography of the living Pueblo and Navajo people, distributions of tribal and Pueblo entities, and something of the geology and natural history of the region. She did not shy away from requesting the best people in the disciplines to speak to her girls, and the list of speakers through the years reads like a “Who’s Who” of Southwest experts. In addition to those named thus far, speakers included J.O. Brew, Harold Colton, Gladys Reichard, Clyde Kluckhohn, Watson Smith, Emil Haury, Paul Martin, John Rinaldo, Fred Wendorf, A. E. Dittert, Ray Ruppe, Charles Lange, Erik Reed, Charlie Steen, Natt Dodge, Frank Hibben, Al Schroeder, Boaz Long, Robert Young, Bruce Ellis, Bruce Inverarity, Ed Ladd, Sally Lippincott, and Georgia O’Keefe and more. Many of these individuals were visited in the field, at ongoing excavations or other places where they were doing research. Laura Gilpin took a series of photographs of the girls at one of the 1955 camps, and also accompanied one of the field sessions and furnished photographs for an article in Arizona Highways (Wethey 1955). Press coverage, with some articles written by the girls for their home-town newspapers, and others published in New Mexico and Denver papers, outlined the unique experiences of the campers (Dutton Collection: Box 26). Some of these seem to have resulted in dollar donations to the program, which were always gladly received.

Bert was particularly attentive to proper etiquette on the part of her girls when visiting Pueblo or Hispanic villages or Navajo homesteads. She always took the girls to the home of the Pueblo governors for official entrance to the communities, and stressed that the girls must obey the rules of proper visiting: no photographs/sketches without explicit permission, no laughing or other loud or rude behavior—only courtesy befitting guests in someone’s home. Depending on the year and the itinerary, visits also included Hopi and Zuni Kachina ceremonies, various Rio Grande Green Corn and other feast day dances, Navajo rodeos and dances, parts of the Inter-Tribal Ceremonials in Gallup, Santa Fe Fiesta, and much more. Bert always quizzed the participants after the events, making sure that they had been keen observers and had understood what was taking place. She likewise quizzed the girls along the trail, again to make sure that they were paying attention to what they were seeing and absorbing the meaning and significance of situations. Several mobile camps also had Indian and Hispanic Girl Scouts from New Mexico or Arizona as participants, something that Bert hoped would foster deeper cultural understanding (Wethey 1955).

The excavation sessions, begun in 1951, ultimately garnered most of the newspaper publicity because of their “all girl” crews who displayed serious earth-moving abilities. As noted, excavations were not part of the initial plan of the camps, but several of the repeat campers lobbied Bert to have “a dig of our own.” Pueblo Largo (LA 183), in the Galisteo Basin, which had first been mapped and tested in 1912 by Nels Nelson of the American Museum of Natural History, became the focus of the dig, largely because it was close to Santa Fe for logistic support and was protected on private land. This Southern Tewa site, with a beginning date in the late 1200s, was estimated to have 500 + rooms and at the time showed little vandalism. Six two-week sessions at the site resulted in the clearing or testing of several rooms, a plaza and at least two kivas (Figure 4). The excavation camp, set up nearby, featured a full field laboratory for processing, and considerable stress was placed on the cataloging keeping pace with the excavations. Several visitors came to the site, and remarked as to the progress and professionalism of the crew. Bert (1985) later reported that Fred Wen-
dorf said that “he never saw any boys work as hard.” A. V. Kidder took considerable interest in the kivas and ceramics at the site, and sent Bert copies of his yet unpublished maps and drawings of comparable structures at Pecos (Dutton Collection, Box 31: letter, B. Dutton to C. Yeagley, Sept. 21, 1956). Bert’s plan after the six sessions was to do a preliminary report of work at the site as an evaluation of the progress and a guide to future work in the Galisteo Basin, a region of long-standing interest to her. She then intended to offer her best girls the opportunity to continue the project with the analysis (Figure 5). The work was never completed, although field notes, photos and catalog cards form part of the Dutton Collection at the Laboratory of Anthropology in Santa Fe (Dutton Collection: Boxes 26, 31, 35). Analyses of several artifact classes were incorporated into findings from Bert’s later excavations at the site of Las Madres (LA 25) and her general overview of Galisteo Basin archaeology (Dutton 1980).

By 1956, Bert was spending an increasing amount of time on the Girl Scout effort, and was beginning to feel the burden. She wrote to Claire Yeagley, one of the repeat diggers, that “I simply cannot continue giving my entire summers to the GS activities” (Dutton Collection, Box 31: letter, B. Dutton to C. Yeagley, Sept. 21, 1956). She recommended to the Girl Scout officials that the 1956 dig session at Pueblo Largo be the last, and that emphasis be refocused on the mobile camps, perhaps with other leadership. She would be willing to be the advisor, do the initial reconnaissance each year, and possibly lead one trip, but not all three. She added: “But I feel deeply that, after these ten years, if the GS organization thinks the program is of sufficient value they should take it over.” She felt that the mobiles did not need a professional archaeologist as head, and she recommended a successor.

Other issues were also affecting Bert’s decision to begin withdrawing. In 1953, administration of the summer program shifted away from the Dallas regional office to the National Girl Scout headquarters in Washington, D.C. There it became part of the “National Camping Division” (89LA5.063: letter, B. Long to Mrs. R. Beckhard, Nov. 18, 1952). Up until that time, arrangements apparently had been informal, with a letter written between the regional director and the head of the Museum of New Mexico outlining and approving the schedule and itinerary for that summer’s camps. But after that time,
agreements became more formal, with contracts (up to several pages) specifying responsibilities (89LA5.063; 89LA5.064; 89LA5.065). The Museum was very proud of the program, and continued to support Bert’s participation in it, as it was garnering national and international recognition (89LA5.063: letter, B. Long to L. B. Jones, Sept. 23, 1954). However, it was taking an increasing amount of administrative time. For the 1956 season, the selection process for campers also was shifted to National headquarters and out of Bert’s personal control, and the number of campers was raised from 16 to 24. Up until this time, she had carefully scrutinized each application to make sure that the girls had the requisite camping skills and interest levels (89LA5.064: letter, B. Long, June 3, 1955). With the increased numbers, and in order to make sure that the Museum and SAR were not legally responsible for the girls, Boaz Long (89LA5.065: letter, B. Long to Mrs. R. Beckhard, Nov. 1, 1955) requested that the GSA take full contractual responsibility for “supervision of the girls, their welfare, safety and care” and furthermore, “hold the Museum and School harmless from any claims or suits that may arise in connection with the trips.” (The Museum’s attorney, O. Seth, was now reading the contracts.) In view of this, he also requested a change in Bert’s job description to reflect that she would no longer be designated as “supervisor.”

Bert’s report of the 1956 season indicated eight points that she felt had become obstacles to the former overwhelming success of the program, all due to the increased

Figure 5.
Excavation crew, Pueblo Largo, with Bert Dutton in center, 1956.
Courtesy of the Laboratory of Anthropology, Museum of New Mexico.
number of girls and the lack of control. The last is perhaps the most telling (89LA5.065: letter, B. Dutton to G. Yoffa, Sept. 14, 1956):

Most important of all, [this has] obviously resulted in the acceptance of younger and unqualified campers in order to fill the quotas; several of these younger, extremely immature girls showed promise, indicating that some two years from now they would have been prepared for the experience offered; some, even older, had utterly inadequate camping experience, skills, and background for this opportunity, and were a detriment to our camps.

It was also in this report that she suggested that her role be diminished to reconnaissance and advisor, that the number of mobile camps be reduced from three to two, that the excavation camp be discontinued, that the participants for mobile camps be limited to 16 "older, mature, girls," and that preference be given to "campers [who] have proven their interest and abilities." She added: "One of the major features of this program has been its continuity, which has made it possible for several young ladies to chart their futures thereby" (89LA5.065: letter, B. Dutton to G. Yoffa, Sept. 14, 1956). The GSA took these recommendations under advisement, and agreed to lower the number of mobile camps to two for the summer of 1957. However, they refused to reduce the number of girls from 24 to 16, and also requested one last excavation season, to be conducted by Bert or someone else qualified (89LAS.065: letter, G. Yoffa to B. Dutton, Nov. 20, 1956). Bert acquiesced on the numbers for the mobile camps, but held firm on the excavation. She (89LA5.065: letter, B. Dutton to G. Yoffa, Nov. 23, 1956) wrote back:

It will be impossible for me to conduct another excavation camp for the Girl Scouts. Personally, and as an agent of our institution, there is too much involved at Pueblo Largo to allow of anyone else stepping in there. We have obligations and unfinished studies which must be continued in due time. What we have accomplished during the six seasons that the Senior Girl Scouts have been working there, will be made a part of the reports which will be published, with full recognition [sic] given to the Scout organization.

In a letter to one of the veteran diggers, she noted that the two-week sessions were not long enough to make real progress, and further, "I don't feel that enough girls get enough (or give enough) for the experience to make a worthwhile expenditure of time, effort or money" (Dutton Collection: Box 31, letter, B. Dutton to C. Yeagley, Sept. 21, 1956). She felt that a more concentrated effort was needed at the site to make real progress, perhaps with "a few strong men to do the heavier excavation work," and longer sessions. Two more mobile camps were thus held in the summer of 1957 in which Bert participated, but no dig session.

In 1958, the program was re-titled "Senior Girl Scout Mobiles to the Southwest" and turned over to a new director, Jan Fleming, who was not an archaeologist, but had been a GSA representative on several previous mobile camps. Fleming wrote that "We are broadening our program to include nature, wildlife, types of terrain, natural history, geology and archaeology" and that camp headquarters while in Santa Fe would be at Jack Stacy's ranch (89LA5.066: letter, J. Flemming to W. L. Mauzy, April 15, 1958). Bert had been involved in an automobile accident that spring, and thus could not do the reconnaissance as planned, although she continued as an advisor to the Region IX of the Girl Scouts. The Museum's participation that year was reduced to two lectures (Lambert, Mauzy), and it was further suggested that in view of limited time, that the "girls interested in Ethnology can go through that department [Bert's] on their own" (89LA5.066: letter, J. Flemming to W.L. Mauzy, May 10, 1958). The program as Bert had originally conceived and developed it ceased to exist.

Bert stayed in contact with many of her former Diggers through the years, however. Although her immediate plans for analysis and write-up of Pueblo Largo did not materialize, she corresponded with former excavation team members about the possibilities, and induced some to take on other related tasks. Many stopped by her home(s) in Santa Fe whenever they came to town; many
more wrote her notes, especially at Christmas and for her birthday. They reported their progress in school, marriages, children, and other experiences. Most continued to thank her and acknowledge her profound influence on them and their lives. She delighted in keeping in touch with so many, especially through her annual Christmas letter, and enjoyed passing on the news of “her girls” to others whenever and however she could.

Bert went on with her work at the Museum of New Mexico for several years, including continuing to survey and excavate in the Galisteo Basin. Her biggest project after Pueblo Largo was the excavation of Las Madres (LA 25), accomplished in the 1960s under National Science Foundation sponsorship (Dutton 1980). The results of the project, contained in two large unpublished volumes, include analyses of several major artifact classes by Dutton and contributing specialists. Wherever possible and appropriate, the analyses also include materials from Pueblo Largo. Bert apparently saw this as an alternative venue to the separate report on Pueblo Largo. The extensive notes, photographs, and reports on Las Madres are also in the archives at the Laboratory of Anthropology.

Bert also wrote several scholarly and popular works after 1957, including various versions of the MNM’s handbooks *Indians of the Southwest* (Dutton 1960), *Navaho Weaving Today* (Dutton 1961), *New Mexico’s Indians of Today* (Dutton 1965), tour books on Zuni Pueblo, Rio Grande Pueblos, and local sites around Santa Fe. She contributed over 100 articles to *El Palacio*, the museum’s popular journal, and was the museum’s instructor for television and adult education classes from 1947 to 1957 (Morris and Olin 1997:653). Her volume *Sun Father’s Way* (Dutton 1963), based on the Kua’ua murals of Coronado State Monument, New Mexico, was one of her favorite scholarly works, but still written in a style for the educated public. Bert went on to direct the Navajo Museum of Ceremonial Art after she retired from the Museum of New Mexico in 1965, a post she held until 1975.

Bert saw her activities with the Girl Scouts, as well as her popular writing, museum work, and public lectures as a form of *applied anthropology* (Dutton 1985). She noted that “people want to learn,” that is why the Archaeological Institute of America had a chapter in Santa Fe, and that is why she took trips with them and others to all the national monuments and parks, into Mexico, and elsewhere, something that she had started under Hewett’s tenure. She noted that public education and support was further important, in that “archaeology needs money and good will, and nothing can raise them faster than showing and telling what we have” (Dutton 1985). She said, “It’s my contribution. I am an only child, and this is my way to give to mankind” (Dutton 1985).

In 1983, on Bert’s eightieth birthday, 50+ Diggers, including many who had stayed in touch through the years, came together in Santa Fe (*Santa Fe New Mexican*, 3/20/83). At least another 50 who could not attend sent cards and letters to her, telling about their lives and careers and the influence she had on them. Most had gone on to finish college, several going into anthropology and archaeology, but also completing degrees in other academic areas. Six had full careers in anthropology and more than 30 were educators in other fields. Another 30+ had become nurses, medical technologists or gone into medicine (including psychiatry) or dentistry. Others had full careers in other sciences and/or law. The list was impressive and the outpouring of gratitude and respect overwhelming (Dutton Collection, Box 27). Also on that occasion, Bert was finally and officially recognized by the Girl Scouts of America for her contributions to the program and to the development of so many fine young women (Dutton Collection, Box 27). Again, in 1994, several of these plus others of her friends and many colleagues gathered for her memorial service in Santa Fe and to celebrate her accomplishments. Her Girl Scout years were a continual reference.

Bert was most pleased to have influenced so many young women to go on to get university degrees in all fields, including anthropology and archaeology. She was very proud of her “more than 200 daughters.” Her legacy lives on in the many women who still consider themselves “Dutton’s Dirty Diggers.”
ENDNOTES

1. Special thanks to Diane Bird, Archivist, Laboratory of Anthropology, Museum of New Mexico, for her help with the Dutton Collection, and with general Laboratory files. Research for this paper was first undertaken in 2003 for a paper for the annual meeting of the Society for American Archaeology. It was then continued while I was a Summer Fellow at the School for Advanced Research in the Human Experience in 2007 under a Bill and Nettie Adams Fellowship in the History of Anthropology. I was a member of the Senior Girl Scout Mobile Camps in 1956 and 1957. Nettie Adams also participated in Mobile Camps and in the Pueblo Largo excavation (Figures 4 and 5).

2. In an article in *The Girl Scout Leader*, February 1952, titled “The Digger Caravan” on the 1951 program, there is a brief note to the effect that there was another archaeological opportunity being offered in Region X (Midwest) through the Smithsonian Institution to excavate in an area to be flooded by a dam—suggesting something perhaps connected to the River Basin Surveys.

3. The Dutton Collection is in the Laboratory of Anthropology Archives, Museum of New Mexico, Santa Fe. They are cited here by original Box # as the collection is currently undergoing processing. Additional materials in the Lab Archives are listed file number (LA5.065, etc.).

4. Dutron (1985) also indicated that San Cristobal Ranch where Pueblo Largo is located changed hands about this time, and that “the Senator from Texas” who now owned it “didn’t like what the Scouts and the Museum were doing.” Thus, the project may have been over for other reasons as well.
REFERENCES CITED

Babcock, Barbara A. and Nancy J. Parezo

Bohrer, Vorsila

Dutton, Bertha P.
1960 *Indians of the Southwest (formerly New Mexico Indians).* Pocket Handbook. Southwestern Association on Indian Affairs, Santa Fe. (various editions)
1961 *Navaho Weaving Today.* Museum of New Mexico Press, Santa Fe. (various editions; "Navaho" changed to "Navajo" in 1975 edition)
1963 *Sun Father's Way.* University of New Mexico Press, Albuquerque.
1965 *New Mexico’s Indians of Today.* Tourist Division, New Mexico Department of Development, Santa Fe.
1985 *Video Interview of Bertha P. Dutton.* Laboratory of Anthropology, Museum of New Mexico. [Rough cut, ca. 1 hr.; Dutton Collection, Laboratory of Anthropology]

Fowler, Don D.

The Girl Scout Leader
1952 *The Digger Caravan.* February 1952.

Hewett, Edgar Lee

Morris, Elizabeth Ann, and Caroline B. Olin

Parezo, Nancy J. (editor)

Santa Fe New Mexican
1983 [article on Bertha Dutton’s 80th birthday, 3/20/83]. Santa Fe.

Wethey, Gillian H. (photos by Laura Gilpin)
1955 *Girl Scouts Southwestern Trek.* *Arizona Highways* 31 (June):14-17.
CERAMIC ARTIFACTS FROM SITES AT CERRO DE LOS LUNAS AND ALBUQUERQUE’S SOUTH VALLEY, WITH OBSERVATIONS ON PUEBLO III POTTERY IN THE MIDDLE RIO GRANDE VALLEY

INTRODUCTION

The region along the Rio Grande and its tributaries between about Bernalillo and Belen has an archaeological identity problem. It starts with the territory. Various terms have been applied to the area, including Middle Rio Grande district, Rio Medio, or northern Rio Abajo, while geologists refer to it as the Albuquerque Basin. Not all these terms apparently refer to exactly the same territory, but we are speaking here of a core between Albuquerque and Los Lunas, perhaps extending north to Bernalillo, and southward to an undefined boundary between Belen and Socorro. Marshall and Walt’s survey of Rio Abajo (1984) stopped at Abeytas, just south of Belen. At some ill-defined point, the Middle River gives way to the Lower River, perhaps corresponding to the cultural boundaries of the Keres and Southern Tiwa pueblos on the north with the Piro to the south. Marshall and Walt (1984:1) mention the validity of a “Rio Medio” region, north of “Rio Abajo,” as a distinct cultural area.

Traditionally, this area has been regarded as a cultural backwater or frontier (e.g., Anschuetz 1987), at least prior to the explosion of glazeware sites in Pueblo IV (P IV) times. As the poor stepchild during earlier phases, the area is seen as peripheral to major developments elsewhere, in the northern San Juan-Mesa Verde area and the Chacoan sphere in the San Juan Basin. The belated adoption of above-ground adobe and masonry architecture contributes to this impression. In spite of this, it is now known that many villages dotted the landscape during the Basketmaker III (BM III) through P III time period (Pecos classification), or Developmental through Coalition phases (Wendorf and Reed 1955). In terms of pottery, similar interpretations prevailed. That is, this area was the recipient of pottery made elsewhere, with no particular tradition of its own.

There is some basis for the belief that the area was strongly influenced from cultural centers in the central and southern San Juan Basin, and then the Middle San Juan-Mesa Verdean sphere, later. Ceramics from the west, particularly the Cibola-Chaco region, certainly did arrive here during P I-P III, and included Red Mesa, Puerco-Escavada, Gallup, and Chaco Black-on-white (B/W) trade items. After A. D. 1200, additional ceramic imports arrived from the north, including carbon-painted wares identified as McElmo, Chaco-McElmo B/W, and then Rio Grande types Santa Fe and Wiyo B/W. These trends are a matter of archaeological record.

However, to view the Albuquerque Basin as simply the passive recipient of ceramic wares manufactured elsewhere would be incorrect. Resident populations did, in fact, develop their own local ceramic traditions. While influenced from adjoining areas, these local practices are verifiable analytically, and deserve more recognition. This article presents new data that suggests that the Middle Rio Grande populations in the pre-Classic times manufactured a series of types that were produced with local materials and underwent local evolutionary change. Specifically, the focus will be on the time period of ca. A. D. 1100 - 1300, corresponding to the P III phase of the Pecos system, or the late Developmental and the entire Coalition phases of Wendorf and Reed (1955).
Recent analyses of ceramics from two sites of this period are summarized, and then compared to contemporary sites in the area. The authors conducted independent analyses of ceramic collections for separate projects. Subsequently, comparison of results revealed similarities of the two studies regarding the time, typology, and general conclusions at each site. This paper summarizes the two sites’ ceramic data and compares our results to previously excavated sites in the Middle Rio Grande area. Data summarized here are drawn from Murrell (2009) and Franklin (2009). Recent summary descriptions of area pottery are found in Wilson (2005), Dyer (2008), and Windes and McKenna (2009). All dates are anno Domini.

LA 100217 (CERRO DE LOS LUNAS)

Cerro de Los Lunas (LA 100217) is located on the edge of New Mexico State Highway 6 (NM-6) in the outskirts of Los Lunas, New Mexico. It was originally recorded by survey along the right-of-way by Condie (1993). It was further described by Cibola Research Consultants (Marshall and C. Marshall 2003). Combined survey data suggested a maximum date range of 1050-1300. Subsequently, excavations have been reported by Parametrixx (Murrell 2009) and are summarized here. Excavations in a series of gridded pits tested the site’s extent and depth. The team uncovered a series of pit features and trash deposits. Pits often contained burned maize. No living structures were located, but they must have existed, because of an extensive midden. Disturbance by previous road construction may have obscured or removed habitations, or they may lie outside of the investigated area.

Date estimates made during surveys were corroborated by Parametrixx, with several Accelerated Mass Spectrometer (AMS) dated maize samples, which ranged from 1000-1280. Six statistically similar AMS age determinations produced a mean pooled age with a 1 sigma range of Cal. A.D. 1181-1223 and a 2 sigma range of Cal. A.D. 1169-1253 (Murrell 2009:215). Evaluation of mean ceramic calculations, frequency-adjusted ranges, and composite ceramic distribution curves showed that a number of excavated sites in the current study area generally date between 1100 and 1250 (Murrell 2009:212).

### Table 1.
Decorated pre-P IV Ceramic Types of the Middle Rio Grande Area.

<table>
<thead>
<tr>
<th>Type</th>
<th>A.D. Date Range</th>
<th>Median Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rio Grande whiteware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Marcial Black-on-white</td>
<td>750 - 950</td>
<td>850</td>
</tr>
<tr>
<td>Socorro Black-on-white</td>
<td>1050 - 1275</td>
<td>1163</td>
</tr>
<tr>
<td>Kwahe'e Black-on-white</td>
<td>1050 - 1200</td>
<td>1125</td>
</tr>
<tr>
<td>Chupadero Black-on-white</td>
<td>1150 - 1500</td>
<td>1325</td>
</tr>
<tr>
<td>Santa Fe Black-on-white</td>
<td>1200 - 1350</td>
<td>1275</td>
</tr>
<tr>
<td>Wiyo Black-on-white</td>
<td>1250 - 1400</td>
<td>1325</td>
</tr>
<tr>
<td>Galisteo Black-on-white</td>
<td>1300 - 1400</td>
<td>1350</td>
</tr>
<tr>
<td><strong>Cibola White Ware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kiatuthlanna Black-on-white</td>
<td>850 - 950</td>
<td>900</td>
</tr>
<tr>
<td>Red Mesa Black-on-white</td>
<td>900 - 1050</td>
<td>975</td>
</tr>
<tr>
<td>Cebolleta Black-on-white</td>
<td>900 - 1150</td>
<td>1025</td>
</tr>
<tr>
<td>Escavada Black-on-white</td>
<td>1000 - 1130</td>
<td>1065</td>
</tr>
<tr>
<td>Gallup Black-on-white</td>
<td>1030 - 1125</td>
<td>1078</td>
</tr>
<tr>
<td>Puerco Black-on-white</td>
<td>1030 - 1150</td>
<td>1090</td>
</tr>
<tr>
<td>Reserve Black-on-white</td>
<td>1050 - 1125</td>
<td>1088</td>
</tr>
<tr>
<td>Tularosa Black-on-white</td>
<td>1175 - 1300</td>
<td>1238</td>
</tr>
<tr>
<td><strong>White Mountain Red Ware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puerco Black-on-red</td>
<td>1030 - 1150</td>
<td>1090</td>
</tr>
<tr>
<td>Wingate Black-on-red</td>
<td>1050 - 1200</td>
<td>1125</td>
</tr>
<tr>
<td>St. Johns Black-on-red</td>
<td>1175 - 1300</td>
<td>1238</td>
</tr>
<tr>
<td>St. Johns Polychrome</td>
<td>1175 - 1300</td>
<td>1238</td>
</tr>
<tr>
<td>Heshotauthla Polychrome</td>
<td>1300 - 1400</td>
<td>1350</td>
</tr>
<tr>
<td><strong>Rio Grande Glaze Ware</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaze A, Agua Fria Glaze-on-red</td>
<td>1315 - 1425</td>
<td>1370</td>
</tr>
</tbody>
</table>

The survey estimates, AMS dates, mean ceramic dates, and known date ranges for pottery types from the Cerro de Los Lunas site all showed a high degree of agreement. As such, it falls within the Socorro Phase as suggested by Mera (1935:27) and further defined by Marshall and C. Marshall (1994:234). It also corresponds to most of Pueblo III in the traditional Pecos system.

A sample consisting of 1155 ceramic artifacts were selected for analysis. They were subjected to attribute analyses, including examination of paste and tempering materials, and then assigned to a pottery type. Typological assignment to known standard Southwestern pottery types (e.g., Hawley 1936; Mera 1935; Wilson 2005) was achieved. Decorated types of the area are in shown for reference in Table 1. Table 2 gives the specific types and frequencies tallied.

Decorated pottery is dominated by Socorro, Wiyo, Santa Fe, and Kwahe'e B/W types in descending order of prevalence. Cibola White Ware types emanating from the west included Escavada and Cebolleta B/W. Cibola White Ware types are typical accompaniments of local whitewares along the Middle Rio Grande at this time. Indeed, the ceramic connection to the west had been ongoing since P II, and imported Red Mesa B/W is abundant in the Middle Rio Grande. White Mountain Red Ware (Carlson 1970) is a known tradeware from the Little Colorado drainage area of Arizona. Some 20 sherds were assigned to this group, including St. Johns Polychrome (Poly) and St. Johns Black-on-red (B/R) (Table 2). These types were extremely popular, and were widely traded to the east and northeast of their production area; they are known as far east as the Pecos River.

### Table 2.
Pottery Type Frequencies at Cerro de Los Lunas, LA 161967.

<table>
<thead>
<tr>
<th>Ware and Type</th>
<th>Frequency</th>
<th>Percent in Ware</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Middle Rio Grande whiteware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socorro B/W  a</td>
<td>55</td>
<td>20.3%</td>
<td></td>
</tr>
<tr>
<td>Kwahe'e B/W</td>
<td>15</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>Santa Fe B/W</td>
<td>15</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>Wiyo B/W</td>
<td>16</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>Unidentified B/W</td>
<td>68</td>
<td>25.1%</td>
<td></td>
</tr>
<tr>
<td>Plain white</td>
<td>102</td>
<td>37.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>271</td>
<td>100.0%</td>
<td>23.5%</td>
</tr>
<tr>
<td><strong>Cibola White Ware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Escavada B/W</td>
<td>1</td>
<td>4.0%</td>
<td></td>
</tr>
<tr>
<td>Socorro B/W, Cibola variety</td>
<td>1</td>
<td>4.0%</td>
<td></td>
</tr>
<tr>
<td>Cebolleta B/W</td>
<td>8</td>
<td>32.0%</td>
<td></td>
</tr>
<tr>
<td>Unidentified B/W</td>
<td>7</td>
<td>28.0%</td>
<td></td>
</tr>
<tr>
<td>Plain white</td>
<td>8</td>
<td>32.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25</td>
<td>100.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td><strong>White Mountain Red Ware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Johns B/R  b</td>
<td>6</td>
<td>30.0%</td>
<td></td>
</tr>
<tr>
<td>St. Johns Poly</td>
<td>9</td>
<td>45.0%</td>
<td></td>
</tr>
<tr>
<td>Unidentified B/R</td>
<td>3</td>
<td>15.0%</td>
<td></td>
</tr>
<tr>
<td>Plain red</td>
<td>2</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>100.0%</td>
<td>1.7%</td>
</tr>
<tr>
<td><strong>Los Lunas Plain and Corrugated Ware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain gray</td>
<td>51</td>
<td>8.9%</td>
<td></td>
</tr>
<tr>
<td>Plain gray, smudged interior</td>
<td>27</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td>Plain brown</td>
<td>119</td>
<td>20.7%</td>
<td></td>
</tr>
<tr>
<td>Plain brown, smudged interior</td>
<td>197</td>
<td>34.3%</td>
<td></td>
</tr>
<tr>
<td>Los Lunas smudged</td>
<td>111</td>
<td>19.3%</td>
<td></td>
</tr>
<tr>
<td>Corrugated</td>
<td>3</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>Indented corrugated</td>
<td>16</td>
<td>2.8%</td>
<td></td>
</tr>
<tr>
<td>Indented rubbed corrugated</td>
<td>5</td>
<td>0.9%</td>
<td></td>
</tr>
<tr>
<td>Indented smeared corrugated</td>
<td>10</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>Rubbed corrugated</td>
<td>36</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>575</td>
<td>100.0%</td>
<td>49.8%</td>
</tr>
<tr>
<td><strong>Tijeras plain and corrugated ware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain gray</td>
<td>77</td>
<td>31.8%</td>
<td></td>
</tr>
<tr>
<td>Plain brown</td>
<td>40</td>
<td>16.5%</td>
<td></td>
</tr>
<tr>
<td>Corrugated</td>
<td>8</td>
<td>3.3%</td>
<td></td>
</tr>
<tr>
<td>Indented corrugated</td>
<td>49</td>
<td>20.2%</td>
<td></td>
</tr>
<tr>
<td>Indented rubbed corrugated</td>
<td>5</td>
<td>2.1%</td>
<td></td>
</tr>
<tr>
<td>Indented smeared corrugated</td>
<td>41</td>
<td>16.9%</td>
<td></td>
</tr>
<tr>
<td>Obliterated corrugated</td>
<td>18</td>
<td>7.4%</td>
<td></td>
</tr>
<tr>
<td>Rubbed corrugated</td>
<td>4</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>242</td>
<td>100.0%</td>
<td>21.0%</td>
</tr>
<tr>
<td><strong>Cibola plain and corrugated ware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain gray</td>
<td>3</td>
<td>13.6%</td>
<td></td>
</tr>
<tr>
<td>Corrugated</td>
<td>3</td>
<td>13.6%</td>
<td></td>
</tr>
<tr>
<td>Indented corrugated</td>
<td>15</td>
<td>68.2%</td>
<td></td>
</tr>
<tr>
<td>Indented smeared corrugated</td>
<td>1</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>22</td>
<td>100.0%</td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>1155</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

a B/W=Black-on-white  b B/R=Black-on-red
Note: from Murrell (2009:66)
Utility wares, including plain and corrugated styles, were traditionally classed as grayware or brownware. However, the distinction between brown and gray may be meaningless culturally (Post 1994:65; Wiseman 1980:103). A small change in firing atmosphere, or customs of cooking vs. non-cooking with utility ware can produce such differences in coloration. For this reason, recent analyses of utility assemblages have tended to lump both brown and gray surfaced varieties together (e.g., Murrell 2009). Mera (1935:29) named Pitoche Rubbed-ribbed, which was combined with Los Lunas Smudged and other brownware types into Los Lunas brownware by Marshall and E. Marshall (1994). Tempers generally are sand and intermediate igneous rocks. By contrast, Tijeras utility pottery is noted for its micaceous schist and granitic rock temper (Hill 1994:287; Warren 1980a, 1980b:155).

Clapboard and indented corrugated surface textures are evident in the utility pottery. Wiping, rubbing, and obliteration of coils yielded differing surface appearances. Plain untextured utility pottery is also well represented. Interior smudging and polishing is seen in varying degrees. Los Lunas Smudged (Mera 1935:28–29), with its distinctive smudged polished bowl interiors and fine rubbed coils on exteriors, is here in abundance (111 sherds). This type reaches a peak in this area during this time, and occurs in many localities. It appears that Los Lunas Smudged and related Pitoche Rubbed-ribbed were made locally at this settlement.

Microscopic analysis of tempering materials was also undertaken. Tempers of the Middle Rio Grande whiteware types contained sand, angular igneous rock fragments, and/or sherd temper in varying combinations (Murrell 2009:70). Results show that the four major types—So-corro, Kwahè'e, Santa Fe, and Wiyó B/W—all have similar temper constituents. As a result, all could have been produced with the same or similar tempers. By default, this implies a consistent production process for all these types at this village, or at least in the immediate area. Cibola White Ware and Cibola utility ware are tempered with characteristic inclusions of quartz sand, multilithic sand, and/or potsherd. In addition to other characteris-

tics, this temper, in combination with blocky white paste, are definitive for identification. Los Lunas Smudged, on the other hand, is 80 percent sand-tempered. Another 12 percent contains angular mafic rock fragments that match those in the local whitewares. Ostensibly, this suggests that at least some of it was made from local igneous rocks so common in the local whiteware. Los Lunas plain and corrugated sherds also contain similar tempers, i.e., either sand or angular mafic igneous rocks, or a mixture. White Mountain Red Ware is readily identified by buff-firing pastes and large chunky sherd temper, along with distinctive surface traits. Twenty sherds were St. Johns B/R or Poly. The utility pottery from the Tijeras district is marked by micaceous schist-granitic temper. This identifies these 242 sherds as derived from Tijeras Canyon.

In sum, temper analyses confirmed the imported nature of the Cibola White Ware, White Mountain Red Ware, and Tijeras plain and corrugated ware. The inclusions of the four Middle Rio Grande whiteware types are so similar that they could have been made from the same materials. Los Lunas plain and corrugated ware revealed some similarities, and yet differences, from the whitewares. The actual materials sources for the local whitewares and local plain and corrugated ware are not known, but are likely to be within the local area.

Thus, at Cerro de Los Lunas, the local wares are considered to be Middle Rio Grande whiteware as well as Los Lunas plain and corrugated ware (Murrell 2009:102). Basic analysis indicated that these painted and utility wares were made at this locality, or at least within the local area. Conversely, Cibola White Ware, White Mountain Red Ware, and Cibola plain and corrugated ware are the result of interregional exchange. Likewise, the frequent occurrence of Tijeras plain and corrugated ware in the assemblage is also considered to be the result of importation from the Sandia-Manzano production zone. Indeed, a substantial proportion of the assemblage by frequency and weight consisted of Tijeras plain and corrugated ware.

Importation of copious amounts of plainware is noteworthy—in this case, the Tijeras plain and corrugated
ware. It was brought from settlements in the Sandia and Manzano range. Given present knowledge, the main source may be early Tijeras Pueblo itself, although there may have been other production centers within the canyon. Warren (1980b) depicted the grayware at Tijeras Pueblo, characterized by the distinctive mica schistose rock mixed with granite. From the mountains, this distinctive schist-tempered utility was distributed widely to towns along the Rio Grande Valley. It has been noted at many P IV glazeware sites along the river and bajada (Franklin 1997; Warren 1981; Wiseman 1980). Apparently, this traffic in Tijeras utility started even earlier, in P III times. At Cerro de los Lunas, a substantial amount of the utility ware is classed as Tijeras in origin.

In all, Cibola White Ware and Cibola plain and corrugated ware comprise 47 pieces (4.1 percent of total). White Mountain Red Ware types are another 20 (1.7 percent). Tijeras plain and corrugated ware includes 242 (21 percent) sherds, a substantial proportion of the utility ware. Together, 26.8 percent of the assemblage can be attributed to imports from various non-local sources (Table 2).

These data suggest evidence for intra- and inter-regional trade, as is indicated by typological imported wares listed above. However, more localized exchange may have also been in effect, accounting for variations in Middle Rio Grande whiteware and Los Lunas plain and corrugated ware. Exchange at this more localized scope of interaction has not been well studied in this area, but undoubtedly occurred. Murrell (2009) noted that several known sites of this general time period are situated in the vicinity. These include LA 2567 and LA 2569 (Cerros Mojinos) (Fenenga 1956; Fenenga and Cummings 1956), as well as Socorro phase components along NM-6 (Marshall and C. Marshall 2003:38). Exchange at this level may explain variability within the pottery of Rio Grande whiteware and Los Lunas plain and corrugated ware observed at this site.

LA 161967
A small sherd collection from a site in the Albuquerque South Valley was made by Bradley Bowman in 2008. This 100 percent surface collection was obtained at a private residence in the South Valley, as a part of a prehistoric site was revealed by house construction. Subsequently, the pottery was loaned to Franklin for study. This small site may possibly be related to LA 582, in the vicinity, but the relationship to that larger site is unknown; modern construction in a residential neighborhood has erased most traces of prehistoric activity.

Analysis by Franklin, reported in Franklin (2009), included typological identification, vessel form, and temper analysis on all 158 sherds. A photographic record included microscope photos. Oxidation (refiring) tests were also conducted to assess clay characteristics, and to compare to the distribution of the tempering materials. Many studies have demonstrated the importance of clay and temper identification in locating areas of manufacture.

Pottery types represented revealed many of the same ones found at Cerro de Los Lunas, and a comparable timespan is indicated. Temporally, they fall into the time frame of 1050-1325 at the maximum (outside). Minimum (inside) dates, during which all types were in production, fall between 1150 and 1275. Here also, the sample can be placed into the P III, or late Developmental and Coalition periods. A few sherds of Agua Fria Glaze-on-red (G/R) indicate that at least part of the occupation persisted to 1300 or perhaps slightly later. Except for a few early glaze sherds, the temporal placement of this site is contemporaneous with Cerro de Los Lunas.

The assemblage includes 158 sherds of decorated and utility types, as well as a partially reconstructable Agua Fria G/R bowl. The major decorated types are, again, Socorro, Santa Fe, and Wiyo B/W. Numerically, Santa Fe B/W is the most common (Table 3). No Kwahe’e B/W is present. Unlike LA 100217, this locality lacks Ci-
bola White Ware from the west. Nor is there San Juan region pottery, or verified imports from the northern Rio Grande, although the sample size is not large.

Here, also, White Mountain Red Ware imports occur, in the form of 17 sherds of St. Johns Poly. Although decoration is minimal on some sherds, it is likely that all are either St. Johns Poly or Black-on-red (B/R). Two of these exhibit some black basalt temper, which would suggest a manufacture in the Rio Grande Valley. As such, they are a local St. Johns, or typeable as Los Padillas Poly.

The utility wares used for cooking and storage include several styles: clapboard (unindented) corrugated, indented (finger impressed) corrugated. Obliterated (coils smoothed to the point of invisibility) corrugated was the last stage in this progression. No brownware (Pitoche series) corrugated or plain-surfaced utility was seen. Los Lunas Smudged is also common at the South Valley site, composing 7 percent of ceramics. Here, the type displays the typical attributes, including smudged and polished bowl interiors and finely coiled upper exterior walls on bowls.

Tempers of the black/white decorated pottery from the South Valley site are consistently composed of potsherd, sand, or mixtures of potsherd and sand. There is no significant difference between the types of Socorro, Santa Fe, and Wiyo B/W in terms of temper. Each has the same range of tempers; sherd, sherd/sand, and sand alone were used in all of them. About half the specimens are sherd tempered alone, the rest are sherd/sand or sand tempered. This in itself suggests that these individual pottery types, with differing paints and from distinct traditions could have been produced from the same raw materials.

At this site, Los Lunas Smudged is consistently tempered with sherd and sand, duplicating the tempers in over 50 percent of black/white pottery. Again, overlap with the painted pottery suggests a common usage of tempering ingredients.

Note: from Franklin (2009).

<table>
<thead>
<tr>
<th>Pottery Type</th>
<th>N</th>
<th>Ware %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socorro B/W</td>
<td>5</td>
<td>5.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Santa Fe B/W</td>
<td>21</td>
<td>22.6%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Wiyo B/W</td>
<td>10</td>
<td>10.8%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Carbon paint unident.</td>
<td>7</td>
<td>7.5%</td>
<td>4.4%</td>
</tr>
<tr>
<td>St. Johns Poly</td>
<td>17</td>
<td>18.3%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Glaze A G/R &amp; Poly</td>
<td>3</td>
<td>3.2%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Plain white</td>
<td>30</td>
<td>32.3%</td>
<td>19.0%</td>
</tr>
<tr>
<td>Total Painted</td>
<td>93</td>
<td>100.0%</td>
<td>57.0%</td>
</tr>
<tr>
<td>Indented and clapboard corrugated</td>
<td>16</td>
<td>24.6%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Obliterated corrugated</td>
<td>22</td>
<td>33.8%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Plain gray</td>
<td>16</td>
<td>24.6%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Los Lunas Smudged</td>
<td>11</td>
<td>16.9%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Total Unpainted</td>
<td>65</td>
<td>100.0%</td>
<td>29.0%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>158</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

* B/W=Black-on-white
* Poly=Polychrome
* G/R=Glaze-on-red

Note: from Franklin (2009).
On the other hand, utility tempers are completely different from the painted and Los Lunas Smudged examples. No potsherd and very little pure sand is seen here. The 54 utility grayware sherds consist of indented and clapboard corrugated, obliterated and plain gray surface styles. No correlation of temper with surface treatment is evident; the same tempers were employed across corrugated and plain gray styles. Temper distribution within the utility ware is: mica schist (26) (48 percent), schist and quartz (18) (33 percent), quartz sand (8) (15 percent) and basalt (2) (4 percent). Clearly, the majority is schist or schist mixtures; in fact, 81 percent of the utility is entirely or mostly schist tempered.

Geologically, a variety of source areas is implied (Kelley 1977; NM Geological Society 1982). The quartz sand (with additional crushed detrital rock and occasional mica) is ubiquitous in the sand and gravels of the site’s environment. Basalt occurs in the volcanic cones and flows in Rio Grande rift zone. This ideal tempering agent was available on the mesa west of Albuquerque.

Micaceous schist, confined to the utility pottery, is restricted in occurrence to the Sandia and Manzano Mountains. Outcrops occur in Tijeras Canyon several places within a short distance from Tijeras Pueblo (Warren 1980b; and personal observation). Dikes and localized exposures of this material occur throughout the Sandia-Manzano mountain range. Prehistorically, this schist was utilized by potters at Tijeras Pueblo (Warren 1980b), and other settlements in the Tijeras Canyon (Bowman and Bice 2004; Oakes 1978; Warren 1980a; Wiseman 1980). Apparently traded widely into lower elevation settlements in the Rio Grande Valley, micaceous utility also occurs at many P III and P IV sites (e.g., Acklen 1995; Franklin 1994; McKenna 2009; Warren 1981). Its occurrence at Cerro de Los Lunas has already been mentioned. The precise origin of the micaceous materials in this utility pottery remains unclear. At present, evidence points to Tijeras Pueblo as the center of production of much of it during early P IV glazeware times; prior to that, other settlements in and near the canyon must have been the producers. However, downstream transport of micaceous detritus eroded from the Sandia uplift remains a possibility. In the case of LA 161967, the site location is near enough to the confluence of Tijeras Arroyo with the Rio Grande that it might be possible to collect some micaceous fragments from the alluvial wash sands. However, pottery temper is purely schist, and not mixed with much quartz sand or other materials as would be expected in an extended stream environment. Moreover, aside from occasional small mica flecks, this schist rock does not occur in primary outcrops or secondary redeposited situations along the Rio Grande floodplain. It therefore appears that the schist-tempered utility ware so common in the Rio Grande Valley sites, and westward to Pottery Mound and Cerro de Los Lunas environs, is the result of trade in finished vessels. Since utility pottery itself was probably not the desired trade object, the contents may have been. It could be that products of the mountainous environment (e.g., piñon nuts) were carried to the valley in such vessels.

White Mountain Red Ware pieces contain the typical buff to yellow paste and large sherd tempers known to be characteristic of this series. Together with the diagnostic surface traits, the paste/temper attributes clearly reveal the St. Johns Poly to be an imported type. The two pieces with basalt tempers illustrate the beginnings of local Rio Grande production of this type, which is also known as Los Padillas Glaze Poly in its new environment.

The next stage in ceramic evolution is also evident here, since a partially restorable bowl of Agua Fria G/R was included in the collection. Tempered with basalt, it is clearly a product of the early P IV glazeware production which blossomed in the early fourteenth century. The transition from St. Johns to Los Padillas, and into full-blown Agua Fria G/R is visible in this assemblage. Numerically, the incipient “St. Johns - like” glazeware is not common, and the developed Agua Fria G/R may possibly relate to a separate village in the vicinity. As such, LA 161967 did not last long into the glazeware era.

Comparison of oxidized coloration is helpful in assessing similarities between finished ceramics and between ceramics and raw clay sources from the environment. Clips from 51 sherds were oxidized in an electric kiln to 900 degrees C. in order to test for paste clay colors. A standard measure of color, such as the Munsell Soil Color Chart, is generally used. Matching colors do not prove
that the same clay source was employed, but certainly suggest that possibility.

The refired sample is shown in Table 4, in which color frequencies are plotted on a representation of the Munsell chart. Standard statistics cannot be used, since the Munsell chart is not a continuous numeric scale. But, several things emerged from this test. First, all clays used in all this collection are relatively rich in mineral impurities, especially iron, yielding bright colors. The Value (light to dark) is high and the Chroma or saturation is also high (6-8). This confirms that they were not made from the light buff to white Cretaceous clays typical of Cibola whiteware imports from the San Juan Basin.

The whiteware types (Socorro, Santa Fe, and Wiyo) fall on the lighter and saturated end of the 5YR and 7.5 YR hues, and are high on Chroma dimension. There is some variability, but it is continuous, and does not correlate with pottery type. All three types could have been made from the same narrow range of clays.

Secondly, Los Lunas Smudged fired consistently to 5YR 6/8. The lack of variability indicates that a single clay source was utilized. This color also coincides with at least a portion of the whiteware, as did the temper (above). Together, the data suggest that Los Lunas Smudged was produced from the same clays and tempers employed in the majority of the whiteware sherds. In turn, it would seem that this smudged brownware type was locally made rather than imported.

The 20 pieces of utility ware actually show more variability in color than other categories (Table 4). While 14 fall into the same color range as the whiteware and Los Lunas Smudged (5YR 6/8 - 5YR 5/8), six others derived from a

---

Table 4.
Munsell Colors of Refired Sherds from LA 161967.

<table>
<thead>
<tr>
<th>Type = Whiteware Types n=20</th>
<th>Type = Los Lunas Smudged n=11</th>
<th>Type = Utility Ware n=20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hue: 2.5YR Light Red</td>
<td>Hue: 5YR Reddish Yellow</td>
<td>Hue: 5YR Reddish Yellow</td>
</tr>
<tr>
<td>Chroma (Saturation)</td>
<td>Chroma (Saturation)</td>
<td>Chroma (Saturation)</td>
</tr>
<tr>
<td>Value</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>light</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>dark</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hue: 7.5 YR Light Reddish Yellow</th>
<th>Chroma (Saturation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>0</td>
</tr>
<tr>
<td>light</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>dark</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

---
distinctly redder clay source. Those that matched the whiteware-Los Lunas group contained micaceous schist temper; the other six had tempers of quartz sand or basalt. The latter group is typical of the valley floodplain, and basalt is available on the west side of the river. Schist-tempered utility is typical of the Tijeras Canyon production zone, as mentioned. The fact that most of the whiteware and all the Los Lunas Smudged matched the schist-tempered utility in color suggests that a single clay source or similar localized clay sources were employed for this entire group. Conversely, some of the red-firing utility tempered with other ingredients arrived from other places in the wider Rio Grande zone. Actual sources of clay in the valley and in Tijeras Arroyo need to be located and sampled in order to further verify source locations.

**COMPARISON OF THE TWO SITES**

Both sites share much in common, and are essentially coeval in time, centered on the 1100-1300 period. Temporally, both pre-date the major glazeware reorganization of P IV, but extend into the late 1200s; as such, they reveal what assemblages were like before the glazeware “explosion.” Both contain essentially the same pottery types, dominated by Socorro B/W, but with significant amounts of carbon-painted Santa Fe and Wiyo B/W. Concurrently, the presence of Tijeras, as well as Los Lunas plain and corrugated wares, form the basis of the utility wares. Los Lunas Smudged is often found in area sites after 1125, and these sites are no exception. St. Johns Poly imports are common in both assemblages. However, Cibola White Ware intrusives from the west are lacking at the South Valley site, probably a function of its location to the northeast. Likewise, a reduced frequency of brownware utility as one moves north and east is inferred.

Changes in the nature of the slips, paints, and designs are evident during the occupations of both sites. At both sites a series of steps can be seen in the transition between mineral and carbon paints in the 1200s. Pure mineral, then washy-mineral-carbon combinations, and finally better controlled carbon paints all occur. Present chronological placement cannot separate the fine degrees of gradation as this evolved; we can only view the alteration via seriation within the 100 year period. During this time, slips became thicker and lines wider. The fine line work of Socorro becomes increasingly broader and then bolder in the Santa Fe to Wiyo progression. Rather than discrete “types,” these whitewares form a dynamic series of changes during this century.

At the same time, however, pastes and tempers remain quite constant, arguing for a continuous locally based community of production. Although pastes and tempers are not the same between the two sites, they do tend to be internally consistent within each site’s assemblage. The output from each village remained remarkably consistent in paste-temper across the Socorro-Santa Fe-Wiyo continuum. Oxidation analysis at the South Valley site also shows consistency in the use of similar clays for all its Rio Grande whiteware types. What color variation exists does not correlate with pottery type, but probably local village community production.

In short, the body fabric of the whiteware types (Socorro, Santa Fe, and Wiyo) at each site is indicative of a consistent tradition of materials usage, which continued across the vicissitudes of paint composition and design styles. The internal consistency of temper and paste clay usage across these types argues for local production at both sites. The notion that such sites received all their carbon-painted pottery from the north and the mineral-painted from separate sources is not supported. These data demonstrate a consistent and localized manufacture of Rio Grande whitewares that crosscuts all the major P III whiteware paints and decorative styles.

Both locations contain abundant Los Lunas Smudged. At both sites, the type was independently interpreted to be mostly locally produced. Tempers in this type vary markedly between sites in the area; at Los Lunas, the dominance of sand and rock temper contrasts with the prevalence of sherd temper at LA 161967.

Strong utility connections with Tijeras are shown at both sites. The schist temper appears only in utility wares, never in the whitewares. At Cerro de Lunas, 21 percent
of all pottery was schist-tempered Tijeras grayware. At the South Valley site, the Tijeras connection is even stronger, with 81 percent of the utility being schist tempered. Massive trade in micaceous utility ware verifies that decorated pottery was not the only tradeware. It also proves that such exchange with the Tijeras area preceded the P IV glazeware period.

COMPARATIVE DATA FROM THE AREA

In the Albuquerque-Socorro corridor along the Rio Grande, sites of the period were numerous. Earlier work included the Tunnard Site (Hammack 1966), the Denison Site (Vivian and Clendenen 1965), and the Sedillo Site (Skinner 1965). Some of the more recent investigations undertaken through mitigation efforts belong to this period, e.g., Acklen (1995), Sullivan and Akins (1994), Marshall and C. Marshall (1994), Murrell (2009), and Post (1994). Other reported sites of this culture in the Coalition period include numerous villages on the Lower Puerco, for instance, Fenenga (1956), Fenenga and Cummings (1956), Marshall and Walt (1984), and Warren (1982).

Many sites of the period were noted in surveys of Kirtland Air Force Base (Franklin 1981, 1994; Franklin and Neal 1981; Higgins 1998), with excavation at Two Dead Junipers Site (McKenna 2009, and personal communication 2009). In the Tijeras Canyon vicinity, sites of this era are also common, as summarized by Anschuetz (1984). The formation of Tijeras Pueblo occurred at this time (Cordell 1980), and many other sites are evident up and down the Tijeras drainage as described by Bowman and Bice (2004), Oakes (1978), Warren (1980a, 1980b), and Wiseman (1980). In all, this period was a florescent one, and formed the foundation for the massive expansion of populations and town sizes in the following Classic Period. Cordell (1979) summarized the archaeology of the general Middle Rio Grande area.

The similar assemblages at our two sites are echoed throughout the Middle Rio Grande area. Many of these localities were excavated years ago, and analyses extended no further than basic typology. Nevertheless, it is worth examining them on this basis alone (Table 5 and Figure 1). Initially, it is clear that, far from being a cultural vacuum, the area was well populated. Sites range from riverine settlements to upland hamlets on the bajada slopes and into the canyons of the mountains to the east. Ar-

Figure 1.
Decorated pottery at P III sites in the Albuquerque area, in approximate time order. (Bar data is in percentages within sample; sample totals are at the right.)
architecture evolved from pit structures to jacal and then adobe pueblos rapidly during this period, mirroring alterations in the ceramic practices. Large amounts of pottery were in use at these settlements (Table 5).

Table 5 compares decorated samples from 13 published sites that have dates that extend into the 1100-1300 period. (Percentages are not given, since counts do not include unidentified or generically identified sherds, or unpainted utility sherds). Figure 1 depicts 12 of these sites graphically, in seriation order of probable date, from top to bottom. The Sedillo Site, dominated by Red Mesa B/W, is the earliest, while Tunnard and Rio Bravo are the latest, dominated by Santa Fe and Wiyo B/W. The waxing and then waning of Socorro B/W is discernible, as is the increase of carbon-painted Santa Fe and Wiyo types. Numerous other small sites are known from surveys and

<table>
<thead>
<tr>
<th>Site</th>
<th>Sedillo</th>
<th>Denison</th>
<th>LA 2567</th>
<th>Cerro Majanos</th>
<th>Meade Avenue</th>
<th>Airport Hamlet</th>
<th>Cours</th>
<th>County</th>
<th>Los Lunas</th>
<th>NA 161967</th>
<th>Tunnard</th>
<th>Bravo Pueblo</th>
<th>Two Dead</th>
<th>Janiper</th>
<th>Kirtland AFB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>g</td>
<td>h</td>
<td>i</td>
<td>j</td>
<td>k</td>
<td>l</td>
<td>m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cibola White Ware</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle Rio Grande series</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Marcial B/W (1)</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socorro B/W</td>
<td>14</td>
<td>64</td>
<td>321</td>
<td>409</td>
<td>266</td>
<td>231</td>
<td>372</td>
<td>56</td>
<td>118</td>
<td>26</td>
<td>930</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chupadero B/W</td>
<td>3</td>
<td>4</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cibola White Ware</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>San Juan Basin series</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaatubhanna B/W</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Mesa B/W</td>
<td>144</td>
<td>85</td>
<td>62</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Escalada B/W</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puebro B/W</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallup B/W</td>
<td>21</td>
<td>61</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cibola White Ware</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acoma District series</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobolleta B/W</td>
<td>16</td>
<td>8</td>
<td>9</td>
<td>13</td>
<td>8</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserve B/W</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tularosa B/W</td>
<td>2</td>
<td>14</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North and Middle Rio Grande</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Ware (mineral and carbon)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kwahhe' B/W</td>
<td>65</td>
<td>2</td>
<td>26</td>
<td>15</td>
<td>60</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santa Fe B/W</td>
<td>11</td>
<td>15</td>
<td>15</td>
<td>21</td>
<td>435</td>
<td>94</td>
<td>144</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiyo B/W</td>
<td>1</td>
<td>16</td>
<td>9</td>
<td>20</td>
<td>294</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galisteo B/W</td>
<td>56</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Mountain Red Ware</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pueblo B/R (2)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wingate B/R</td>
<td>28</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>12</td>
<td>2</td>
<td>3</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wingate Poly</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Johns B/R</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Johns Poly (3)</td>
<td></td>
<td>9</td>
<td>17</td>
<td>40</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hochotahtola Poly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rio Grande Glazeware</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaze A red (Aguas Fria G/R)(4)</td>
<td>6</td>
<td></td>
<td>2</td>
<td>9</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painted Decorated Totals</td>
<td>5123</td>
<td>280</td>
<td>236</td>
<td>428</td>
<td>455</td>
<td>287</td>
<td>248</td>
<td>540</td>
<td>126</td>
<td>54</td>
<td>749</td>
<td>419</td>
<td>1123</td>
<td>178</td>
<td></td>
</tr>
</tbody>
</table>

References:
1) B/W = Black-on-white
2) B/R = Black-on-red
3) Pol = Polychrome
4) G/R = Glaze-on-red

<table>
<thead>
<tr>
<th>Reference</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) LA 3122 (Pitouses 4, 5, and 10 (Skinner 1965:Table 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) LA 49995 (Vivians and Clendenen 1965: Table 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) LA 2567 (Fenenga 1956)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) LA 2569 (Fenenga and Cumming 1956)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) LA 1884139 (Hill and Larson 1995: Table 91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) LA 15265 (Post 1994: Tables 7-9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) LA 100217 (Murrell 2009: Table 5-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) LA 161967 (Franklin 2009:Table 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j) LA 6868 (Hammack 1966:11-14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k) LA 57214, LA 88334 (Marshall and Marshall 1994: Tables 24 and 30)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l) LA 87432 (McKenna 2009 and Larson 2009)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m) KAFB survey (Franklin 1994:Table 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
limited testing in the area, especially in Tijeras Canyon and the piedmont zones, as well as unrecorded components on the Lower Puerco near Pottery Mound. A full roster of all recorded P III components of this phase is not known, but probably exceeds 25.

All these sites shared in a community of whiteware production, which underwent fairly uniform changes during the 1100-1300 year period. A consistent body of shared design-style, slipping and painting traditions is evidenced; many villages underwent similar changes in paints and designs synchronously, while maintaining local paste and temper resource utilization. Ultimately, the concept of carbon painting surely arrived from the north, with McElmo and Chaco McElmo B/W types as the logical sources of inspiration in time and space. Prieta Vista (Bice and Sundt 1972) as well as sites in the middle Puerco Valley, which are intermediate in space and time, must have been instrumental in spreading the use of carbon paint along with new design styles into the Albuquerque area and farther south during the late 1100s. From that, a strong carbon painting tradition on the Rio Grande emerged, not only in the northern but also in the middle sectors of the Rio Grande PIII occupational areas.

To be sure, a certain amount of actual imported carbon-painted pottery arrived from the north, but it is now clear that an indigenous carbon-painting tradition was well established between Albuquerque and Los Lunas by the early 1200s. Local P III carbon-painted whiteware has been noted by several investigators, including Bowman and Bice (2004), Franklin (1994, 2009), Hammack (1966), Hill (1994), Hill and Larson (1995), Larson (2007), McKenna (2009), and Murrell (2009). Bice referred to local Santa Fe B/W as “San Ignacio B/W” (Bowman and Bice 2004:28), although the rubric has not been much used. Hammack (1966:11) noted the diversity of Santa Fe B/W at Tunnard, which “form an interesting assemblage with much diversity in decoration, finish, and other traits,” including “similarities with Socorro B/W.” A local variety of Socorro B/W with schist temper was termed Tijeras Black-on-gray (e.g., Franklin 1994; McKenna 2009). Similarly, local varieties of Santa Fe and Wiyo B/W might simply be called typologically, “Middle Rio Grande varieties,” without adding to typological confusion.

Nevertheless, distinguishing the local from the northern imports of carbon-painted wares remains a difficult task. Information on geological sources of clays and tempers is limited at present, although general distribution of deposits is gained from Kelley (1977) and New Mexico Geological Society (1982). Limited paste and temper studies indicate that Socorro transition into Santa Fe B/W occurred locally at many sites as paint composition and design were altered. However, the basic paste-temper fabric remained little changed. Similarity of composition between these types was noted at the two sites discussed here, although the inclusions seen in these two types at Two Dead Junipers differed (McKenna, personal communication 2009). The discrepancy is likely due to the importation of some carbon-painted pottery, while the rest was locally made, after the custom of Socorro B/W.

New data, presented here, tend to confirm the localized nature of much of the carbon-painted production in the Albuquerque area. As such, this reinforces the opinion of Hill (1994) and Hill and Larson (1995), based on petrology, that the characteristics of much of the whiteware appear to be “local.” Overall, paste-temper compositions of Socorro and Santa Fe B/W types tend to overlap in the Albuquerque area. As such, local production of Socorro B/W and indeed much of the Kwahe’e and Santa Fe B/W seems to be indicated.

Trade from the Cibola area is seen in all phases in Rio Grande ceramics. Starting in Red Mesa B/W times, if not earlier, a constant stream of whiteware and grayware imports from the west is seen in local valley locations. The resulting influence on the eastern offshoot types of Socorro and Chupadero B/W is undeniable. After the demise of Chacoan centers, however, the influence of Cibola ceramic traditions in the central basin waned. Instead, new wares and ideas emanated from the north.

White Mountain Red Ware appears at virtually all sites in the area after 1200. It is present in consistently large amounts at these locations, not only at our two sites, but
in the collections at virtually all P III towns in the area. Table 5 lists 210 sherds of this series, and all but one site produced them. White Mountain Red Ware averages 5 percent to 6 percent of painted totals at these sites, and ranges from 2 percent to 31 percent of decorated types. Of course, White Mountain Red Ware and St. Johns Poly, in particular, were widely traded. Thus, its appearance in the Albuquerque area should not be surprising. Still, the quantity and consistency of this importation is noteworthy. In a sense, this is a continuation of a long connection with the northern Mogollon region, which is also expressed in brownwares, smudging, and decorative coiling. Commerce in White Mountain Red Ware began surprisingly early, with Wingate and Puerco B/R entering the area during P II. Wingate Poly and St. Johns B/R follow in time, and are also abundant locally. A total of 11 sites yielded White Mountain Red Ware types that pre-date 1200. After 1200, St. Johns variety assumed priority, with five sites yielding this type (Table 5). In all, White Mountain Red Ware was consistently imported for 250 years.

These redwares are significant also, in that they lead directly to the production of early glazewares after 1300. By 1315, coalesced villages (e.g., Tijeras Pueblo) were beginning to produce large amounts of glaze-on-red pottery based on the White Mountain Red Ware model. As such, it is tempting to see an influx of people as well as tradeware in the century preceding the glazeware florescence. Although there may have been other influences that affected later glazeware styles on the Rio Grande, there seems little doubt that the prime instigation was both the pottery, and probably population, from the White Mountain Red Ware region. Documentation of its popularity in sites of the 1200s, and earlier, tends to support this conclusion.

Los Lunas Smudged paste composition varies across the area, and does not always copy the other brownware types. Indeed, in at least some cases, its clay-temper characteristics match closely those found in the local whitewares, as seen at LA 161967. Although Los Lunas Smudged owed its origin to types of the northern Mogollon, such as Reserve and Forestdale Smudged, Mera (1935:29) proposed it as a local type, while recognizing its heritage in similar smudged wares to the west. Present evidence indicates a diversity of constituent materials, corresponding to localized preferences. Its constant association with Socorro B/W forms an intriguing combination of white and brownwares, revealing a convergence of trends from the north and the west along the Rio Grande.

In the utility arena, tempers of the Pitoche group are mostly granitic sands, whereas Tijeras utility is identified by distinctive micaceous schist and granite temper traceable to Tijeras Canyon settlements. Abundantly produced, Tijeras utility was distributed widely throughout the valley by 1150, continuing up into the glazeware period. Surprisingly large amounts (often 20-30 percent of the total pottery) are seen in assemblages ranging as far away as Los Lunas. Intensive trade with settlements in the canyon is implied.

The mutual occurrence of whitewares and brownwares has perhaps been a puzzle in this area, although this is common throughout the Mogollon for much of its history. The Rio Abajo expressions owed much to Mogollon origins (Marshall and Walt 1984), and probably the Rio Medio as well. The way these origins were integrated into the melting pot of the valley cultures is not well understood. Knowing the extent to which brown, gray, and white wares were produced in the same or different locations would be of great interest.
FUTURE INVESTIGATIONS

There are many possible directions for further research, but sourcing of pottery would be important. Despite much interest in the origins of glazeware production, there has been little research on the geographic clay and temper sources, or centers of production, in the preceding P III period. Some basic questions in this subject would include the following:

- Now that we know that local varieties of Santa Fe, Wiyo, and Kwahe'e B/W were commonplace, how do we reliably distinguish those from imports of similar whitewares from Santa Fe or north?

- The origins of Pitoche or Los Lunas brownware, including various corrugated, ribbed, and Los Lunas Smudged, is clearly in the northern Mogollon. However, how much of this category was locally made in the valley settlements? Evidence suggests that at least some was, and by people who also produced whitewares customarily.

- Thirdly, the widespread distribution of schist-tempered utility pottery made at or near Tijeras Canyon is becoming even more apparent, although Warren (1981) commented on its presence in valley pueblos years ago. What is now clear is that such importation of utility wares from the mountainous country was massive during glazeware times, and this commerce began at least as early as 1200.

- There are also some perplexing anomalies and incongruities in this sequence. Many of them fall into the category of “upstream-downstream” relationships and sequences. For instance, what is the connection between the carbon-painted Elmendorf B/W of the Rio Abajo (Marshall and Walt 1984) to the development of carbon painting in the “Rio Medio” discussed here? The transition into locally made carbon-painted pottery occurred in the Albuquerque area in the 1175-1250 period. However, the Elmendorf material is not well dated, nor is its relationship to the Albuquerque sequence understood.

- Kwahe’e B/W is also an enigma. Said to be the first indigenous whiteware in the Rio Grande (Wilson 2005), there is little agreement as to its beginning dates or manufacturing areas. Its start date as given varies from 1050 to 1150; ending dates are likewise nebulous. Categorized usually as a northern Rio Grande type, it also occurs in minor amounts throughout the Middle Rio Grande. Its derivation may be from the San Juan region (e.g., Mancos B/W) much as carbon-painted wares were later. Or, its origin may have been in Puerco-Escavada B/W of the Cibola White Ware. A third possibility, in the Middle Rio Grande area, is that it may be an indigenous outgrowth of San Marcial B/W of P I times, and there are strong design style and paint similarities.

- Finally, there is the question of the relationship between the spread of carbon-painted “McElmo”-like pottery into this area, and the site unit intrusions that apparently mark the direct immigration of Mesa Verdeans into part of the middle and lower valley in the 1200s (Roney 1995). Is Magdalena B/W an expression of this phenomenon? Is one a matter of diffusion of ceramic ideas while the other is a direct immigration?

Clearly, as new research answers some questions, it raises others. Additional AMS or other direct chronometric dates will be essential. New insights can also be gained from sourcing studies and detailed ceramic comparisons.
REFERENCES CITED

Acklen, John C.

Anschuetz, Kurt F.

Bice, Richard A., and William M. Sundt

Bowman Bradley F., and Richard A. Bice
2004 Ceramics. In Human Remains at LA 138465, a Late Developmental, Coalition Period Site, at the National Headquarters of the American Society of Radiologic Technologists, Albuquerque, New Mexico, by Bradley F. Bowman, pp. 27–49. Museum of Archaeology and Material Culture Reports, No. 11, Cedar Crest, New Mexico.

Carlson, Roy L.

Condie, Carol J.
1993 An Archeological Survey of 2.6 Miles of Waterline Easement and Tank Site on Private Land within the San Clemente Grant West of Los Lunas, Valencia County, New Mexico for the Village of Los Lunas. Quivira Research Center Reports, No. 227, Albuquerque.

Cordell, Linda S.

Cordell, Linda S. (editor)

Dyer, Jennifer Boyd

Fenenga, Franklin

Fenenga, Franklin, and Thomas S. Cummings

Franklin, Hayward H.


Franklin, Hayward H., and William R. Neal

Hammack, Laurens C.
1966 The Tunnard Site: A Fourteenth Century Ruin near Albuquerque, New Mexico (with an appendix by Erik K. Reed). Museum of New Mexico Research Records, No. 3, Santa Fe.

Hawley, Florence M.

Higgins, Howard C.

Hill, David V.

Hill, David V., and Dorothy L. Larson

Hunt, Tim, and Carl Phillip Lipo

Kelley, Vincent C.

Larson, Dorothy L.

Marshall, Michael P., and Christina L. Marshall
1994 Archaeological Excavations at Three Sites within the Proposed Rio Bravo Blvd. and Paseo del Volcan Corridors, Bernalillo County, New Mexico. Cibola Research Reports, No. 97, Corrales, New Mexico.


Marshall, Michael P., and Elizabeth Marshall

Marshall, Michael P., and Henry J. Walt
1984 Rio Abajo: Prehistory and History of a Rio Grande Province. New Mexico Historic Preservation Division, Santa Fe.

McKenna, Peter J.
2009 Unpublished field notes from excavation at the Two Dead Junipers Site (LA 87432). Manuscript on file, Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.
Mera, Harry P.
1935 Ceramic Clues to the Prehistory of North Central New Mexico. Technical Series Bulletin No. 8. Laboratory of Anthropology, Santa Fe, New Mexico.

Murrell, Jesse B.

New Mexico Geological Society
1982 New Mexico Geologic Highway Map, Scale 1:1,000,000. New Mexico Geological Society and New Mexico Bureau of Geology and Mineral Resources, Socorro.

Oakes, Yvonne
1978 Excavations at Dead-Man’s Curve, Tijeras Canyon, New Mexico: New Mexico State Highway Department Project I-040-3(55) 171 and I-040-3(36) 169. Laboratory of Anthropology Notes, No. 137, Museum of New Mexico, Santa Fe.

Post, Stephen S.

Roney, John R.

Skinner, S. Alan

Sullivan, Richard B., and Nancy J. Akins
1994 Archaeological Excavations at LA 15260, the Coors Road Site, Bernalillo County, New Mexico. Archaeology Notes, No. 147. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Vivian, R. Gwinn, and Nancy W. Clendenen

Warren, A. Helene


Wendorf, Fred, and Eric K. Reed

Wilson, Gordon P. (editor)

Windes, Thomas C., and Peter J. McKenna

Wiseman, Regge N.
1980 The Carnue Project: Excavation of a Late Coalition Period Pueblo in Tijeras Canyon, New Mexico. Laboratory of Anthropology Notes, No. 166, Museum of New Mexico, Santa Fe.
There is no doubt that when humans moved into the Southwest they came already equipped with dogs. There has been a lot of argument as to when and where dogs stopped being wolves and became “man’s best friend,” but there is no doubt it was long before humans moved into and occupied the Western Hemisphere.

Actually, the creatures from which *Canidae* would spring developed in the Western Hemisphere during the Miocene period and spread out to the rest of the world (Olsen 1985:9). A very long time ago (perhaps 30,000 years, it would appear) a “domestication event” occurred between wolves and humans (Vila and Savolainen 1994:1687-1689; Germonpré et al. 2008). This is subject to argument, mostly based on different interpretations of DNA. Dates range from 100,000 years ago (Vila and Savolainen 1994:1687) to 15,000 years ago (Savolainen et al. 2002) with the best evidence splitting the difference at 31,000 B.P. for a dog skull found in Belgium (Germonpré et al. 2008).

I say “domestication event” in quotes because it is probable that it was more of a “symbiosis event” by two species who needed each other. However it occurred, the relationship started as one with wolves and ended as one with dogs, and it was as dogs that canines wandered back over the Bering Strait with their humans. Together, the two species spread out over the New World. As companions, the mega fauna-hunting partners wandered into the Southwest and became established. These very early dogs were already of varying size and shape even then (Allen 1920:438; Olsen 1985:22-29). What niches these various dogs filled in the human-dog social arrangement is unknown. Some of these dogs were probably for hunting and some were camp scavengers; also some dogs’ fur may have been used in weaving. Whether they were used for transport is not known. We are not sure how these dogs and people viewed each other as individuals but they had already cemented a co-dependence based on mutual needs. Many exhibited physical characteristics similar to the Chinese Short Nosed Wolf, Canis lupus *chanco* (Olsen 1985:19). The two canines, Indian dogs and *chanco*, show closely related physiological features, the most obvious being a shortened lower jaw and the lack of the first premolars, along with a pronounced ‘hook’ on the proximal end of the ascending condyle of the mandible (Olsen 1977, 1985:41-42). These characteristics have persisted and were even evident in phenotypes as late as the 1970s (Colton 1970:53-54).

We do not have much to go on as far as the appearance of either species. PaleoIndian remains are quite scarce and PaleoIndian dog remains at this time are non extant. Still, when these people hunted whatever they hunted and gathered whatever they gathered, they probably had the assistance of a dog. The best evidence for this is that everywhere else in the world at this time there were humans who had dogs and were doing the same things. Undoubtedly dogs and people had a somewhat different relationship from the one that they have now. Then, dogs were the only “domestic” animal and seemed to have held a more egalitarian position than they did in later times.

In this paper I am going to be discussing what I call “ritual burials.” I would like to be specific about what I mean and why I call them “ritual.” 1. The expenditure of energy used in burying a dog. Ethnographically there is evidence that burying dogs in the Southwest was not done...
either in the past or until very recently. 2. I am defining “ritual burial” as the burial of an individual or group of creatures for ritual/symbolic/religious purposes (Bonnechere 1994; Van Haepen 2004).

As people began moving in the direction of horticulture and the raising and storing cultigens, quite probably the smaller dogs’ role shifted from scavengers to “pest control.” From this time on, mice and corn seem to have become a large part of their diet (Kelly 1975:83). Some ethnographic evidence suggests that there were women’s dogs and men’s dogs, but the evidence is tenuous (Schwartz 1997:57-58).

We do have some human and canine remains from the Archaic indicating a small, short muzzled terrier type of dog, a larger, longer nosed dog, and a medium sort of “generalized” everyday dog. These are known by the prosaic names: short nosed Indian dog (or Basket Maker Dog), small Indian dog, and large Indian dog (Allen 1920:456-458; Lawrence 1967:54-55). Actually, they seem to have ranged on a bell curve from Big’uns to Little’uns. They had all sorts of fur length, all sorts of ears from floppy to short cropped, all sorts of coat colors and markings from solids to spots to the classic ring collar with white on the feet and belly and a white tip to their tails. They were red, brown, black, yellow, white grizzly and God knows what else (Fugate, personal observation). They looked like terriers, border collies, greyhounds, coyotes, and spaniels. On the Plains people crossed them with wolves to produce a brawnier draft animal, though one with a chancy disposition (Schwartz 1997:18).

When Francisco Vasquez de Coronado first entered the area of the North American region called the Southwest he brought his own dogs with him. As a matter of fact, the Spanish were so proud of their war dogs they wrote about these dogs’ exploits as though they were soldiers. At the same time the Spanish probably brought herding dogs as well, though we find no mention of them (Varner and Varner 1983:102).

As Governor Mendoza reported to the King of Spain, when the Spanish arrived at Hawikuh, the main village of the Zuni People, they found that the Zunis already had big shaggy dogs “like large Spanish hounds” who lived in the Zunis’ houses with them. Mendoza said their hair was used for weaving (Winship 1896:548-549). As the Spanish continued to explore the new frontier, they found that the Piro people of the middle Rio Grande Valley also had small shaggy dogs that lived in “underground hovels,” an interesting thing as there seems to have been some sort of relationship between dogs and pit houses over a long period of time. If the Piros had dogs, the dogs’ coats were no doubt also used as raw weaving material (Hammond and Rey 1966:85). There is no report among the Spanish of either the Piro or the Zuni using dogs for food (Allen 1920:456-458) and very little other comment on indigenous canines. Quite probably, there would have been more comment if there hadn’t been dogs in the pueblos. In the New World as in the Old, dogs were simply a common part of the landscape. They were just there. Sometimes they were someone’s dogs, sometimes not. They scavenged, they chased coyotes, they hung out (Mason 1965:19).

There are a few folk tales about dogs, but not many. Ethnologists seldom asked about them or even commented on them except to say there were dogs at the pueblo they were studying. Sometimes they didn’t even say that much. All our ethnographic information about Indian dogs has been filtered through several sets of Euro-centric cultures. Most ethnographers were interested in the social and religious interaction of the Pueblos with “wild” animals; domestic animals were considered of less importance. Dogs were not really a very exciting topic for researchers. After all they were...just dogs. Pueblo informants probably limited their information to what they thought the ethnographers wanted. The proselytizing of the Christian religion, influence of various European cultures, and western European assurance that everyone perceived things in the same way western Europeans did, served to cloud the view of how peoples may have viewed their animals in pre-Columbian times (Ariel de Vidas 2002:531-550). In later periods, the romantic view of the “Noble Savage” produced a different, though just as biased, view of the Indian and his dog as wise and noble companions in har-
mony with nature and each other. Early archaeologists were as blase as the ethnologists. Many early excavation reports simply say “and, of course, we found dogs,” nothing more (Morris 1928:372, 1939:8).

So what are the changes we can determine from the material record relating to people and their dogs over time in the American Southwest? During the Archaic in the Southwest, dogs are found both buried with humans and buried alone. Whether this was so in the PaleoIndian period is unknown. But during the Archaic period, at least, there is evidence that dogs, or apparently some of them, were held in esteem. Individual dog burials are found all over North America, some with food and pottery left in the graves (Eddy 1966:249; Schwartz 1997:23; Smith et al. 1966:293). From the Archaic period on, there is also widespread evidence of formal burials of dogs with humans in what appear to be ritual contexts (Eddy 1966:249; Guernsey and Kidder 1921:45; Smith et al. 1966:293).

Dog burials during the late Basketmaker and Pueblo I and II periods are varied and include whole dogs buried with humans, dog heads buried with humans, dogs carefully halved and buried with humans, multiple dogs in one grave, and burials of an adult dog and puppies. Sometimes these last were not buried with humans. These dogs were often of the small variety, but there were some large dog burials as well. Many of these dogs accompanied infants, suggesting that these were not dogs simply buried with their owners but dogs that fulfilled some function in the afterlife. In other words, these dogs didn’t just end up where they were found by accident.

In the case of dogs not buried with people we find single burials, multiple burials, some formally laid out, some simply thrown into pit houses, adult dogs with puppies, dogs with grave goods of their own, dogs in closed kivas, and just carefully buried dogs (Ambler and Andrews 1981:69-70; ARMS site files, Navajo Reservoir Project; Eddy 1966:226, 248; Emslie 1978:167-182; Frisbie 1967:121-133). These types of burials are also prevalent in other parts of the Western Hemisphere, but not in such prolific numbers (Schwartz 1997:92-121).

On the Colorado Plateau during the Archaic (5,000-4,000 to 1,000-500 B.C.), we find dogs accompanying shamanic figures in hunting contexts (Schaafsma 1986:221), and dogs may have served either as spirit guides or guardians for shamans on their spirit journeys. Such a concept continued in other cultures even into the contact period (Danien 1997:37-48; Schwartz 1997:132-160). Dogs were considered good guards to protect and assist the shaman because they had magic of their own (Schaafsma 1971:68-73). Given this concept of guardianship, both in the world of the everyday and the world of the spirit, it is easy to believe that during this time the relationship of people and their dogs was far more intense than just barking at the big game and eating mice.

Burying dogs with the dead is not just a New World trait. Dogs buried with people have been found worldwide, especially at sites dating to the Neolithic and Bronze ages (Olsen 1985:47-70; Schwartz 1997:92-121). To stop and speculate on the many reasons why this is so is beyond the scope of this paper. Dogs are not the only animals found buried with the dead. Still, of all animals, worldwide, the dog is by far the animal most commonly found accompanying humans into the afterlife.

The most famous early dog burials in the Southwestern U.S. come from Arizona. One is the little dog found in Ventana Cave (Haury 1950:81-82). The date on this dog is questionable, but it was a small, white, short-nosed Pueblo dog. The other burial is a mummified pair from White Dog Cave up on the northern Navajo Reservation located not far from the rock panels Polly Schaafsma described above (Guernsey and Kidder 1921:45). In 1916, A. V. Kidder and Samuel Guernsey found these dogs in a rock shelter near Kayenta Arizona. In the cave there were a number of well-preserved burials. Burials in two related cysts were extremely rich in grave goods and remarkable in their preservation. Buried in several large baskets were a man, a woman, and an infant. Buried with the man and child was a white (actually tan) longhaired male dog around a year and a half old (Figure 1, age determined from X-rays by Joy Alesdatter, DMV and by
personal observation of the author). He was similar to a border collie. With the woman was a small black and white-spotted, rough coated dog. This dog, about the size of a spaniel, had a short nose and a domed forehead (Guernsey and Kidder 1921:15-17). This dog was a female about eight months old (Figure 2, age determined from X-rays by Joy Alesdatter, DMV and by personal observation of the author). Could this be an indication of the varying roles of dogs in Archaic lifestyles? One is left to postulate that larger dogs may have been used for hunting while the smaller dogs were used for scavenging and catching rats.

Dogs similar to these examples are found illustrated on pottery and mummified as far south as Peru (Allen 1920:475-476). Dogs with the same markings as the smaller dog are found on Mimbres pottery (Brody et al. 1983). The dogs from White Dog Cave (Basketmaker II) have always been considered old burials, but recent research has pushed the date of these burials to 1,000-1,500 B.C. (Smiley 1993:252-253, 1994:181). Old dogs, indeed.

In the years since Guernsey and Kidder found the White Dog Cave burials, formal burials of dogs, with or without people, have been found all over the Southwest. During the Archaic and Basketmaker periods, dogs were buried in middens and sometimes in pit houses. Often they were buried in a composed manner and in a prepared hole or on the floor of a structure. There is also evidence that during this time dogs, and later turkeys, were used in formal rituals and as offerings when closing down religious structures (Emslie 1978:167-182; Frisbie 1967:121-122). In some places, Schaafsma's Archaic spirit guides seem to continue this role through the Basketmaker period when dogs were more and more frequently buried with the dead. During the Rosa period (Pueblo I) in the San Juan drainage of the four corners area—a notoriously "doggy" region—dog heads were so often found with burials that it was considered a culture trait of the phase (Eddy 1961:96, 1966:226, 248; Lawrence 1944:76; Wormington 1959:75).

The Basketmaker people also made sashes out of dog hair (Morris 1959:93-97; Nusbaum 1922:103-104) and it appears some dogs were kept and bred for such uses. We know that they were still being used for this at Zuni as late as 1540, as the Mendosa report above verifies (Mason 1965:19).

As people depended more and more on corn, dogs probably were also helpful in keeping wild animals out of fields as well as for continued help in hunting and pest control, for camp clean up, and as companions. We have less physical evidence for these activities, but later ethnographic reports suggest this (Brant 1954:215; Mason 1965:9-10). What does seem to be clear is that from the Archaic into the early Pueblo periods, some dogs had a formal as well as a domestic role in Pueblo societies. There is some evidence during this time period of dogs being used as food as well, but the use was not extensive. There is a suggestion that dogs were used in extreme cases of hunger, as a "special" meal or for medicinal purposes (Schwartz 1997:89-90).

The North American Southwest, even the Pueblo Southwest, is a large area, and the timespan covered in this paper is extensive. There is not, and never has been, a homogeneous Pueblo Culture. Therefore, all of the generalizations in this paper are based on observed situations in various areas and at various times. While there may have been dog burials or dogs buried with humans in one canyon, in the same general area, the next canyon over might contain groups of people whose material culture shows no evidence of having dogs at all, much less using dogs in ritual contexts (ARMS Site Files, Navajo Reservoir Project). For example, the Gobernador area (that very "doggy" place) was abandoned by the Pueblo III period and therefore there is no information for later dog-human relations in this area. In other areas, by Pueblo III, dog burials were becoming less frequent among the people of New Mexico (Frisbie 1967:121-122). On the other hand, in the Kayenta region of Arizona, older practices held on so that pit houses and dog burials lasted into the late Pueblo III period (Ambler and Andrews 1981:78-79).

During the Pueblo III period there seems to have been a distinct change in the use of dogs. The change is not abrupt and is not found all over the area at the same time;
still there is evidence that over time, dogs became a food resource and begin to be found less in ritual context. While in some areas dogs were eaten during earlier periods (Haag 1966:131-135; Kelly 1975:82-83), dogs really enter the realm of cuisine from the late Pueblo III period on (Lang and Harris 1984:88-90).

It has been suggested that this change from a companionable relationship to one of a more dietary nature is due to the increasingly limited resources of pueblo groups that needed more protein as they became sedentary. A corn, bean and squash diet is okay as long as there are dietary supplements such as game, but this kind of diet is low in iron and as local wild meat resources became depleted, other food supplies became necessary (Layrisse 1969:38-42).

During the Basketmaker and early Pueblo periods, there had been a trend to use dogs and turkeys interchangeably in ritual contexts. Turkey feathers had been a source of weaving material just as dog hair had, but in some areas turkeys had been used for food as well. During Pueblo III among some groups, turkeys began to fill a serious niche in the need for meat. Lang and Harris, in their Arroyo Hondo Report, suggest that as the Pueblos became more dependent on turkeys for food as
well as feathers, dogs posed a hazard to the younger turkeys and became more of a detriment than an asset. Dogs were then killed as a food source and to cut down on their number, so that they wouldn’t impact the precious turkey poults (Lang and Harris 1984:89). It would seem that this is really too simplistic an explanation. It takes into account the material and economic life of the Pueblos but disregards the rich religious contexts and ethos of the cultures.

Nonetheless, dogs are seldom found in human burials by late Pueblo III. Dog burials do persist in some areas, but they are scarce and evidence of dogs as dinner is more common (Lang and Harris 1984:89). This would suggest that when an animal ceases to be one’s spirit guide and becomes a part of the food chain, a change of cosmology likely takes place.

With first Spanish arrival in the Southwest, dogs still occupied a special place in some Pueblo homes, but with the acquisition of Spanish sheep and goats, the dog was no longer needed for hair. Dogs soon became herders of wool producers, instead of the producers themselves (Mason 1965:19).

In the case of dog burials and the lack of dog bones in some prehistoric pueblos, the ethnographic evidence would be worth considering. Sadly there is little direct information in this area. When the information does appear it is fairly consistent. In most Pueblos, dead domestic animals were not buried. As a rule they were disposed of away from the residences and allowed to decay.

The Hopi have a story of dogs coming from the “dog kiva” where the “dog people” live and voluntarily coming to Hopi to help the Hopi People (Mason 1985:65). There are very old pictographs of dogs at Hopi, and a dog Katchina is believed to sometimes act as a representative of all domestic animals (Mason 1985:69). Dogs at Hopi are also said to be given names connected with their owner’s clan, as are Hopi children (Mason 1985:19). That is to say, they are not just named Fuzzy or Rover.

At Santa Clara, dogs are kept for pets and used for hunting but are not allowed to come into the house. They are allowed to sleep in the hornos when they are not in use (Hill 1982:37). Most pueblos believe that dogs are good at protecting their families, not only from strangers but also from witches. Dogs are believed to have their own magic which allows them to see witches and dangerous spirits (Newcomb 1940:52; Parsons 1939:28; Schwartz 1997:21, 155).

We have no evidence of any attempt to keep indigenous dogs from interbreeding with the European dogs, Still, some of the physical characteristics they brought with them from Asia have been very persistent. In 1970, Harold Colton went to Hotevilla, on the Third Mesa of the Hopi Reservation, hoping to find dogs that still had the characteristics of ancestral Pueblo dogs. He discovered that there were such dogs and their owners were quite attached to them. When he tried to buy a pair to see if he could breed the strain the owner was very reluctant to part with her dogs and nothing ever came of the idea (Colton 1970:154).

A lot of Navajo beliefs have been influenced by the last 400 years of Pueblo proximity. The Navajo people have a strong belief that animals shouldn’t be buried but that they should be taken away from the living area and left for the scavengers (Laurence Isaac Jr., personal communication 1967).

At Cochiti, dead dogs are left by the river or thrown in (Lange 1959:107). The Zunis believe that to bury a dog would be treating it as a human and this would be inappropriate. To take the dead animal away from the pueblo and leave it to the elements is considered proper. My informant could not explain the phenomenon of dog burials in relation to present day Zuni beliefs (Edmund Ladd, personal communication 1997). Nonetheless, in his 1917 to 1923 excavations of the Zuni Village of Hawikuh, Frederick Hodge excavated a number of dog burials. Some of the burials had food with them. One had a par-
rot head as well (Smith et al. 1966:293). Burying a dog with a parrot’s head, no matter how well regarded that dog might be, is indicative of something beyond a simple pet burial. Leaving animals to decompose tends to be a custom with most domestic animals that die and are not used for food (Lange 1959:107). Even ritually killed eagles may be taken out and left for the scavengers or are thrown into the river (Lange 1959:137). At Hopi, depending on the particular village, dogs, domestic livestock and the eagles from rituals may be dropped down into rock cliffs instead of being buried (Mason 1965:26). Today, when I talk about dog burials to young Pueblo people the immediate reaction is “Aw, isn’t that sweet. They buried their pets.”

When found in ritual structures, dogs are usually found in doorways between the ventilator shaft and the fire pit or in the vent shaft itself. Turkeys are found in the same places. Sometimes humans are found in similar places. The placement suggests dogs are left in buildings as guardians of the entrances when they are deconsecrated. Perhaps they are placed there instead of a human. In Mexico, Central and South America, dogs are represented as both deities and as human substitutes (Clutton-Brock 1994:825; Schwartz 1997:134-140).

Therefore, when we find buried dogs in archaeological sites, it is worth noting. On occasion, though gnawed bones and evidence of dogs used as a food source are present, few just plain dog bones are found. Sites are also found with little or no evidence of dogs, though it is probable that dogs were a part of the community. Perhaps dead dogs, with no ritual context, were taken from the habitation area and left elsewhere to decompose. This would leave the appearance of few or no dogs among these people.

Among the pueblos of the southwest, dogs have worn many faces over the last 2,000 years as spirit guides, witch hunters and guards, friends, helpers and wool sources, then food items, then herders, and domestic scavengers, but always they have remained companions in our shadow, a guard, a guide, a friend.

REFERENCES CITED

Allen, G. M.

Ambler, J. Richard, and Michael J. Andrews

Ariel de Vidas, Anath

Bonnechere, Piere

Brandt, Richard B.

Brody, J.J., Catherine Scott, and Steven LeBlanc

Colton, Harold S.

Clutton-Brock, Juliet
Danien, Elin

Eddy, Frank W.

*Excavations at Los Pinos Sites in the Navajo Reservoir District.* Museum of New Mexico Papers in Anthropology 4, Santa Fe.

1966 *Prehistory in the Navajo Reservoir District, Northwestern New Mexico.* Museum of New Mexico Papers in Anthropology 15, Santa Fe.

Emslie, Steven D.

Frisbie, Theodore Robert

Germonpre, M., M. Sablin, R. Stevens, R. Hedges, M. Stiller, M. Hofreiter, and J. Jaenickedesprese
Fossil Dogs and Wolves from Paleolithic Sites in Belgium, the Ukraine and Russia: Osteometry, Ancient DNA and Stable Isotopes. *Journal of Archaeological Science* DOI 2008(9):33.

Guernsey, S. J., and A. V. Kidder

Haag, William G.

Hammond, George P., and Agapito Rey
1966 *The Rediscovery of New Mexico 1580-1594.* University of New Mexico Press, Albuquerque.

Haury, Emil W.

Hill, Willard William
1982 *An Ethnography of Santa Clara Pueblo, New Mexico.* University of New Mexico Press, Albuquerque.

Kelly, James E.

Lange, Charles H.
1959 *Cochiti: A New Mexico Pueblo: Past and Present.* University of New Mexico Press, Albuquerque.

Lang, R. W., and A.H. Harris
1984 *The Faunal Remains from Arroyo Hondo Pueblo, New Mexico.* Arroyo Hondo Series No. 5, School of American Research Press, Santa Fe.

Lawrence, Barbara


Layrisse, Miguel

Mason, Lynn D.

Morris, Earl H.


Morris, Elizabeth Ann
Newcomb, Franc Johnson  
1940  *Navajo Omens and Taboos*. Rydal Press, Santa Fe.

Olsen, Stanley J.  


Parsons, Elsie Clews  

Schaafsma, Polly  


Schwartz, Marion  

Savolainen, Peter, M. Ya-ping, Zhang, Jing Lou, Joakim Lundeberg, and Thomas Leitner  

Smiley, Frances E.  

1994  The Agricultural Transition in the Northern Southwest: Patterns in the Current Chronometric Data. *Kiva* 60(2).

Smith, Watson, Richard B. Woodbury, and Nathalie F.S. Woodbury  

Van Haaperen, Francoise  

Varner, John Grier, and Jeanette Johnson Varner  

Vila, Carles, and Peter Savolainen.  

Winship, George Parker  

Wormington, H. Marie.  


Site records of the Columbia University-Laboratory of Anthropology Joint Expedition, 1941, in the archives of the Laboratory of Anthropology, Santa Fe.

Collections from the Navajo Reservoir Project, 1958-1965, and of the Columbia University-Laboratory of Anthropology Joint Expedition of 1941. Both housed in the Archaeological Research Collections of the Laboratory of Anthropology, Museum of New Mexico, Santa Fe.
What is optical dating? Optical dating, or optically stimulated luminescence (OSL), is a method for determining the time a sediment was last exposed to light. In other words, OSL dating gives us the time of burial. Quartz (and feldspar) mineral grains in a deposit carry the luminescence signal. The signal is produced due to exposure to ambient radiation within the surrounding sediments and from incoming cosmic rays. Specifically, high-energy particles (e.g., alpha, beta, and gamma particles) dislodge electrons within minerals. The dislodged electrons are trapped in defects in the crystal structure of the grains. With the passage of time, more electrons are dislodged and trapped.

In nature, the luminescence signal is zeroed out (bleached) by a few seconds exposure to light. Eolian sand is well suited for OSL dating because the quartz sand grains are exposed to sunlight and the luminescence signal reset before being deposited and buried. In the laboratory, the OSL sample is subjected to light of a specific wavelength (typically blue-green or green). The trapped electrons are stimulated (energized) by the light, causing them to be evicted from their traps and give off energy in the form of short wavelength light (luminesce) as they fall into a lower energy state. The intensity of the light signal given off by a prepared sample is measured. This intensity corresponds to the number of trapped electrons; the greater the luminescence, the greater radiation exposure a sample has had and the older the sample. OSL ages are generally based on the measurement of twenty or more subsamples or aliquots (10’s to 1000’s of grains per aliquot), the results of which are used to produce the optical age. OSL ages are presented with a one-sigma error, similar to radiocarbon ages (see review by Aitken 1998). Unlike radiocarbon, OSL ages are in calendar years before the date of collection, requiring no calibration.

The other main luminescence technique, thermoluminescence (TL), is the grandfather of OSL dating. Instead of light, TL dating uses heat to release the trapped electrons. TL dating was first perfected to date pottery and other burnt archaeological materials (see Aitken 1985, and review by Feathers 2003). More recently, OSL techniques have also been used to date burnt materials and sediments associated with prehistoric sites (e.g., Wintle 2008). OSL dating is a comparatively new technology, the first initial trial introduced by Huntley et al. in 1985. The new optical dating method is in the late developmental stage, perhaps similar to radiocarbon dating at the close of the 1950s. Currently, all luminescence laboratories are at universities and government research facilities; commercial labs are not yet available. An excellent technical overview of OSL dating is presented by Goble in Hall et al. (2008).

CASE STUDIES IN NEW MEXICO

During the past decade, several archaeological projects in New Mexico have incorporated geologic studies and OSL dating. In every case, geologic input has aided field interpretations of local prehistoric sites. In addition, optical dating of the geologic deposits has proven pivotal to determining the context of archaeological sites within the broader record of landscape erosion and deposition. The new optical chronology is providing fresh insights as well into sand sheet geomorphology in the state.

Mescalero Plain, Southeastern New Mexico

The first optical dating in New Mexico was part of a feasibility study of sediments associated with archeological sites in the south-central United States. Holocene eolian
sand from the Blackwater Draw site and late Pleistocene materials from nearby Salt Lake (Arch Lake) were satisfactorily dated by OSL, an important regional test of the methodology (Rich and Stokes 2001). Subsequently, a geomorphic study of the Mescalero Sands resulted in the documentation of two eolian sand units, the older unit OSL dated 90,000 to 75,000 years and the younger unit dated 9000 to 5000 years. It was concluded that archaeological sites younger than 3000 B.C. would occur on the stable surface of the sand sheet but that older sites would be buried (Hall 2002a, 2002b; Hall and Goble 2006, 2008).

Expanded studies of eolian sand stratigraphy and OSL dating were carried out at Pierce Canyon and at sites along NM 128 southeast of Carlsbad. The results document a difference in the chronology of the Mescalero sand sheet that is especially significant to archaeology. The younger sand unit began to form 14,000 years ago and continued to accumulate without detectable interruption until 3000 years ago. Thus, prehistoric sites younger than 1000 B.C. occur at the surface of the sand sheet in that area. Sites older than 1000 B.C. are buried, indicating younger sites are buried here than observed in the Mescalero Sands (Figure 1) (Hall 2007a, 2009a; Raymond et al. 2007).

Recent archaeological testing of 16 sites at Bear Grass Draw included optical dating as a supplement to radiocarbon dating at four of the sites. The OSL ages are thousands of years earlier than the radiocarbon ages for the sites and were dismissed as too old (Condon et al. 2008). The OSL samples were collected from culturally disturbed sand at the sites, illustrating the difficulty of obtaining an optical age of a site itself, discussed below.

**Middle Rio Grande Valley**

Several recent projects west of Albuquerque have produced new information on the age of eolian sand and paleosols and associated archaeology. The soil geomorphology of a Folsom site on the West Mesa was studied and radiocarbon dated. Five OSL ages from eolian sand underlying the site’s stratigraphic position range from 26,000 to 20,000 years; an isolated exposure of eolian sand was OSL dated to 6100 years (Holliday et al. 2006).

---

**Figure 1.**

OSL-dated stratigraphic sections of eolian sand with associated archaeology; site age range shown in italics.
Eight archaeological sites along the Paseo del Volcán corridor in Rio Rancho were tested, and a series of twelve optical ages were obtained from the eolian sand exposed in many trenches around the sites. The main eolian sand unit accumulated from 16,000 to 10,000 years; a red paleosol formed in the sand during the Holocene. The archaeological sites occur at the surface of the Pleistocene sand and red paleosol; site features intrude into the sand. Subsequently, the sand and paleosol, as well as some site features, were scoured by sheet erosion. Thirteen AMS radiocarbon dates on charcoal from the sites range from 4600 to 580 \(^14\)C years B.P., indicating four millennia of intermittent prehistoric occupation on the surface of the late Pleistocene sand (Figure 1) (Hall et al. 2008; Raymond et al. 2009).

The Nine Mile Hill Site (LA 144128) west of Albuquerque along Interstate 40 is Middle Archaic with multiple occupations. The site rests on, and intrudes into, eolian sand that is OSL dated 18,000 to 5500 years and is characterized by a well-developed reddish brown paleosol. The site is partly buried by 30 cm of brown fine eolian sand with an OSL age of 490 ± 50 years (Fig. 1) (Hall 2009b; Murrell 2009a). The recent brown eolian sand likely covers other archaeological sites on the West Mesa.

A Socorro phase site with many artifacts, including ceramics and evidence of maize, dated A.D. 1000 to 1280, occurs on the present day surface of a local eolian sand sheet west of Los Lunas. Two late Holocene OSL dates indicate that the sand sheet stabilized 2800 years ago, consistent with local geologic mapping (Hall 2009c; Love et al. 2000; Murrell 2009b).

**Tularosa Valley-Hueco Bolson**

Geologic studies of the sand sheet on the valley floor south of White Sands dune field show the presence of two sand units, similar to the sand sheet in southeastern New Mexico. OSL dating at El Arenal site at Fort Bliss produced a single 44,000 year age for the older Q2 unit and a series of ages for the younger Q3 unit extending from 24,000 to 5000 years (Hall 2007b). AMS radiocarbon dates on charcoal from El Arenal indicate three periods of occupation of the site ranging from 2860 B.C. to A.D. 1630 with dates clustering around 250 B.C. (Figure 1) (Miller 2007). The new optical chronology of the sand sheet has important implications to the occurrence of archaeological sites at Fort Bliss, discussed below in the conclusions.

**DATING ARCHAEOLOGICAL SITES**

**Direct Dating**

Can archaeological sites be dated directly by OSL? The answer is, in most cases, no. One of the difficulties associated with open-air archaeological sites is identification of sediments that have accumulated contemporaneous with site occupation; undisturbed sedimentary deposits dating from the period of site formation are evidently rare. The experienced field worker recognizes that the sediment matrix containing artifacts and features is mostly disturbed deposits that pre-date site formation. The zone of culturally disturbed sediment is the site footprint (Figure 2). The longer a site is occupied, the more intense will be the sediment mixing. The end result of continual and prolonged occupation and accompanying disturbance is an anthrosol. Important exceptions are documented where OSL dating can provide direct dating of a site. These include undisturbed eolian sand fill in a room block or other large feature that could date the time of local abandonment (not yet attempted), canal sediments (Berger et al. 2004, 2009; Sanderson et al. 2007), baked and burnt sediments and pottery (Lain and Brooks 2004; Feathers and Rhodes 1998), sediment-filled artifacts and remains (Grine et al. 2007), and alluvium-covered sites that experienced rapid burial (see Rittenour 2008).

**Bracket Dating**

While it may not be possible to directly date open air sites, considering the degree of cultural disturbance of sediment in the site footprint, OSL dating excels by pro-
Figure 2.
Development of site footprint in eolian sand, based on archaeological geologic studies in New Mexico. A recent A horizon soil post-dates the site but merges and blends with the anthrosol. The stable surface may be 5000 years old based on case studies of OSL dating. Because of disturbance, sand in the site footprint and anthrosol may not be suitable for OSL dating.

Figure 3.

DISCUSSION
OSL dating has a wide range of age capability. Currently, the earliest optical age from eolian sand in New Mexico is 169,800 ± 12,700 years in the Pierce Canyon area (Hall 2007a). At the other end of the time scale, the youngest OSL age currently from New Mexico is 40 ± 31 years, or A.D. 1962 ± 31 years, the sample taken from near the top of a mesquite coppice dune outside of Loco Hills, Eddy County (Hall et al. 2003). Optical dating can also fill the need for ages from the past 500 years, a period when the radiocarbon content of the atmosphere fluctuated dramatically, resulting in problematic calibrations of radiocarbon dates. The trick is to find undisturbed sediments suitable for optical dating.

OSL ages are in calendar years. However, there is no “zero” time that is agreed upon in OSL dating. As a result, an OSL age is reported in “years” that, literally, is the time from which the sample was collected in the field. The year A.D. 2000 has been suggested as the reference year or zero B.P. (before present) for the reporting of OSL dates (Holliday et al. 2006:774), but the luminescence community has not yet taken any action on the issue.

At the current state of technology, the one-sigma error for OSL ages is generally greater than that for radiocarbon ages. Using representative examples, an OSL age of 2000 ± 130 years, a conventional radiocarbon age of 2000 ± 60 ^14C years B.P., and an AMS radiocarbon age of 2000 ± 40 ^14C years B.P. have a one-sigma value of 6.5, 3.0, and 2.0 percent, respectively. However, there are instances when uncertainties in the radiocarbon calibration curve result in much greater error, especially for dates
Core area of the Mescalero Sands, Eddy County, with parabolic dunes, blowouts, and sand pedestals formed by twentieth century deflation. The four- to five-meter thick eolian sand in this area is OSL-dated 9000 to 5000 years old. Archaeological sites are locally buried by twentieth century sand but are deflated and exposed in blowouts such as these. The sand sheet is partly stabilized by shrubs of shinnery oak (*Quercus havardii*) (Hall 2002a; Hall and Goble 2006, 2008). Archaeological sites in areas of thick eolian sand such as this are difficult to inventory.

falling within the past 500 years. Part of the error in optical dating is related to the number of aliquots used for age determination. In most New Mexico OSL studies, the number of aliquots for each date has ranged from 20 to 60. However, in the study along Bear Brass Draw in Eddy County, OSL dates on eolian sand are based on as few as four to 11 aliquots with a one-sigma as high as 18 percent (Condon et al. 2008:201, 303). Given the greater precision of radiocarbon dates and the need to correlate OSL-dated deposits with radiocarbon-dated archaeological, geologic, and paleoclimatic records, it is crucial to have OSL ages of the highest precision.

While all of the examples cited here are from eolian landscapes, dating alluvial deposits and their contained archaeology presents a different set of problems to solve. Open-air prehistoric sites occur on low terraces and floodplains of Southwestern streams. Throughout the Holocene, fluvial erosion and deposition have been ongoing processes. As a result, many prehistoric sites are buried by recent alluvium (Hall and Periman 2007). Charcoal from buried sites provides reliable radiocarbon ages. Dating the alluvial sequence itself in order to establish the chronology of the deposits and the potential for buried archaeology is another matter. Fine-textured alluvium generally contains sufficient organic matter for bulk sediment radiocarbon dating. However, some areas of New Mexico are characterized by low-grade coal, lignite, and carbonaceous shale in Cretaceous and early Tertiary rock sequences. Organic particles from these strata are washed into streams and incorporated into alluvial deposits. Holocene alluvium in Chaco Wash, Rio de Puerco (both east and west), Zuni River, and the Vermelho River, to name a few, contain recycled carbonaceous particles that make the radiocarbon dating of bulk alluvium impractical, producing spurious ages. A palynologic study of Chaco alluvium, for example, shows the presence of 5 to 92 percent reworked Cretaceous spores and pollen, in proportion to Holocene pollen, and an undetermined amount of other Cretaceous organic particles (Hall 1977). Where radiocarbon dating of bulk sediment from alluvium is ill advised, optical dating can come to the rescue. It should be noted that, while radiocarbon dating is best with fine alluvium, OSL dating is applied best to sandy facies. Rittenour (2008) provides a thorough review of the special problems and issues of OSL dating of alluvium.
HOW TO COLLECT SAMPLES

The following procedure has evolved from many years of field and laboratory experience. The following sampling guide has been adapted from an illustrated guide available on the Utah State University luminescence lab website: http://www.usu.edu/geo/luminlab/.

1. Clean off the outcrop. Hammer into outcrop an opaque metal pipe or tube, roughly 1.5 x 8.0 in, with a removable pounding cap at one end. Place duct tape around the cap to keep it in place; a Styrofoam plug may be placed in the end entering the sediment to ensure that it is kept packed tightly during sampling. PCV and other plastic pipes or tubing are not recommended because they vibrate during pounding (mixing the sample) and they are not completely opaque.

2. Hammer the tube all the way into the outcrop. The tube must be full of sediment and packed tightly to avoid mixing during transport. If a root, pebble, or rodent burrow is encountered, thoroughly clean out the tube and relocate to another spot a few decimeters away. Softer eolian sand may be sampled with a large, sturdy tin can driven into the outcrop with a rubber mallet.

3. Sample the sediment immediately around the tube for moisture content using an airtight container. Make a note of evidence for vadose or groundwater such as sediment mottling or iron staining, and describe the expected history of the water content of the sampled deposit. Label the container.

4. Sample the sediment from a 10-cm radius around the tube for environmental doserate (K, U, Th). Place the sediment in a one-quart zip-locked freezer plastic bag, filling it half-full or more, and label the bag.

5. Extract the tube carefully to avoid loss of sediment. With the open end of tube pointed up, pack any extra space with more sediment, tamping it down lightly. If more than one centimeter needs to be added, use duct tape, paper, or plastic to fill the tube firmly, not sediment that could be mistaken for real sample; make a note of this on sample sheet. In the laboratory, the ends of the sediment in the sampling tube are discarded because they have been exposed to light during sampling.

6. Seal the end of the tube with at least two layers of duct tape. A cap may be used to seal the tube; duct-tape it in place. If the sediment in the tube rattles upon shaking, it is a ruined sample and should be discarded; start over.

7. Label the tube, moisture sample, and doserate sample; keep labels simple, but avoid sample numbers OSL-1, OSL-2, etc. due to potential confusion of ownership in the dark lab. Clear tape should be placed over the labels if there is a chance of the labels being rubbed off during transport.

8. Place the tube, moisture, and doserate sample in a large bag for orderly transport.

9. Document the sample: (a) depth of burial below the landform surface; if there has been recent erosion or removal of sediment, estimate the original depth; the depth of burial is needed to calculate cosmic doserate; (b) note details of the stratigraphy, both vertical and lateral, with a measured section, including sedimentology, soil horizons, and unconformities, and where the sample fits into the section; (c) relationship of the sample to other samples in the series; (d) UTM or latitude-longitude, and elevation of the sample; (e) date that the sample was collected. Finally, photograph the stratigraphic section with a meter scale in place, before and after sampling. A “before” photograph that shows the stratigraphy is useful for publication since sampling messes up the outcrop.

WHERE TO SAMPLE FOR OSL DATING

To determine the place of a sedimentary deposit in a sequence of geomorphic events, it is important to sample near the base, near the top, and from the middle of the
deposit. To establish the full age of a sediment layer, a minimum of three optical samples is strongly recommended; more is better. From the age-depth relationship, a sedimentation rate can be determined that in turn can be used to estimate the actual age of the base and top of the preserved deposit. A sediment accumulation rate can also be applied to determine the age of buried sites, if charcoal is not present, or the maximum depth at which early Paleoindian archaeology might be found. In the Mescalero sand sheet, the early Paleoindian horizon in some areas is about 80 cm depth.

Two of the most important issues to consider when selecting a locality for optical dating are partial bleaching and post-depositional disturbance. Partial bleaching, or incomplete zeroing of the luminescence signal, can produce age overestimates due to the incorporation of a residual luminescence signal at the time of burial. One should think about the depositional environment of the target horizons and look for sedimentary structures that indicate the greatest chance of exposure of the sediment to light prior to deposition (e.g. eolian, shallow water, or well-sorted deposits). Where this is not practical, reliable optical ages of partially bleached sand still may be possible using various statistical treatments of the data to pick out the youngest age population, presumably representing the grains bleached at deposition.

It has been found in New Mexico studies that very shallow sediment, generally less than 30 cm depth, may exhibit a mixed signal derived from the incorporation of recently bleached grains from the land surface from bioturbation, pedoturbation, and other mixing processes. For these reasons, shallow samples may yield bimodal ages. These cases are caused by the mixing of young and old sediment. While rodent burrow fills are conspicuous and can be avoided, long-term sediment mixing by ants, cicada, and rootlets may be invisible in the outcrop. One way to minimize the potential for collecting mixed, disturbed samples is to avoid the upper 30 cm of the sediment column or similar depth under paleosols. In geological environments, it is always best to avoid the upper one meter of the sediment profile if possible due to potential sediment disturbance and exponential changes in cosmic dose rate contributions at these shallow depths. In the New Mexico studies, the partially bleached state of some samples is a consequence of sampling thin deposits.

Unconformities in a stratigraphic sequence should be bypassed when sampling for optical dating. The sediment immediately below the unconformity may have been disturbed and can contain younger sand grains. The sediment above the unconformity may incorporate older grains that have been reworked from the underlying deposit.

In sampling alluvium for optical dating, clay beds, coarse sand, and gravel should be avoided. The grain size fraction used in routine laboratory procedures is 90 to 150 μm (0.09 to 0.15 mm) or very fine-to-fine sand. Thus, the ideal alluvium for sampling is fine sand. Fortunately, most eolian deposits are fine-to-very fine or fine-to-medium quartz sand and are excellent for optical dating.

CONCLUSIONS

1. While OSL dating may not be useful for directly dating open air sites, optical dates provide valuable information on the age of the deposits on which sites occur as well as the age of the sediments that bury sites. For example, sites that occur on the eolian sand sheet in the western Mescalero Plain are younger than 1000 B.C. Older sites are buried in the sand and are not visible at the present-day surface. Accordingly, site surveys of the sand sheet are biased for Late Archaic, NeoArchaic, and younger sites. Middle Archaic, Early Archaic, and Paleoindian sites are buried and not visible at the surface, unless exposed by recent erosion, and, accordingly, are underrepresented in surveys.

2. As new OSL ages of sand sheets have become available, it is apparent that not all deposits of eolian sand in New Mexico, or elsewhere, have the same geologic history. For example, the stable surface of the Mescalero Sands appears to have an age of 3000 B.C., while farther south in the western Mescalero Plain the stable eolian surface dates to 1000 B.C. Consequently, Middle Archaic sites are buried in the Mescalero Sands but are visible at the surface in
the Mescalero Plain. It is anticipated that, as new OSL studies are completed, the geographic variability in the chronology of sand sheets, as well as the visibility of prehistoric sites, will become clearer.

3. New OSL dating of sand sheets in New Mexico has led to the discovery that archaeological sites located at the present-day surface may be centuries and even millennia younger than the age of the underlying sediments. This relationship leads to other conclusions. Archaeologic sites and geologic deposits may not have formed contemporaneously. Thus, the age of the site is not the age of the sediment and, conversely, the age of the sediment is not the age of the site. Archaeological sites may have components spanning thousands of years, all on the same stable surface. A good illustration of this is Fort Bliss where a previous geologic investigation assumed that the radiocarbon age of sites was also the age of associated eolian sand (Blair et al. 1990). Optical dating at Fort Bliss has shown that the sand sheet is much older, stabilizing around 3000 B.C., and that sites of different ages occur on the same stabilized surface (Hall 2007b; Miller 2007). As with the situation in the Mescalero Sands, sites earlier than 3000 B.C. at Fort Bliss are buried in the local sand sheet.

RECOMMENDATIONS

1. Collect samples for sediment dating at a distance from sites to avoid prehistoric cultural disturbance. This includes not just OSL samples, but radiocarbon samples from A horizon soils and other dateable deposits.

2. Optical dating of sediment columns from eolian sand sheets in New Mexico has included sediment analysis by a geotechnical laboratory. The analyses characterize the sediment and soils and have proven vital to the interpretation of the optical ages. In most cases, the sediment and age data show that eolian sand accumulated slowly and continuously for many millennia without discernible breaks in deposition. In one important case, however, the laboratory textural data showed the presence of an unconformity in the eolian sand that was not readily visible in field outcrops; the shift in eolian sedimentation also coincided with a jump in optical age. Sediment analyses of each stratigraphic column chosen for optical dating is strongly recommended.

3. Optical dates are valuable only within the context of the stratigraphy and sedimentology of the sampled deposit. It is imperative that the local geology and geomorphology and their relationship with local prehistoric sites are understood before sampling locations are chosen. The OSL samples must be taken with great care; no amount of laboratory effort can make up for heedless field collection.

ACKNOWLEDGMENTS

The geologic studies of the archaeological sites mentioned here would be only so-so stories if it were not for the careful laboratory work by Dr. Ronald J. Goble, Director of the Geochronology Laboratory, Department of Geosciences, University of Nebraska-Lincoln. Age is everything in this business, and the optical ages he has produced are the foundation for the new understanding of the physical landscape and prehistoric record now coming together in New Mexico. Mary Jo Schabel of the Milwaukee Soil Laboratory has produced valuable high resolution sediment data for all of these studies; her careful work is gratefully acknowledged. Many individuals have contributed ideas and have been supportive in many ways during the past 10 years of fieldwork in New Mexico: Mark Sale (Haughk), Regge Wiseman, Robert Dello-Russo, Gerry Raymond, Kirsten McCullough, Doug Boggess, William Penner, and Jesse Murrell. Stephen Fosberg and many others with the BLM Santa Fe and Carlsbad offices have been continually supportive. Finally, but certainly not last, Glenna Dean is especially recognized for her encouragement and insight, kicking off the geologic studies of the Mescalero Sands in 1999 with the words, "Go do science." Her high professional standards and expectations are an inspiration.
REFERENCES CITED

Aitken, M. J.

Berger, Glenn W., T. K. Henderson, D. Banderjee, and F. L. Nials

Berger, Glenn W., Stephen Post, and Chris Wenker

Blair, Terrance C., Jeffrey S. Clark, and Stephen G. Wells

Condon, Peter C., David D. Kuehn, Linda Scott-Cummings, Maria Hroncich, Lillian M. Ponce, Nancy Konulainen, and Willi Hermann
2008 Archaeological Testing and Data Recovery Recommendations for 16 Prehistoric Sites, Bear Grass Draw, Eddy County, New Mexico. TRC Environmental, El Paso.

Feathers, James K.

Feathers, James K., and D. Rhodes


Hall, Stephen A.
2002b Guidebook, First Geoarchaeology Field Course, Southeastern New Mexico. Bureau of Land Management, Santa Fe, and Historic Preservation Division, Santa Fe.
2009a Late Quaternary Geology and Associated Prehistoric Sites, Western Mescalero Plain, Eddy County, New Mexico. Office of Archaeological Studies, Department of Cultural Affairs, State of New Mexico, Santa Fe.

Hall, Stephen A., and Ronald J. Goble

Hall, Stephen A., Ronald J. Goble, and Hewitt W. Jeter  
2003 Luminescence and Radioisotope Chronology of the Late Quaternary Mescalero Sands, Southeastern New Mexico. *New Mexico Geology* 25:46.

Hall, Stephen A., Ronald J. Goble, and Gerry R. Raymond  

Hall, Stephen A., and Richard A. Periman  


Huntley, D. J., D. I. Godfrey-Smith, and M. L. W. Thewalt  

Lain, O. B., and G. R. Brooks  

Love, David W., F. Maldonada, B. Hallett, K. Panter, C. Reynolds, W. McIntosh, and N. Dunbar  

Miller, Myles R.  
2007 *Excavations at El Arrenal and Other Late Archaic and Early Formative Period Sites in the Hueco Mountain Project Area of Fort Bliss, Texas*. Directorate of Environment, Fort Bliss Garrison Command, Historic and Natural Resources Report No. 02-12.

Murrell, Jesse B.  
2009a *Archaeological Investigations at the Nine Mile Hill Site, City of Albuquerque, New Mexico*. Parametrix, Albuquerque.


Raymond, Gerry R., Nina Harris, Jalesa Johnson, and Stephen Yost  

Raymond, Gerry R., Kirsten McCullough, Adam Okun, David Vaughn, and George Arms  
2009 *Testing and Data Recovery Excavations at Eight Sites Along Paseo del Volcán, Unser Boulevard to Iris Road, City of Rio Rancho, Sandoval County, New Mexico*. Criterion Environmental Consulting, Albuquerque.

Rich, J., and S. Stokes  

Rittenour, Tammy M.  

Sanderson, D. C. W., P. Bishop, M. Stark, S. Alexander, and D. Penny  

Wintle, A. G.  
INTRODUCTION

This article is the second study of the historic artifacts collected by avocational archaeologist Frank Alpers, a resident of Cimarron, New Mexico (Figure 1). The first study (Kirkpatrick 2004) was of the metal ration tokens that Mr. Alpers found in the vicinity of the Jicarilla Apache reservation and agency buildings in the Ponil Canyon, north of the village of Cimarron. Alpers was a vocational archaeologist.
who collected both prehistoric and historic artifacts and recorded and reported on archaeological sites in the Cimarron area (Alpers 1963). He was a member of the Manley Chase family, pioneer settlers in the 1870s who established the Chase Ranch in the lower portion of the Ponil Canyon. Upon his death at age 77 in 1989, his sister Audrey Alpers inherited his various collections. She later donated his collections to the New Mexico Farm and Ranch Heritage Museum. The metal projectile points discussed here are part of the collections of this agricultural museum.

The Jicarilla Apache and Moache Ute peoples lived in the area now known as Cimarron, New Mexico. In 1851, in an attempt to stop the raiding by the Jicarilla Apache, a treaty was proposed in which the Jicarilla Apache agreed to stay within a specific area. They would also grow crops, stop the raiding, and return captives and stolen property. The United States government would aid and assist (Tiller 1983:451). For two years the Jicarilla abided by the terms, but the U. S. government never ratified the treaty.

CIMARRON INDIAN AGENCY

After several years of conflict and pursuit, a peace treaty was signed in Abiquiu on September 10, 1855 between the United States government and the Jicarilla Apache and Ute. As a consequence of the treaty, two agencies were established in 1856, one in Abiquiu and the other in Taos. The purpose of the agencies was to stop raids and other forms of conflict between the Jicarilla and Ute with the Hispanic and Anglo-American farmers and ranchers. By issuing rations for food, the United States government hoped that conflict could be avoided (Tiller 1983:451).

In 1861, an agency was established in Cimarron, a village in the Beaubien-Maxwell Land Grant, owned by Lucien B. Maxwell. The Cimarron Agency replaced the Taos Agency, which was closed in part because of the problem of easy access to liquor and the resulting problems. Kit Carson, the first Indian Agent at Taos, believed that remoteness of the Cimarron village would provide a more stable setting for the Jicarilla and Ute to increase their agricultural skills with resulting self sufficiency as farmers (Murphy 1983:121-122) and not as traditional hunters and gatherers.
Although there were protests from ranchers on the east side of the Sangre de Cristo Mountains, plans were made and completed to establish an agency in Cimarron. While Kit Carson was the agent for the Taos Agency, the Cimarron Agency was initially assigned to William F. M. Arney, who had no experience in the west or with Indians. The agency buildings were constructed on 1,280 acres leased from Maxwell for $20.00 a year. Arney arranged for agency buildings to be constructed on the Poñil Drainage above its confluence with the Cimarron River. The agency was located near the junction of Dean Canyon with Poñil Canyon (Figures 1 and 2), now on the Chase Ranch. The complex of adobe buildings included a school, council chamber, offices, and a residence for the agent at a construction cost of $2,000.00, which was paid to Maxwell. In April of 1862, Arney left to move his family to the agency (Murphy 1983:123-124.).

Maxwell and Carson initially settled at Rayado in 1848 to provide supplies and services to the military and travelers on the Santa Fe Trail. In the spring of 1859, Maxwell moved his ranch headquarters from along the south bank of the Rayado Creek north to the south bank of the Cimarron River. In the summer of 1864, he built a stone gristmill to grind corn and wheat into flour nearby. It reportedly was capable of processing 15,000 pounds of wheat into 44 barrels of flour (Murphy 1983:110). The mill also served as a focal point for distributing ration goods to the Indians, as illustrated in a period photograph (Murphy 1983:129).

Maxwell benefited from the agency since he provided most of the supplies given to the Jicarilla and Ute. For example, he sold corn and wheat to the agency along with beef, lamb and other supplies. The invoice to the government was $2,827.11. With the Civil War in the east, prices increased to a point where Maxwell billed the agency for $10,559.00 worth of goods in the first half of 1862 (Murphy 1983:125). Because of his remote location on the frontier, Maxwell held the competitive edge for providing supplies to the military at Fort Union and the Cimarron Agency.

Hunting deer and other game was an important part of the Jicarilla Apache and Moache Ute subsistence system. The intrusion of Hispanic and Anglo-American ranchers and other settlers into traditional hunting areas resulted in raids on cattle herds for food. Cattle were the replacement protein source for wild game protein. In October 1862, the Jicarilla and Utes stressed the need for meat. To stop raids on livestock herds, the agency provided 60 head of cattle, presumably from Maxwell’s herds, to the Apache and Ute peoples (Murphy 1983:126). Over the next years, Maxwell continued to provide supplies to the military and the Cimarron Agency. Because of this, his influence and actions were crucial to keeping the peace with the settlers and military and the Apaches and Utes (Murphy 1983:133-135).

Arney and later agents for the Cimarron Agency faced many difficulties with administering the agency. For example, in 1868, Erasmus B. Denison, a new Indian Agent, reported that the Cimarron Indian Agency buildings in the lower Poñil drainage had been destroyed by floods (Murphy 1983:139). This area later became the ranch of Manly M. Chase, who purchased 1000 acres on the lower Poñil and established his headquarter there (Murphy 1972:139). At an unknown time, Alpers made a sketch map for Murphy showing where the agency buildings were located and the locations of the ration tokens and other artifacts (Figure 3).

Maxwell was a dominant personality as well as the most influential landowner in the area. He probably had more influence over the Native American population than the military did. Maxwell allowed his Cimarron flourmill to be used as a distribution point for rations to the Jicarilla Apace and Utes (Murphy 1983: 129). This influence appears to have been a point of conflict between Maxwell and those Indian Agents serving after Kit Carson.
Dear Larry Murphy:

The above jottings constitute what I have read, found or have been told about Indian Agency Buildings. I would appreciate any information that you might find about the U.S. Subsistence medals and the tin pieces. I thought that perhaps you might possibly read something about them during your researching or know where to write for information.

Ind. Agency Letter
Nov. 19-1866
mentions Indian Agency
buildings as being destroyed
by high water. No location
said.

Ind. Agency Letter
May 7-1871
"here is not a single
building here belonging
to the Agency."

Figure 3.
Hand drawn map by Frank Alpers to Larry Murphy showing Cimarron Indian Agency location and recovered artifacts (Courtesy of New Mexico Farm and Ranch Heritage Museum).
Table 1.
Chronology of the Cimarron District (after Glassow 1972a:Table 1).

<table>
<thead>
<tr>
<th>Period or Phase</th>
<th>Date</th>
<th>Dating Method</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jicarilla Phase</td>
<td>A.D. 1750-1900</td>
<td>Ceramic</td>
<td>Cimarron Micaceous</td>
</tr>
<tr>
<td>Cojo Phase</td>
<td>A.D. 1550-1759</td>
<td>Ceramic</td>
<td>Ocate Micaceous</td>
</tr>
<tr>
<td>Cimarron Phase</td>
<td>A.D. 1200-1300</td>
<td>Ceramic</td>
<td>Cimarron plain; neck banded, incised, punctate, and/or Santa Fe Black-on-white</td>
</tr>
<tr>
<td>Poñil Phase</td>
<td>A.D. 1100-1250</td>
<td>Ceramic</td>
<td>Taos Incised or punctate</td>
</tr>
<tr>
<td>Escritores Phase</td>
<td>A.D. 900-1100</td>
<td>Ceramic</td>
<td>Kiathuthlanna or Red Mesa Black-on-white</td>
</tr>
<tr>
<td>Pedregoso Phase</td>
<td>A.D. 700-900</td>
<td>Radiocarbon sample</td>
<td>1200+/- 80; 1195+/-80 (UCLA 1369a, 1269b)</td>
</tr>
<tr>
<td>Vermejo Phase</td>
<td>A.D. 400-700</td>
<td>Radiocarbon sample</td>
<td>1460 +/- 50 (UCLA 1407), circular stone wall structures</td>
</tr>
<tr>
<td>Archaic Period</td>
<td>Pre-A.D. 400</td>
<td>Projectile point styles</td>
<td>Stemmed dart points</td>
</tr>
<tr>
<td>Lithic Period</td>
<td>?</td>
<td>Projectile point styles</td>
<td>Folsom point</td>
</tr>
</tbody>
</table>

JICARILLA APACHE ARCHAEOLOGY IN THE CIMARRON DISTRICT

The cultural chronology of the Cimarron area (Table 1) was developed by Michael Glassow (1972a, 1972b, 1980), based on his doctoral research while directing the summer archaeology program at Indian Writings in the 1960s. Kirkpatrick provided a regional synthesis of the Cimarron District with northeastern New Mexico (1976, 1977) while Cordell (1979a, 1979b) included the Cimarron District in her synthesis of northern Rio Grande archaeology. Archaeological evidence places the Jicarilla Apache in the area as early as the mid-1500s (D. Gunnerson 1974; J. Gunnerson 1959, 1969). Gunnerson’s (1969) excavations included sites in the lower Poñil River Valley. Skinner (1964) excavated a multicomponent rock shelter in the North Poñil Canyon, overlooking the North Poñil Creek. He recovered a cache of wheat seeds plus a notched rasp, and a yucca fire board that have been documented as being used by the Jicarilla Apache and Utes. The wheat is thought to have been distributed to the Ute and/or Jicarilla Apache as part of the ration allotment as part of the terms for staying on the reservation. Glassow (1972a) also excavated a Cojo phase site in the North Poñil.
Table 2.
Data from Metal Points in the Alpers Collection.

<table>
<thead>
<tr>
<th>Point (No.)</th>
<th>Blade Shape</th>
<th>Blade tip</th>
<th>Length Overall (cm)</th>
<th>Blade Length (cm)</th>
<th>Blade width (cm)</th>
<th>Thick (cm)</th>
<th>Stem style</th>
<th>Stem length</th>
<th>Stem width</th>
<th>Hafting style</th>
<th>Base shape</th>
<th>Stem notches**</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (6)</td>
<td>Straight</td>
<td>Rounded</td>
<td>6.8</td>
<td>5.8</td>
<td>1.7</td>
<td>.25</td>
<td>Straight</td>
<td>1.0</td>
<td>.9</td>
<td>Straight</td>
<td>Straight</td>
<td>3/4</td>
<td>Base slightly diagonal;</td>
</tr>
<tr>
<td>B (3)</td>
<td>Straight</td>
<td>Tip</td>
<td>5.5</td>
<td>4.1</td>
<td>1.4</td>
<td>-</td>
<td>Straight</td>
<td>1.4</td>
<td>.7</td>
<td>Shoulder</td>
<td>Straight</td>
<td>Rusted</td>
<td>Slight curve of blade</td>
</tr>
<tr>
<td>C</td>
<td>Straight</td>
<td>Impactblunt</td>
<td>-</td>
<td>5.6</td>
<td>1.6</td>
<td>.2</td>
<td>-</td>
<td>-</td>
<td>-.7*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Slight curve of blade</td>
</tr>
<tr>
<td>(D) 8</td>
<td>Straight</td>
<td>Rounded</td>
<td>-</td>
<td>5.6</td>
<td>1.7</td>
<td>.2</td>
<td>-</td>
<td>-</td>
<td>-.65*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Slight curve of blade</td>
</tr>
<tr>
<td>E</td>
<td>Straight</td>
<td>Missing</td>
<td>3.5</td>
<td>2.7</td>
<td>2.1</td>
<td>.2</td>
<td>Straight</td>
<td>.8</td>
<td>.6</td>
<td>Shoulder</td>
<td>Straight</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>F (4)</td>
<td>Straight</td>
<td>Impactblunt</td>
<td>5.2</td>
<td>4.2</td>
<td>1.6</td>
<td>.2</td>
<td>Straight</td>
<td>1.1</td>
<td>.6</td>
<td>Shoulder</td>
<td>Straight</td>
<td>2/2</td>
<td></td>
</tr>
<tr>
<td>G (7)</td>
<td>Straight</td>
<td>Missing</td>
<td>6.5</td>
<td>5.5</td>
<td>.8</td>
<td>.2</td>
<td>Straight</td>
<td>1.1</td>
<td>.9</td>
<td>Shoulder</td>
<td>Straight</td>
<td>2/2</td>
<td>Base slightly diagonal</td>
</tr>
<tr>
<td>H</td>
<td>Straight</td>
<td>Rounded</td>
<td>6.1</td>
<td>5.0</td>
<td>1.7</td>
<td>.2</td>
<td>Straight</td>
<td>1.2</td>
<td>1.0</td>
<td>Straight</td>
<td>Straight</td>
<td>2/2</td>
<td>Slight curve of blade</td>
</tr>
<tr>
<td>I (5)</td>
<td>Straight</td>
<td>Missing</td>
<td>4.9</td>
<td>3.6</td>
<td>1.8</td>
<td>.2</td>
<td>Straight</td>
<td>1.3</td>
<td>.8</td>
<td>Corner narrow</td>
<td>Single notch</td>
<td>3/3</td>
<td>Slight curve of blade</td>
</tr>
<tr>
<td>a</td>
<td>Straight</td>
<td>Missing</td>
<td>7.3</td>
<td>6.1</td>
<td>1.8</td>
<td>.2</td>
<td>Straight</td>
<td>1.0</td>
<td>.9</td>
<td>Shoulder</td>
<td>Straight</td>
<td>None</td>
<td>Base slightly diagonal</td>
</tr>
<tr>
<td>b (2)</td>
<td>Straight</td>
<td>Missing</td>
<td>7.0</td>
<td>6.0</td>
<td>2.5</td>
<td>.2</td>
<td>Straight</td>
<td>.8</td>
<td>.9</td>
<td>Shoulder</td>
<td>Straight</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>c (1)</td>
<td>Straight</td>
<td>Straight</td>
<td>8.7</td>
<td>7.5</td>
<td>2.2</td>
<td>.15</td>
<td>Straight</td>
<td>1.2</td>
<td>1.25</td>
<td>Straight</td>
<td>Straight</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Straight</td>
<td>Straight</td>
<td>5.1</td>
<td>4.0</td>
<td>2.15</td>
<td>.15</td>
<td>Expand</td>
<td>1.1</td>
<td>.94</td>
<td>Straight</td>
<td>Straight</td>
<td>None</td>
<td>Base slightly diagonal</td>
</tr>
<tr>
<td>e</td>
<td>Straight</td>
<td>Point</td>
<td>6.8</td>
<td>6.1</td>
<td>2.0</td>
<td>.2</td>
<td>Straight</td>
<td>.7</td>
<td>.95</td>
<td>Shoulder</td>
<td>Straight</td>
<td>None</td>
<td>Base slightly diagonal</td>
</tr>
</tbody>
</table>

* at base of blade  ** triangular cut, probably with flat file edge

METAL PROJECTILE POINTS

Frank Alpers collected nine finished and five blanks or partially completed metal projectile points from areas around the location of the Indian Agency at the mouth of Dean Canyon, Cimarron, and Slate Hill (Figure 1). Alpers made a generalized sketch map of the locations where he found and collected the points and blanks (Figure 4). He identified the finished points by using a capital letter (A-I) and he identified the partially manufactured points as blanks and used a lower case letter (a-e). Some of the points and blanks were also given a numeric designation, possibly the sequence of discovery. That number is included in Table 2. The upper and lower case designations are used in this article.

The condition of the metal points ranges from very good to badly rusted with missing portions of the stem and blade. All the metal points have a rusty patina that covers the entire surface of the artifacts. In the more poorly preserved points, the rusty metal has an exfoliating surface.
The paper records with the collection include the length, width and thickness of the points in centimeters. No other measurement data were collected by Alpers. For this study both metric and non-metric data were recorded for the points and blanks (Table 2). The metric data were collected using a hand caliper for the measurements in centimeters. The measurements were the overall length of the point, blade length, width, and thickness. The stem measurements were for length and width. The non-metric data include blade shape, tip style, stem style, hafting style, base shape, the number of stem notches, and general comments about the points and blanks. The measurements taken by Alpers were generally within a millimeter of the newly recorded measurements. The locational data were notes made on a piece of paper where Alpers made an outline drawing of the points and blanks and identified them by letter as well as eight by numbers (1-8).

**Metal Points**

As a group (Table 2), the nine metal points range in size from 3.5 cm to 6.8 cm for overall length, 2.7 cm to 2.1 cm in width, and consistently 0.2 cm in thickness, except for point A which is .25 cm thick. The stem length ranges between 0.8 cm to 1.4 cm and the width between 0.6 and 0.9 cm. The blade shape is straight, as is the stem style. The tips are rounded, blunted from impact, or missing from corrosion or unknown causes. The hafting style is either straight or shouldered, though two points have the stem missing from corrosion or unknown causes. In profile, several of points have a slight curve to the blade, possibly the result of the manufacturing process or the material used to make the point.

**Metal Point A**

This point was found at Bob Dean’s house site (Figure 3). This point has a straight blade shape, straight stem style, and shoulder hafting style (Figure 5). The base has a slight diagonal cut. The stem has three notches on one side and four on the opposite side that are well defined. The tip is rounded and is narrower when compared to other rounded points such as Point H.
**Metal Point B**

This point was found at Poñil Plaza, but the exact location is not shown on Figure 3. The point location in Figure 4 suggests it is in the lower portion of the Poñil Canyon. This point is in the worst condition of all the points and blanks in the collection (Figure 6). The metal is exfoliating from the body and stem areas of the point. The blade shape appears to have been straight. The stem is in poor condition and it is not possible to determine the number of stem notches. In profile, the blade has a slight curve. The tip is missing from corrosion.

**Figure 6.**
Metal point B: front.

**Metal Point C**

This point was found west of Sutcliff’s, but this name is not familiar nor on the Figure 3 map. The point has a straight blade shape (Figure 7). The stem is missing, either from corrosion or from being snapped off. The tip is slightly blunted from impact. There is a slight curve to the body of the point, more so towards the tip (Figure 8). The tip is rounded but narrower when compared to other rounded points, notably Point H. It is almost triangular.

**Figure 7.**
Metal point C.

**Figure 8.**
Profile of metal point C showing curved blade.

**Metal Point D**

This point was found above a terrace by Larry (?)? Rupert (Figure 4). The point has a straight blade shape (Figure 9). The stem is missing, either from corrosion or from being snapped off. The tip is rounded. There is a slight curve to the body of the point. The body is one of the longer points at 5.6 cm. If the stem were present, this could have been the longest point in the collection.

**Figure 9.**
Metal point D: front
**Metal Point E**

This point was also found in Poñil Plaza. The point has a straight blade shape, straight stem style, and shoulder hafting style (Figure 10). The straight base has a slight diagonal cut. It was not possible to identify stem notches. The tip is not present. There is no curve to the blade.

![Figure 10. Metal point E: front.](image1)

**Metal Point F**

This point was found on the Chase Ranch near the edge of a bench north of Dean Canyon (Figure 4). The point has a straight blade shape, straight stem style, and shoulder hafting style (Figure 11). The straight base has a slight diagonal cut. The stem has two notches on both sides that are well defined (Figure 12). The tip very blunted or bent backwards from impact (Figure 13). There is no curve to the blade.

![Figure 11. Metal point F: front.](image2)

![Figure 12. Detail of stem and filed notches on metal point F.](image3)

![Figure 13. Detail of blunted tip on metal point F.](image4)
**Metal Point G**

This point was found near a house site (of prehistoric age?) north of Cimarron (Figure 4). The point has a straight blade shape, straight stem style, and shoulder hafting style (Figure 14). While the overall blade shape is relatively straight, it is asymmetrical as if one edge was a manufactured edge rather than a cut edge. The straight base has a slight diagonal cut. The stem has two notches on both sides that are well defined but there may be a smaller notch on both sides at the base of the blade (Figure 15). The tip is rounded. There is a curve to the blade, most noticeably towards the tip (Figure 16).

**Metal Point H**

This point was also found north of town and possibly at the same location a Point G based on Alper’s notes. The point has a straight blade shape, straight stem style, and straight hafting style (Figure 17). The straight base has a slight diagonal cut. The stem has two notches on both sides that are well defined (Figure 18). The tip is very rounded. There is a slight curve to the blade.
Metal Point I

Point I was also found at Ponil Plaza. This point has a straight blade shape, a straight stem style, and a corner hafting style (Figure 19). This is the only point that has a notched base though it may be the base had a diagonal orientation. The stem has three notches on both sides that are well defined (Figure 20). The tip is not present. There is a slight curve to the blade.

![Figure 19. Metal point I.](image)

Blanks or Partially Completed Points

The five blanks and partially completed points range in size from 5.1 cm to 8.7 cm for overall length, 1.8 cm to 2.5 cm in width, and range in thickness between 0.15 and 0.2 cm in thickness. The stem length ranges between 0.7 cm to 1.2 cm and the width between 0.9 and 1.4 cm. The blade shape is straight, as is the stem style. The tips are straight, a point, or missing as a result of the point not being completed. The hafting style is either straight or shouldered. In profile, the blanks do not have a slight curve, as seen in the completed points.

Metal Blank a

Blank a was found up canyon from Ponil Plaza (Figure 4). This blank or partially completed point has a straight blade shape, a straight stem style and a shoulder hafting style (Figure 21). The base is straight with a slight diagonal cut. There are no notches present. The tip is not present at this stage of manufacture.

![Figure 20. Detail of stem and filed notches on metal point I.](image)

![Figure 21. Metal point blank a: front.](image)
Blank b

Blank b was found on a bluff above Sutcliffs in association with Apache sherds. This blank or partially completed point has a straight blade shape, a straight stem style, and a shoulder hafting style (Figure 22 and 23). The base is straight with a slight diagonal cut. There are no notches present. The tip is not present at this stage of manufacture. The edges of this blank are very irregular as a result of the use of a chisel in the manufacturing process.

Figure 22.
Metal point blank b: front.

Figure 23.
Metal point blank b: reverse; white spot is remains of mounting paper and glue.

Metal Blank c

This point was found south of the cemetery (Figures 1 and 4). This blank or partially completed point has a straight blade shape, a straight stem style, and a straight hafting style (Figure 24). While the overall blade shape is relatively straight, it is asymmetrical as if one edge was a manufactured edge rather than a cut edge. The base is relatively straight without the diagonal angle seen on other points (e.g. Figure 15 and Figure 17). There are no notches present. The tip is not present at this stage of manufacture. The edges of this blank are very irregular as a result of the use of a chisel in the manufacturing process (Figure 25).

Figure 24.
Metal point blank c: front.

Figure 25.
Blank c: detail of stem chisel cut marks on bottom.
**Metal Blank d**

Blank d was found on a bluff bench on the Chase Ranch above the mouth of Dean Canyon, and near Point F (Figure 4). This blank or partially completed point has a straight blade shape, an expanding stem style, and a straight hafting style (Figure 26). This is the only point with an expanding stem style. The base is a relative straight without the diagonal angle seen on other points (e.g. Figure 15 and Figure 17). There are no notches present. The edges of this blank are very irregular as a result of the use of a chisel in the manufacturing process (Figure 27 and Figure 28). The tip is not present at this stage of manufacture though it appears that two additional angles were cut to create a preform for a rounded point. The angles are too short for a pointed tip (Figure 29).

---

**Figure 26.**
Metal point blank d: front.

**Figure 27.**
Metal point blank d: reverse.

**Figure 28.**
Metal point blank d: detail of stem chisel cut marks.

**Figure 29.**
Detail of chisel cut marks on tip, metal point blank d.
Metal Blank \(e\)

Blank \(e\) was near Blank \(a\) (Figure 4), up canyon from Poñil Plaza. This blank or partially completed point has a straight blade shape, a straight stem style and a shouldered hafting style (Figure 30). The base is relatively straight with the slight diagonal angle. There are no notches present. The tip is pointed, the only one in the collected points. The edges of this blank are very irregular as a result of the use of a chisel in the manufacturing process. There are “shelf” edges where the initial chisel cut was not complete. A second cut was needed. Based on these “shelf edges”, this point was being prepared by cutting using a chisel along one side, then it was turned over, and the second edge was cut with a chisel. Like the other side, the chiseling did not go through the first time, and was then repeated. This is evidenced by the “shelved” edge of the chisel cut.

Figure 30.
Metal point blank \(e\).

Figure 31.
Metal point blank \(e\), reverse.
MANUFACTURING PROCESS

The blanks or partially completed points provided clues to the manufacturing process. The material appears to be a piece of thin rolled metal with uniform thickness, similar to a barrel hoop. A chisel was used to cut the edges to shape the point. Chisel marks can be seen on Blank c and Bank d, especially on the stem areas (Figures 27 and 28) and the tip of Blank d (Figure 29). The chiseling process resulted in ragged or rough edges along the edges as in Blank b (Figure 22) and in Blank e (Figure 30).

In some cases, the chiseling was done along one side of the blade and part of the stem, then the blank was turned over and the chiseling continued along the reverse side of the stem and edge. This can be best seen in the stem of Blank c (Figure 22) and the body of Blank e (Figure 30 and 31). The bottom part of the stem shows the angle of the chisel cut, but this is absent in the top part of the stem. In other cases, chiseling was done on only one side. A file was then used to clean up or smooth and then sharpen the edges.

During the analysis of the finished points, it was noticed that some points had a wider area of file marks along one edge of the blade than the other edge on the same side. The pattern was also observed on the reverse side of the point (e.g. Point D). Other points had wider file marks on only one side of the point and narrow marks on the reverse side (e.g. Point A). Because of the rusty nature of the surface, it required very close observation under a strong light to see the width differences. Unfortunately, they are not visible in the photographs.

Based on these observations, at least two patterns of edge sharpening were identified. For the first, the blank point was chiseled to shape by cutting on only one side of the metal material. The edge was then cleaned and filed to a sharp edge with wide file band on one side of the point and a narrow band on the reverse. The second pattern, evidenced by the placement of chisel marks on Blanks d and e, show that one side had a wider band along one edge and a narrower edge on the other edge. This pattern was also present on the reverse side so that when looking down the point axis, the upper right edge had a wide file band, as did the lower left side.

The notches in the stem appear to have been cut with the edge of a file. The cut was probably from the top of the stem downward following the angle of the chisel mark. The stem notches of Metal Points G (Figure 15) and Point H (Figure 18) illustrate this pattern.

SUMMARY

This initial study of metal points from an area occupied by the Jicarilla Apache and Moache Ute provides descriptive and metric data on five preforms or partially manufactured points and nine finished points, of which two are missing the tips and one has no stem. The lengths and widths are variable but the thickness is consistent, suggesting a common source of material for the manufacture of the points. The blanks show evidence that chisels were used to cut the preforms from the original stock material. Two cutting patterns were identified. In the first, all the chisel cuts were on one side of the stock material. In the other, one side of the stock material was cut with a chisel, and then it was turned over and cut again. The final shaping and sharpening of the edges continued this pattern.

Future research on metal projectile points should focus on the source material for points, especially the thickness of the material, cutting patterns, and associated finishing patterns using files and other materials, which may have included coarse- and fine-grained rocks.
REFERENCES CITED

Alpers, Frank

Cordell, Linda

Glassow, Michael A.

Gunnerson, Delores

Gunnerson, James

Kirkpatrick, David T.

Murphy, Lawrence R.

Skinner, S. Alan

Tiller, Veronica E. Velarde
ARCHAEOACOUSTICS: ADDING A SOUND TRACK TO SITE DESCRIPTIONS

BACKGROUND

Until recently, archaeologists have not considered acoustics in their site descriptions. Sounds from hundreds or thousands of years ago are lost, never to be heard again. However, architecture and natural features can reproduce sounds as they were heard long ago if properly stimulated. Researchers in the growing field of archaeoacoustics are currently investigating the relationship of sound to human behavior in prehistory. Archaeoacoustics is a relatively new, systematic approach to studying the acoustical properties of archaeological sites. Musical instruments found in archaeological contexts are also considered.

Some of the earliest archaeoacoustic research was undertaken at caves and rock art sites. Many petroglyph panels are associated with unusual acoustic effects such as echoes, reverberation, resonance, and sound carrying unexpectedly far (Waller 2006). Today, investigations include megalithic sites, and architectural sites as well (Scarre and Lawson 2006).

Advances in electronic technology have made these studies easier, cheaper, and more accurate. Digital recording devices with stereo microphones will now fit in a coat pocket and cost under $500. They can be easily connected to a computer, allowing sound files to be analyzed with relatively inexpensive software. Decibel levels, spectral content, and reverberation duration can be quickly measured. Soundscapes are currently being modeled with programs like CATT, EASE, or ODEON. These programs are primarily for room acoustics. For outdoor sound propagation, Soundplan and CADNA are being used. In my investigations at Chaco, I used AutoCAD and an optical raytrace program called ZEMAX. These got the job done but were expensive, somewhat cumbersome to use, and had a steep learning curve.

For producing sounds, portable battery powered amplifiers and speakers can be used with CD recordings or a laptop computer as a source. Many sound editing programs can be used to generate specialized sounds like swept sine waves. I have also used flutes, whistles, and conch shell trumpets to produce echoes. I found the shell trumpets to be one of the easiest ways to produce a loud stimulus for an echo. They are simple, easily portable, don’t require batteries, and are nearly foolproof once you master the technique of blowing one.

PREVIOUS RESEARCH

Paul Devereux provides an excellent summary of the earliest archaeoacoustic research in his book Stone Age Soundtracks (Devereux 2001). In the early 1990s, acoustic research was underway at a Scottish stone circle and at the reconstructed Aztec Ruins great kiva (LA 45) in New Mexico. The studies were soon expanded to include additional megalithic henges, chambered mounds, and “passage graves.” All of these sites exhibited an array of unusual sound effects when stimulated with modern sound equipment.

Aaron Watson recorded dramatic sound effects at Stonehenge (Watson and Keating 1999). He found that the upright stones had been shaped intentionally to focus sound inside the circle. Watson concluded that participants in ceremonies inside the structure would have been

Steve Waller has been searching out rock art sites with unusual echo effects in North America, Europe, and Australia. He found that cave paintings and ancient petroglyphs are typically in echo rich locations. Waller concluded that the selection of these echoing environments by the artists was not a mere coincidence. In addition, a variety of ancient myths attribute the phenomenon of echoes to supernatural beings that live within the rock walls (Waller 2002). One such myth describes the founding of Acoma based on finding the location with the best echo (Gill and Sullivan 1992:79).

David Lubman has conducted a series of acoustic experiments at Chichen Itza. The steps of the pyramid of El Castillo (Kukulcan) generate a “chirped echo.” Interestingly, it sounds very much like the call of the Quetzal bird (Devereux 2001). Lubman has noted a similar effect from the staircase at the Pyramid of the Magician in the classic Mayan city of Uxmal on the Yucatan peninsula. He has also recorded a spectacular flutter echo and “whispering gallery” effects at the Great Ball Court of Chichen Itza (Lubman 2006).

INVESTIGATIONS AT CHACO CANYON

Some unusual acoustical effects were discovered during fine scale mapping of the Chetro Ketl (LA 838) field in 2001 (Stein et al. 2007). At particular points west of the field, conversations among the field team could be heard perfectly even if the speaker was up to 75 m distant. This effect seemed confined to fairly small areas. A movement of just a meter or so caused the effect to disappear. Park employees had known for more than 25 years that the area between Pueblo Bonito (LA 625) and Chetro Ketl had unusual acoustical properties (Loose 2008).

The effects were being caused by an alcove in the cliff face between Pueblo Bonito and Chetro Ketl. This large natural amphitheater has a special Navajo place name and is known as Tse’ Biinaholts’a Yakti (Concavity in the Bedrock That Speaks). It is incorporated in Navajo ceremonial history as the place where two siblings were instructed in the use of ritual tones by the deities. Consequently, the origin of the tones which give power to contemporary Navajo chants can be traced to Tse’ Biinaholts’a Yakti. These tones are produced vocally and are accompanied by the shell trumpet, eagle bone whistle, and reed flute (Blackhorse et. al. 2002). Several acoustical experiments were performed in the amphitheater before the Navajo oral history was discovered. The ethnographic information bolstered our confidence that we were dealing with a real cultural artifact. A brief summary of the results is presented in “Revisiting Downtown Chaco” (Stein et al. 2007). A more detailed and technical description has been published in the British journal “Time and Mind” (Loose 2008).

Five field trips were made between January 2000 and June 2001. Recordings were made at night in order to have a quiet noise background. Nearly five hours of experimental recordings were obtained. After a few preliminary experiments, it became apparent that the cliff face between Pueblo Bonito and Chetro Ketl was in effect a giant acoustical mirror, not unlike the one behind the stage at the Hollywood Bowl concert theater in Los Angeles. At this time it was decided to call the curved cliff face “The Amphitheater.”

A 1-ft contour map of the cliff face was produced with a laser range finder, a GPS unit, and a theodolite. The raw data was converted into an AutoCAD file. The horizontal dimension was found to be over 150 m, while the vertical dimension averaged around 25 m. The cliff wall is curved in both the horizontal and vertical axis. This type of compound curve is called a torus. The horizontal radius of curvature was measured to be 170 m, while the vertical radius of curvature was 46 m. This revealed that the cliff wall is more steeply curved vertically than it is horizontally. The torus shape gives rise to a line focus out in front of the cliff and causes the unusual acoustic effects. Using the AutoCAD drawing file, an idealized 3D perspective view of the Amphitheater was created.
Amplified loudspeakers were used to produce tones and swept sine waves and to play recorded music. Conch shell trumpets, flutes, and the human voice were also used to produce echoes. Recording was done with both analog and digital recorders using studio quality microphones. Some transmissions and recordings were made at the largest mound near Casa Rinconada (LA 841) (Stein et al. 2007), about 600 m distant from the Amphitheater wall. Contemporary Navajo chanters consider this mound to be part of Tse’ Biinaholts’a Yááti.

One of the most spectacular effects noted was a “virtual sound image.” Because the sound waves have been reflected and are coming to a focus in front of the cliff, they are perceived to be coming from inside the cliff. As an example, while I was making one of my recordings, a truck passed in front of the Amphitheater along the Park Service access road. It seemed as if the truck was driving out of the cliff wall instead of passing behind me. Steve Waller noted a similar effect at an Australian rock art site. If he placed himself about 30 m away, the echoes from

Figure 1.
The arc of Tse’ Biinaholts’a Yááti lies between Pueblo Bonito and Chetro Ketl. Note what appears to be a rectangular enclosure in front of the Amphitheater. Photo courtesy of Rich Friedman.
Figure 2.
3D computer model showing the Amphitheater's toric curve. Image courtesy of Jack Crouch.

the curved alcove where pictographic figures were painted appeared to make them speak. He described it as "almost spooky" (Devereux 2001). Like the numerous acoustic sites described by Waller, the Chaco Amphitheater has an elaborate petroglyph panel at the east end of the alcove. The National Park Service has built a trail along the cliff within the Amphitheater and named it the "Petroglyph Trail." During the recording sessions, a related "virtual sound image" effect was noted if someone yelled or tones were played from the Casa Rinconada mound. For someone standing about 30 m from the cliff, the sounds could be heard but it was hard to determine where the sound was coming from. The sound almost seemed to be coming from inside your head. It was not unlike wearing stereo headphones.

All of the research team felt that music played in the Amphitheater seemed enhanced by the fairly long reverberations, which lasted nearly two seconds. This is comparable to typical reverberation in churches and concert halls. Most musicians and listeners prefer some reverberation in their performance environment. Reverberation time of less than a half second makes sound seem "dry." Over three seconds of reverberation causes music to seem garbled and "muddy." During our recordings, we also noted a secondary echo from across the canyon with about a 3.5 second delay. The echo lasted longer than the original pulse, suggesting reverberation was taking place on the opposite side of the canyon as well.

Speech from the Casa Rinconada mound could be heard in the Amphitheater, but it was garbled, and the source of the sound was again indeterminate. It gave the effect of "hearing voices," but you could not quite understand what they were saying. Effects like this can be termed an "acousma," or an auditory illusion similar to an optical illusion. Other effects included noticeable standing waves, buzzing sounds near the cliff face, flutter echoes, and whispering gallery effects. A jet aircraft passing overhead filled the Amphitheater with a sustained low roaring noise. We did not have the opportunity to experience the reverberations of a thunderclap, but the effect would undoubtedly be spectacular.

THE GREAT KIVA AT AZTEC RUINS

In his book, *Stone Age Soundtracks*, Paul Devereux stated that his original research into archaeoaoustics was inspired by a trip to the Great Kiva at Aztec Ruins National Monument. He was visiting the site accompanied by a Princeton University physicist named Robert Jahn (Devereux 2001). They were especially interested in the structure because it had been restored to near original condition by Earl Morris in 1933. The structure subsequently had been maintained in good repair by the National Park Service. It was as close as someone could get to experiencing the acoustics when the kiva was first built and occupied. Jahn felt that the quality of the acoustics in the kiva was notable and would have made ceremonial songs seem powerful and resonant.

In late December of 2001 I visited Aztec Ruins with John Stein and Terry Nichols. We made a series of recordings using a 100 watt audio amplifier, and loudspeakers set near the floor vaults. A string of five geophones was laid out around the floor between the center and the kiva bench. Two microphones were positioned near the center of the room. Continuous tones and a slowly swept sine wave were played inside the kiva. The acoustic effects were quite remarkable. We observed a strong rever-
beration of about 1.5 seconds, low frequency resonances felt mainly as vibrations in the floor, harmonics, and a focus at the center of the room. There was a sensation of being immersed in sound as we descended the staircase into the lower portion of the kiva. It was like walking into a swimming pool full of sound instead of water. The vibrations could be felt in your chest cavity.

Subsequent computer analysis of the soundtracks showed that the strongest low frequency resonance was at 95 Hertz (cycles per second). Devereux found that the resonant frequencies of six Neolithic chambers in England and Ireland had a narrow spectral range between 95 and 120 Hertz. The majority clustered around 110 Hertz. Devereux recently cited a controlled study of the effects of low frequency sound waves on human brain function. It was found that exposure to frequencies around 110 Hertz could change brain wave patterns and induce vivid mental imagery and auditory hallucinations. This 110 Hertz pattern also appears in deep meditation and trance states. It is an ideal brain wave frequency for conducting ritual activity (Devereux 2006). Visual and auditory effects could have been further enhanced by the consumption of psychotropic substances. Datura is one locally available plant known to contain psychoactive alkaloids that can cause visual hallucinations and an altered state of consciousness (Huckwell and Van Pool 2006). It is used in Chaco Canyon at Tse’ Biinaholt’s’a’ Yalti by Navajo practitioners in the Ch’ihwojoolyeyi chant (Blackhorse et al. 2002). E.C. Krupp has documented the use of datura by Chumash shamans to induce visions and provide encounters with divine sources of power (Krupp 1997). The combination of hallucinogens with sustained low frequency sound could have resulted in a profound religious experience.

One of the most interesting features of the Aztec great kiva is the roof support system. Four columns that were 3 ft square rose to about 18 ft to support a flat roof weighing approximately 90 tons. The columns were of an unusual design, consisting of alternating layers of masonry courses and cross-bedded poles. The pole layers were alternated at 90 degrees in each successive layer. Each column rested on four massive fine grained limestone disks set in a 6-ft deep pit (Lister and Lister 1990). These disks appear to be made of a non-local material. The effort required to fabricate and transport the disks to the site would have been an imposing task.

The disks were carefully shaped and had been lapped flat. The disks are about 1 m in diameter and 10 cm thick, weighing about 140 kg apiece. This would make for a total of around 560 kg of dead weight at the bottom of each column. Beneath the disks the pit extended further with a layer of compacted lignite sitting on a base of stone cobbles. Morris noted that similar seating disks had been found at Chetro Ketl (Lister and Lister 1990). Indeed, they seem to be a universal feature of great kiva architecture.

This structural design would have lowered the center of gravity of each column, adding stability and serving much as a “floating column.” The Animas River terrace fill where Aztec Ruins is located consists of sand, silt, and clay with no bedrock outcrops to support large building foundations. Floating columns are used in modern buildings where bedrock is not available. This would have been a very efficient design for an unbraced structure like the Aztec great kiva.

![Figure 3. Stone seating disks in the great kiva at Aztec Ruins. Photo by the author.](image-url)
As for acoustical effects, the columns may be conducive to low frequency vibrations. Each column has potentially three degrees of freedom for small load adjustments due to the alternating poles and the seating disks. This would have allowed some movement compared to a completely rigid support system. If the floor vaults were indeed “foot drums,” a group of people dancing on them could have induced a lot of low frequency resonances. The columns would likely have damped out any high frequency vibration modes.

Figure 4.
A restored roof support column in the great kiva at Aztec Ruins with the internal structure exposed. Photo by the author.

MULTIMEDIA

During the recording session at Aztec, an unexpected discovery was made. It was the afternoon of December 21, 2001 on the winter solstice. John Stein had wanted to check for possible solar alignments that day, but had not yet arrived. By late afternoon, the equipment was ready for recording. During the set-up, I had noticed a rectangular shaft of light creeping across the kiva floor that began to go up the east wall. It was being produced by sunlight passing through a pair of rectangular windows on the western side. I soon realized it was ultimately going to pass through the windows on the opposite side of the structure. I managed to get a photograph through the four aligned windows just as the sun was setting. It was very close to being centered on the aperture created by the windows. These windows are in peripheral rooms 163 and 169 as numbered by Earl Morris (1996). This is based on the assumption that the north arrow shown on his plan map is true north and not magnetic north. The alignment fits well in the Aztec cityscape with its solstitial master plan (Lekson 2008).

Figure 5.
Winter solstice sunset at the great kiva at Aztec Ruins. The sun appears through a set of four aligned windows, two on the west wall and two on the east wall. Photo by the author.

Williamson (1987) found a similar effect at Casa Rinconada in Chaco Canyon. At summer solstice sunrise an opening in the northeast kiva wall casts a beam of light
onto a niche on the inside wall. This occurs about 30 minutes after the sun’s “first gleam.” I should note here that the effects of the reconstruction of both Casa Rinconada and the Great Kiva at Aztec must be considered if the intentionality of the original builders is to be properly understood. Unfortunately, detailed records of the reconstructions are either lost or were never recorded. In the case of Aztec, Morris was determined to reconstruct the kiva exactly as it had appeared in ancient times. “He later told Robert Lister that he had based the entire reconstruction on archaeological research. ‘I didn’t guess at a thing’ he said” (Elliot 1995). This certainly leaves open the possibility that both light and sound were part of ceremonial performances in the great kivas of the San Juan Basin.

CASAMERO

Casamero Pueblo (LA 8779) is located west of Grants about 8 km north of I-40 on McKinley County Road 19. It has been stabilized and developed for public interpretation by the Bureau of Land Management. There are 22 ground floor rooms, an associated great kiva, and prehistoric road segments. There are three spectacular arches in a red sandstone cliff just west of the ruin. The arches are sometimes referred to as “Ojos Tecolotes” (Owl Eyes) by the local residents.

In July of 2009, I visited the site and made some recordings at Casamero using a handheld digital recorder and a conch shell trumpet as a sound source. There was a very distinct primary echo and a secondary echo from a cliff face to the north. The northern arch was focusing sound from vehicles traveling on the county road below once I got fairly close to it. The base of the cliff is covered with alluvium and there does not appear to be a good location for a dance plaza in front of the arches. Nevertheless, the echoes are quite prominent and bring to mind the Acoma myth mentioned earlier.

Figure 6.
The alcoves (Ojos Tecolotes) in the cliff face at Casamero. Photo by the author.
CONCLUSIONS

"So it is not that the acoustic effects found at prehistoric sites are of some special, overriding importance, but rather that such aspects have been ignored for too long. Acoustic archaeology is about the healing of our research 'deafness'; it is giving us an extra sense to use in our investigation of sacred places." (Devereux 2001)

The acoustics of archaeological sites might tell us something useful about the human activities that may have taken place in the past. Intentionality of the choice of a natural location or the design of a structure for acoustical effects is usually hard to determine. Archaeoaoustics shares the methodological difficulties encountered in archaeoastronomy. Are the astronomical alignments or unusual acoustic effects just an accident, or were they preconceived and used intentionally?

Some sites, such as Tse' Biinaholts'a Yalti and the Aztec Great kiva, exhibit both acoustic and astronomical properties that are hard to explain as sheer coincidence. The Chaco Amphitheater is at the very center of the canyon's architectural complex, yet is devoid of architectural features. It sits exactly on the north-south axis and east-west axis of symmetry for the layout of the big buildings. The Casa Rinconada mound, which appears to be man-made and considered part of the Amphitheater by modern Navajo chanters, is located on the north-south axis as well. The ethno-graphic evidence relevant to Tse' Biinaholts'a Yalti makes the interpretation as a ceremonial place much stronger.

Figure 7.
The Amphitheater (Tse' Biinaholts'a Yalti) at the geometric center of the Chaco Canyon architectural complex. Note that the Casa Rinconada mound falls on the north-south axis of symmetry. Photo courtesy of Rich Friedman.
If Chaco was indeed a regional ceremonial center (Gabriel 1991; Van Dyke 2007), an outdoor performance area like Tse’ Biinaholts’a Yáti could have accommodated much larger crowds than any of the individual buildings could have supported. We found a certain “volume threshold” was necessary to stimulate many of the special sound effects. The optimum performance of the Amphitheater would have required the coordinated efforts of a large group of participants (Loose 2008; Stein et. al. 2007). Structures like the great kivas at Chaco could have been used for smaller rituals, but with equally impressive special effects of both light and sound.

ACKNOWLEDGMENTS

Special thanks go to Paul Devereux, who gave me the encouragement and help to get Tse’ Biinaholts’a Yáti published in the British journal *Time and Mind*. Much of the information in this paper comes from that article. Thanks also to Steve Waller for opening my eyes (and ears) to the acoustics of rock art sites. John Stein, Rich Friedman, Taft Blackhorse, and Terry Nichols helped with recording sessions. Dabney Ford and Terry Nichols enabled our research at Chaco Canyon and Aztec Ruins. Rich Friedman and Jack Crouch were essential help in producing the 3D model of the Amphitheater.

REFERENCES CITED

Blackhorse, Taft, John R. Stein, June-el Piper, and J. S. Williams

Devereux, Paul

Elliot, Melinda

Gabriel, Kathryn

Gill, S. D., and I. F. Sullivan

Huckwell, Lisa, and Christine S. VanPool

Krupp, E. C.

Lekson, Stephen H.

Lister, Robert H., and Florence C. Lister

Loose, Richard W.
Lubman, David  

Morris, E.H.  

Scarre, Chris, and Graeme Lawson (editors)  
2006  Archaeoacoustics. McDonald Institute for Archaeological Research, Cambridge.

Stein, John R., Richard Friedman, Taft Blackhorse, and Richard Loose  

Van Dyke, Ruth  

Waller, Steven  


Watson, A., and D. Keating  

Williamson, Ray  
INTRODUCTION

Though archaeologists have long recognized the prehistoric gravel mulched fields that occur in the Ojo Caliente Valley in northern New Mexico, few detailed studies of farming sites have been conducted for that area. In 1999, the Office of Archaeological Studies was given the opportunity to add to our knowledge of prehistoric farming technology in the Ojo Caliente Valley when the New Mexico Department of Transportation decided to improve a section of US 285 south of the town of Ojo Caliente. Nine farming sites were examined by this study (Moore 2009), including LA 105703-LA 105709, LA 105713, and LA 118547. While earlier surveys had defined these sites as separate entities (Levine 1997; Marshall 1995), they actually formed a nearly continuous band of fields stretching for several kilometers atop a gravel terrace on the east side of the valley. The sites contain a variety of farming-related features, and were associated with several of the large proto-Tewa Classic period villages in the region.

Adolph Bandelier was the first to identify and describe farming features in the Ojo Caliente Valley (Bandelier 1892; Lange et al. 1975). Making comparisons to similar features he saw when conducting fieldwork in Sonora and southern Arizona, Bandelier described grids and contour terraces near Hupobi (LA 380) and Pose’uinge (LA 632) in the Ojo Caliente Valley and Sapawe (LA 306) in the nearby El Rito Valley, noting heavy gravel mulching in the latter (Lange et al. 1975: 91). When Hewett (1905, 1906) encountered similar farming sites near Abiquiu a few years later, he mistook many of them for the foundations of ancient structures whose adobe walls had eroded away. Hewett repeated this mistake in the Ojo Caliente Valley in 1910, when an expedition he was leading found extensive fields but again identified them as structural foundations (Mor- ley 1910a, 1910b). Bandelier (1892:51) recognized this problem early on, noting that the linear stone alignments he characterized as gardens were frequently mistaken for foundations. Indeed, Greenlee (1933) discussed the fields near Hupobi that Bandelier (1892) had described, noting their resemblance to “foundation type” ruins, and rejecting the possibility that they were anything other than villages.

The earliest detailed surveys of Classic period fields in the Ojo Caliente Valley were conducted by Bugé (1978, 1979, 1984), who recorded cobble-bordered fields, gravel-mulched grids, and stone-lined channels associated with flood water fields. During excavations at Howiri (LA 71), one of the northernmost of the Classic period villages in the Ojo Caliente Valley, Fallon and Wening (1987) identified gravel mulched grids, check dams, and contour terraces, but did not investigate them. Maxwell (2000) conducted an engineering-oriented study of Classic period field systems around Hupobi on the opposite side of the Río Ojo Caliente from Howiri.

Our study was aimed at defining the extent of fields within project boundaries, and conducting an intensive study of the parts of these sites that fell within the new highway right-of-way. All alignments and other features observed within the right-of-way and an adjacent 25-30 m wide buffer zone were mapped and described in detail. The fields themselves were investigated by a series of 2 m by 2 m excavation units that allowed us to define their internal structure, look for construction details, and recover soil samples for pollen and other analyses. These
procedures allowed the examination of site structure at micro and macro levels, and confirmed some of the conclusions of earlier studies in the region as well as revealing formerly unrecognized aspects of farming in the Ojo Caliente Valley.

THE EFFECTS OF MULCHING

Surface mulches are the best means of controlling runoff and erosion in fields (Mannering and Meyer 1963:84). Mulches intercept raindrops before they impact the soil surface, dissipating their force and preventing detachment of soil particles and sealing of the soil surface (Adams 1966; Epstein et al. 1966; Mannering and Meyer 1963). Gravel mulches are also effective in preventing wind generated soil loss (Chepil et al. 1963; Finkel 1986).

Mulches increase and conserve soil moisture. A gravel cover increases the rate of water infiltration during rainfall and prevents soil surface compaction through raindrop impact (Corey and Kemper 1968; Epstein et al. 1966; Fairbourn and Gardner 1975; Wang 1972). It also conserves the increased supply of moisture by providing a barrier to evaporation (Adams 1966; Fairbourn and Gardner 1975; Wang 1972). Evaporative losses are minimized because large pores in gravel beds prevent the rise of moisture to the surface through capillary action, forcing water to move across the pores as vapor (Fairbourn 1973; Fairbourn and Gardner 1975:377). However, experiments suggest that wind generated evaporation rates are similar to or somewhat greater than those experienced by unmulched plots (Hanks and Woodruff 1958), so the moisture conserving benefits of gravel mulches may be partly offset by windy conditions.

In addition to erosion prevention and moisture conservation, gravel mulches can also affect surface temperatures. Unlike vegetal mulches that reduce the soil temperature profile, gravel mulches increase upper soil temperature (Adams 1965; Fairbourn 1973). This warming seems to be restricted to upper soils because of the effect increased soil moisture has on heat transfer. While moist soils transfer heat more readily than dry soils, they also require more energy input per unit to raise their temperatures (Hausenbuiller 1972). Thus, the increased heat provided by gravel mulching is probably only enough to raise temperatures in the upper 10 to 15 cm of soil.

The higher soil temperatures provided by gravel mulches can be beneficial during the early growing season, and can stimulate the growth of corn seedlings, especially when the temperature is between 10 and 30 degrees C (Van Wijk et al. 1959). Gravel mulches have been shown to hasten corn germination by 2 to 3 days, and tasseling occurs 4 to 7 days earlier when compared to crops grown on bare soil or with vegetal mulches (Fairbourn 1973:927). Mulches stabilize air temperatures at and above the ground surface and, like plant canopies, act as a barrier to radiant heat flow from below, minimizing soil temperature variation (Hausenbuiller 1972). By decreasing moisture loss through capillary action and reducing air movement next to the ground surface, they also curtail evaporative cooling (Wang 1972). This type of protection is important in areas where late killing frosts are a problem (Cordell et al. 1984).

Though the benefits of gravel mulches are many, there are also problems associated with their use. Natural and cultural processes, including wind action, raindrop splash, and surface traffic, can cause soil to mix with the gravel (Fairbourn 1973:928). This decreases porosity and increases compaction, reducing the moisture conserving efficiency of the mulch. Thus, a gravel mulch should be regenerated annually to preserve its benefits (Fairbourn 1973). This is an expensive proposition, especially in an economy lacking mechanization.

Gravel mulches can adversely affect crops on hot sunny days by reflecting heat upward and raising temperatures at the plant stem (Adams 1965). This risk can be offset by applying the gravel mulch in strips, leaving an area around plant bases bare (Fairbourn 1973). It can also be countered by using a vegetative canopy to shade the mulch surface. If economic weeds were allowed to grow alongside domesticates on gravel-mulched plots, the mid- and late-summer canopy could have provided enough shade to minimize this effect (Fairbourn 1974; Wang 1972).
MACRO EXAMINATION: WHEN AND HOW THE FIELDS WERE BUILT

Three topics are important at the macro level of examination: when the fields were built, whether the gravels used for mulching were sorted or unsorted before they were applied to field surfaces, and the timing of field construction.

**Dating the Fields**

Prehistoric fields are difficult to date, since materials amenable to chronometric analysis were rarely used in their construction. The only dateable material that is usually recovered from farming sites tends to be pottery, which was recovered in suitable quantities for this purpose from seven of the nine sites. The types of decorated wares identified in this assemblage mostly consisted of Biscuit A and Biscuit B, with the latter dominating in four assemblages and nearly equal percentages of both types occurring in the other three. Wilson’s (2009) ceramic analysis concludes that the fields were built and used during the late Classic period between ca. A.D. 1450 and 1550. While most of the pottery was recovered from field surfaces, Biscuit B was found in subsurface contexts at four sites, supporting the late Classic period date for those fields.

Examination of field structure was aimed at collecting information that would allow the characterization of field development and dynamics. In order to do this, data concerning gravel sizes, mulch thickness, and construction sequencing were collected. These data permitted comparisons with modern replicative experiments, as well as helping to determine whether fields were built in a single planned episode or grew through time by accretion.

Gravel sizes were examined in order to determine whether materials were sorted before they were used to mulch fields, or were used much as they came out of the numerous borrow pits associated with these sites. In most cases, materials sized from pea gravel to cobbles were seen in excavation units. Cobble sizes thought to be part of an alignment were instead found to be floating in a gravel matrix. Field observations suggested that larger cobbles were sorted out for use in building boundary and internal subdividing alignments. Spoils piles near or within some borrow pits probably represent stockpiles of potential building materials that were separated out during material acquisition. Based on field observations, our initial conclusion was that there was minimal sorting of gravels before they were applied to field surfaces. However, as discussed later, analysis of mulch and control samples suggests that this conclusion was incorrect.

**The Gravel Mulch**

Gravel samples were taken from most features and passed through graduated screens in order to quantify sizes. These data were contrasted with the distribution of sizes in control samples taken from gravel layers exposed in borrow pits. Unfortunately, the largest opening in the screens available for this analysis was 1 in, so materials larger than that were not separated out. Just over 53 percent of the gravel used to mulch the fields was larger than .25 in in diameter. This contrasts with samples taken from strata in borrow pits, where only 37.6 percent of the gravels were larger than .25 in in diameter. Materials that were smaller than .125 in in diameter made up 40.5 percent of the gravel mulch samples, and 53.7 percent of the gravel strata samples.

Since most materials in the gravel mulch samples that were less than .125 in in diameter were sands that had infiltrated the mulch, percentages of larger gravel sizes have probably been diluted. Thus, particles smaller than .125 in in diameter were dropped from consideration, and the mulch samples were again compared with those from the borrow pits, providing an even greater contrast. Gravels larger than 1 in in diameter made up 51.8 percent of the mulch samples, but only 25.0 percent of the borrow pit samples. Gravels between .5 and 1 in in diameter were almost even at 24.2 percent and 21.4 percent, respectively. Materials sized between .25 and .5 in in diameter were nearly twice as common in borrow pit samples (23.6 percent versus 12.2 percent in mulch sam-
pies), and smaller materials between .125 and .25 in in diameter were much more common in borrow pit samples (30.0 percent versus 6.7 percent in mulch samples). These distributions suggest that Pueblo farmers selected for larger gravels for use in mulching fields at the expense of materials smaller than .5 in in diameter.

Because larger gravels were selected for mulch, the mulch itself needed to be thicker than 2.54 cm, as suggested by the results of gravel mulching experiments conducted by Corey and Kemper (1968:14). Overall, the thickness of gravel mulch layers in the investigated fields varied between about 1 cm and 20 cm. Because of this variance, and since erosion has undoubtedly rearranged the mulch after the fields were abandoned, mean mulch thicknesses are probably more accurate estimations of original thicknesses. Mean mulch thicknesses are available for five sites, and averaged 8.4 cm, ranging from a low of 7.3 cm to a high of 9.0 cm. This is a tight range, though the variance in measurements from individual excavation units is larger. If the upper and lower 11 percent of the means for excavation units are dropped to account for some of the more extreme variation that may be due to erosion, we are left with an overall range of 6.2 to 10.6 cm, and our mean thickness remains at 8.4 cm. The average layer of mulch at our sites is 3.3 times thicker than is recommended by Corey and Kemper (1968:14). Since over half of the gravel used to mulch these fields exceeded the size used in Corey and Kemper’s (1968) experiments, the larger mulch thicknesses were probably necessitated by the size of the materials selected for use.

Evidence for Sequenced Construction

Evidence for the sequenced construction of field systems was collected through surface examination and excavation, demonstrating that they were built over time rather than in single or just a few construction episodes. One site—LA 105704—yielded no evidence for staged construction. While there is no reason to suspect that the various parts of this field system were not built at different times, we cannot demonstrate sequenced building for this site.

Five types of evidence for continuing field construction were available. The most obvious was the presence of overlapping fields—a later field that partly covered and was mounded above the surface of an earlier field, representing two different construction episodes. Other evidence included stockpiled materials, fields that were abandoned before construction was finished, and borrow pits that were used on multiple occasions or were located toward the terrace interior away from the edge where gravel layers are visible. In some instances, excavation revealed the presence of multiple layers of mulch, which suggests that some features were modified by the application of a different type of mulching material over the original mulch layer.

Overlapping fields were common, and were found at six of the sites in our sample. They were especially prevalent at LA 105708 and LA 118547, where two distinct bands of features were defined. The original band of fields at both sites follows the terrace edge and is associated with a series of borrow pits located at the edge of the terrace where gravel layers are exposed. A second band of fields was built behind the first band and toward the interior of the terrace at both sites, and contains a series of features that often overlap and are mounded above plots in the terrace edge band. Adjacent to the second band of fields was a series of borrow pits located away from the terrace edge, and situated on the interior of the terrace where gravel layers might be expected but are not exposed. The second band of fields was better preserved at both sites, and the associated alignments were more distinct than was the case for the terrace edge band. Along with the overlapping of these fields above some of those in the terrace edge bands, the difference in preservation suggests that the terrace interior bands were built later than the terrace edge bands, and that some of the materials used to build the later plots were salvaged from the earlier fields.

The configuration of terrace edge borrow pits at several sites suggested that they were used on multiple occasions to obtain materials for building new plots or amending existing plots. Rather than having a round or oval shape
as is most common, these borrow pits often have multiple lobes, and each lobe is thought to represent a separate episode of mining to obtain cobbles for plot borders and gravels for mulching. The lobes probably formed when farmers needed materials to expand an adjacent field system and, rather than opening a completely new borrow pit, they simply expanded an existing borrow pit by digging into its edge where the layer of gravel that caps the terrace was already exposed. This type of feature was identified at several sites including LA 105703, LA 105707, LA 105708, and LA 118547.

The presence of stockpiled building materials suggests that mulched farming plots were still being built up to the time of site abandonment. Most of the stockpiles were small collections of cobbles that did not appear to represent shrines or other types of cultural features. Two small concentrations of cobbles at LA 105703 appeared to be stockpiles. A similar feature was noted at LA 105705, and also seems to represent a stockpile. Separate piles of gravel and cobbles were found in one section of LA 105707, and suggest preparation for a planned expansion of the gravel-mulched fields at that site that was never completed. Excavation showed that a collection of cobbles was stockpiled on top of a gravel-mulched field at LA 105708, probably after that field was abandoned, and appear to have been stored for a planned addition adjacent to the earlier feature that was never built.

Other types of evidence also suggest that farming plots were still being built at the time these fields were abandoned. At LA 105707, a cobble-bordered but unmulched section of one field represented an unfinished extension. Similarly, a feature at LA 105709 was cobble-bordered but unmulched, and was associated with the two cobble stockpiles mentioned earlier. This field also appears to have been under construction at the time the site was abandoned. Remulching may also have occurred on occasion, though few examples of this were found, and all were at LA 105703. In each instance, layers of gravel mulch overlay layers of cobble mulch, and may represent a change in the types of crops grown in those fields.

As this discussion shows, there was good evidence for sequenced field construction at eight of the nine farming sites. The most convincing evidence came from LA 105708 and LA 118547. As discussed above, each of these sites contains two bands of features—an early band running along the terrace edge and a later band situated toward the interior of the terrace but adjacent to the back edges of the earlier fields. We were able to determine which band was earlier and which was later because plots in the interior band often overlap those of the terrace edge band, and are distinctly mounded above their surfaces. The presence of unfinished fields at several sites also indicates sequenced construction, with some fields planned but uncompleted when those sites were abandoned. Stockpiles of building materials adjacent to fields on other sites may be more evidence of this process. The presence of both terrace-edge and terrace-interior borrow pits at some sites is not by itself direct evidence for sequenced field construction, but the similarity of this configuration to that of LA 105708 and LA 118547 suggests that the same process was at work.

More circumstantial evidence comes from the size and shapes of many of the features examined by this study, especially at LA 105707 and LA 118547. These fields are very large and irregularly shaped, with numerous interior subdivisions. They seem to have been built in multiple construction episodes, with plots growing together through time. Some evidence of this process was seen at LA 118547, where one plot in the terrace edge band overlaps another plot in that band. This configuration suggests that each band of fields at this site was built over time rather than in one or just a few construction episodes. Most of these large gravel-mulched field complexes probably began as several smaller plots located near one another, which grew outward and together through accretion from those cores.

The continual nature of field construction and evidence for the abandonment of earlier fields and their replacement by new plots suggests an important aspect of field maintenance. Fairbourn's (1973) experiments suggest that a gravel mulch should be regenerated annually to
preserve its benefits. This is because soil can infiltrate the mulch, clogging pores and decreasing its ability to limit evaporative moisture loss. While there are indications that Pueblo farmers added new layers of mulch to some features, there is no evidence that mulches in general were augmented or cleaned annually. Rather than expend the labor required to regenerate mulches in existing fields, Pueblo farmers instead built new adjacent plots as the productivity of the old ones declined, expanding the system rather than renewing existing fields. This process is especially apparent where newer fields overlap older ones and the latter were used as a source for some of the materials used to build the former. When gravel-mulched plots were no longer in active use, there was no impediment to mining them for building materials and partly covering their surfaces with the newer plots.

**MICRO LEVEL: FIELD STRUCTURE AND THE TYPES OF CROPS GROWN**

At the micro level of examination, we can look at how plots were subdivided and the types of crops that were grown in them. While some information on field subdivision was available from surface examination, the most detailed data came from excavation units. Information on the types of crops that were grown in these fields was provided by the analysis of pollen samples collected during excavation.

*Field Configuration*

Defining the configuration of gravel-mulched fields can be difficult, because the surfaces of these features are often partly obscured by eolian sediments and elements in alignments were frequently dislocated by surface traffic. Nonetheless, some internal configurations can be characterized, based on both surface observations and excavation, and other patterns will likely be defined by future studies. At the grossest level, gravel-mulched fields consist of rectilinear areas enclosed by cobble alignments to which a layer of gravel mulch has been added. Field shapes are sometimes irregular, owing to local topographic features, especially near terrace edges or adjacent to gullies.

The internal configurations of fields are usually quite varied, even within large features that otherwise appear to be single continuous units. The reasons for subdividing plot interiors are not known, and could have been related to a number of factors including land tenure systems, separating different types of crops, or delineating individual crop rows. Another possibility is that many alignments in feature interiors originally formed the outer edges of individual plots, and were simply left in place when fields were expanded by the construction of adjacent plots.

Five patterns of internal subdivisions were defined by this study. The most common pattern consisted of large plots subdivided into smaller, usually rectangular, cobble-bordered plots. These smaller plots were usually variably sized, and could range from just a few meters to a side to much more extensive features. This pattern was seen at every site in our sample. Many of the smaller plots that were included in large continuous features were undoubtedly formed by the process mentioned above—expansion of a field system through construction of adjacent gravel-mulched plots, with former boundary alignments being retained as internal subdividing alignments.

Parts of some fields were divided into checkerboards of small cells, usually measuring 50-80 cm on a side (Figure 1). This configuration was seen at four sites, and is similar in form to historic Zuni waffle gardens, though the gravel-mulched features probably had a somewhat different function. The most elaborate expression of this pattern was at LA 105703, where fairly extensive sections of that site were intricately gridded into small cells. Excavation showed that most cobbles in alignments bordering these small cells were set upright, while the dominant pattern in other features at the site was to set cobbles in alignments on their broadest surfaces. No obvious reason for this difference could be determined.

Cobble alignments were used to form long, narrow rows at eight of the nine sites in our sample, and may have been used to define the locations of individual rows of
Figure 1. An example of an intricate checkerboard of small cells in a mulched field.

Figure 2. Excavated section of long, narrow cobble-bordered rows.

crops (Figure 2). This pattern usually occurred as part of a larger field, and may have been more extensive than was obvious to surface observation. Excavation confirmed the narrowness of these rows in several instances, but was not extensive enough to define the full size of these long, narrow, linear cells.

Cobbles and small boulders were set into gravel mulch in a random, unpatterned fashion at two sites (Figure 3), but no rationale for this type of field was obvious during excavation and analysis. Other fields at the same sites contained areas of evenly spaced but noncontiguous cobbles and small boulders, also set into the gravel mulch (Figure 4). In both cases, the cobbles and small boulders were
placed on the terrace surface before the gravel mulch was applied, demonstrating that they were part of the original configuration of these fields rather than elements that were added later. In most cases, the noncontiguous alignments of large rocks form small cells, usually less than a meter on a side, and may have been used to demarcate individual planting areas.

Types of Crops Grown

Forty-five pollen samples were collected from excavation units at LA 105703, LA 105704, LA 105708, LA 105709, and LA 118547. Evidence for two definite domesticated plants was found: corn pollen was identified in all 45 samples, and cotton pollen occurred in 24. Since both of these pollens are large-grained and are not transported far from flowers by wind, it is certain that these crops were grown in the fields. Corn cultivation was ubiquitous, with this crop being grown at one time or another in every field that was sampled. The distribution of cotton pollen is not quite as ubiquitous, but it occurred at each of the sites that were sampled, and the high percentage of samples containing cotton pollen suggests that it was commonly grown in gravel-mulched fields.

Evidence for other types of domesticated plants is less convincing. Cucurbita pollen was found in four samples, and may suggest the cultivation of squash or related plants in some plots. Unfortunately, this conclusion is tentative because pollen from domesticated cucurbits cannot be differentiated from that of wild cucurbits. Still, the occurrence of this type of pollen in four samples is suspicious, and may be an indication that cucurbits were sometimes grown in gravel-mulched fields. While pollen from other plants with some economic uses like prickly pear, cholla, and evening primrose occurred in multiple samples, they are considered evidence of the natural plant community, though the possibil-
ity exists that they were encouraged to grow in some fields. Indeed, this might be evidence for the encouragement of wild plants in fields that were of economic value, and that could also shade areas between crop rows to reduce the effect of heat reflected back by the gravel mulch on crops.

**LAND TENURE AND FIELD TENDING**

Occupational zones were identified at four sites (LA 105705, LA 105707, LA 105708, and LA 105709), but all such areas were outside project limits and could only be subjected to surface examination. Still, limited inspection of these areas provided information on field tending and, possibly, prehistoric land tenure. Though we identified no definite field structures, temporary shelters similar to those used historically at Hopi (Mindeleff 1891:218) were almost certainly built in the occupational zones. The occupational zone at LA 105707 contains a heavy concentration of cobbles, small boulders, fire-altered rock, and chipped stone artifacts that probably represent the locations of one or more temporary field shelters. In close association are at least three deflated hearths and an extensive artifact scatter. The occupational zone at LA 105705 contains a comparatively heavy concentration of chipped stone artifacts, but lacks surface evidence of thermal features or temporary structures. LA 105708 is bisected by an occupational zone that contains numerous chipped stone artifacts, four to six thermal features, and a few sherds. Though no definite evidence of structures was seen, temporary shelters probably existed in this area. The occupational zone at LA 105709 contains a fairly heavy scatter of chipped stone artifacts and some pottery, but no associated thermal features or structural remains were defined.

Occupational zones were probably commonly associated with gravel-mulched field systems, but have remained undefined in most cases because their surface expression is similar to that of unrelated earlier, aceramic sites. For the most part, assemblages in the occupational zones are dominated by chipped stone artifacts, fire-cracked rock is sometimes common, and pottery tends to be rare. In many cases, this pattern could lead archaeologists to define occupational zones as unrelated earlier components (for example, see Moore 1992). However, since the occupational zones identified by this study follow field edges, and in one case an occupational zone bisects an otherwise continuous field system, their association with the fields appears certain.

Analysis of artifact assemblages showed that a wider range of activities was performed at the four sites with occupational zones than was the case for the sites that lacked this type of feature, and most of the tasks defined through analysis are indicative of a residential function. The occurrence of fragments of ground stone tools in the occupational zones at LA 105707 and LA 105708 suggests that vegetal foods were processed for consumption at those locations. Cherts and obsidians were generally more common on the sites with occupational zones than they were on those that lacked occupational zones, as were formal tools. While chipped stone analysis indicated that all of these sites were also used as quarries, a limited amount of tool manufacture (or modification) may have occurred at the sites with occupational zones, and there is more of a domestic character to their assemblages than there was to those of the sites that lack occupational zones.

The lack of evidence for substantial shelters suggests that the occupational zones were only used during the warm season. Year-round occupation was undoubtedly in the large Classic period villages that occur nearby, including Ponsipa’akeri (LA 297), Nute/Hilltop Pueblo (LA 298), and Pose’uinge. Even though these villages were fairly close to the field complexes, Pueblo farmers obviously felt a need to maintain a presence near their fields during at least part of the growing season, probably to protect their fields from herbivores like deer and rabbits, which would have been attracted to the growing crops. Projectile points are fairly common at the sites with occupational zones and also occur at some of those that lack occupational zones. This distribution suggests that field hunting was probably a common activity, and would have served the dual purpose of protecting crops and providing fresh meat for the diet.
Some of the sites that lack occupational zones are comparatively small and are located near sites that have occupational zones. Since the boundaries between sites are artificial and were assigned for the ease of archaeological recording, they do not replicate prehistoric land tenure patterns. Thus, there is really no separation between LA 118547 and LA 105709 to its north, and LA 118548 to its south. The latter was outside our study area, but is another large complex of gravel-mulched fields (Levine 1997). The fields at LA 118547 and LA 105709, at least, may have been tended from the occupational area on the latter site, and could represent part of the land holdings of a single corporate group. LA 105705, LA 105706, LA 105707, and LA 105708 represent a long string of fields that is broken only occasionally by natural topographic features. However, at least three occupational zones are represented in this group of sites, suggesting that they may have belonged to at least three corporate groups. Though the data needed for a more detailed analysis of land tenure systems was not available at our level of study, this preliminary examination of patterning between field locations and occupational zones suggests that a larger scaled landscape-oriented study of the relationship between various types of farming features and villages could provide the data needed for such a study.

CONCLUSIONS

This study provided important information on Classic period farming in the Ojo Caliente Valley, in some cases confirming the results of earlier studies and in others providing new details concerning the construction and use of these features. Gravel-mulched field systems grew over time through accretion, probably from much smaller cores. The reason for this growth appears to have been twofold—providing more fields for growing crops, and replacing gravel-mulched fields whose productivity was declining because sediments had clogged the mulch rather than regenerating the existing fields. Thus, not all gravel-mulched fields were in use at the same time, and no individual feature could have been farmed throughout the A.D. 1450-1550 period in which these fields were built and used. Individual plots were quite variable in size and shape, though some repetitive patterns were observed and described. However, not enough information has yet been collected to allow us to determine whether the variability in the field shapes and subdivisions represent differences in the types of crops being grown or simply reflect the individuality of the farmers who built them.

Corn was the main crop grown in these gravel-mulched fields, but cotton was also commonly cultivated. While cucurbits may also have been grown in some fields, this possibility is very tentative. Certain wild plants with some economic value were probably encouraged to grow alongside the domesticates, both because they were economically useful and because their foliage would provide shade between crop rows later in the growing season, helping to prevent damage to the crops from reflected heat.

Farmers occupied temporary structures built in zones adjacent to some fields during at least part of the growing season, presumably both to tend their crops and to protect them from herbivores who were attracted to the crops. The distribution of these occupational zones could be a clue to land tenure systems, and may reflect areas owned by individual corporate groups, probably affiliated with different villages.

As the study of farming features in the Northern Rio Grande region continues, archaeologists are better able to understand this very critical aspect of the subsistence system. Historic farming has, unfortunately, masked or eradicated evidence for prehistoric farming methods and land tenure in the river-watered valley bottoms that probably supported the bulk of the domesticated crops grown by Pueblo farmers during the Classic period. Gravel-mulched fields represent an extension of the farming system, one that was probably very important to the economy, but that was not the focus of the farming system. By studying these types of features that still exist in more marginal areas for farming, we can examine aspects of prehistoric farming and land tenure systems that are no longer obvious in the valley bottoms.
REFERENCES CITED

Adams, John E.

Bandelier, Adolph F.
1892 Final Report of Investigations Among the Indians of the Southwestern United States, Carried on Mainly in the Years from 1880 to 1885, Part II. *Papers of the Archaeological Institute of America* 4, Cambridge.

Bugé, David E.


Cordell, Linda S., Amy C. Earls, and Martha K. Binford

Corey, A. T., and W. D. Kemper

Epstein, E., W. J. Grant, and R. A. Struchtemeyer

Fairbourn, Merle L.

Fairbourn, Merle L., and H. R. Gardner

Fallon, Denise, and Karen Wening
1987 *Howiri: Excavation at a Northern Rio Grande Biscuit Ware Site*. Laboratory of Anthropology Notes No. 261b, Museum of New Mexico, Santa Fe.

Finkel, Herman J.

Greenlee, Robert
1933 *Archaeological Sites in the Chama Valley and Report on Excavations at Tsama, 1929-1933*. Manuscript on file, Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Hanks, R. J., and N. P. Woodruff

Hausenbuiller, R. L.

Hewett, Edgar L.
1905 Unpublished Field Notes of Edgar Lee Hewett; New Mexico, 1905; Santa Fe, Otowi, Chama Valley, Expedition for Smithsonian Institution. Manuscript on file, Fray Angelico Chavez History Library, Hewett Collection Box 46. Santa Fe.

Lange, Charles H., C. Riley, and E. Lange (editors)
Levine, Daisy F.

Mannering, J. V., and L. D. Meyer

Marshall, Michael P.

Maxwell, Timothy D.

Mindeleff, Victor

Moore, James L.
1992 Archaeological Testing at Three Sites West of Abiquiu, Rio Arriba County, New Mexico. Archaeology Notes No. 33, Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Moore, James L. (editor)
2009 Living on the Northern Rio Grande Frontier: Eleven Classic Period Pueblo Sites and an Early Twentieth-Century Spanish Site Near Gavilan, New Mexico. Archaeology Notes No. 315, Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Morley, Sylvanus G.


Wang, J. Y.

Wilson, C. Dean
A giant fiberglass donut in Inglewood, California, Wall Drug near Wall, South Dakota, the "Thing" outside Dragoon, Arizona—these are all roadside attractions. Many attractions in the American West include seemingly random assortments of historic and prehistoric artifacts from their local area, sometimes including human remains. Most people view such attractions as fun, quirky, and a nostalgic part of Americana (Legends of America 2003). Others have seen the collections that constitute such attractions as agents that reify a shared cultural history of a colonial past (Prentice 1998). Regardless of their sociocultural significance, since the development of the interstate highway system, many of the smaller roadside attractions have closed. The Million Dollar Museum in White’s City was one such an attraction, entertaining visitors to southern New Mexico on their way to the Carlsbad Caverns for roughly 80 years. However, in 2008 the Million Dollar Museum closed, and the entire town was sold at auction. This paper will discuss the disposition of the skeletal and mummified human remains that were in the Million Dollar Museum’s collection, focusing on the subsequent involvement of the Maxwell Museum of Anthropology. The story of these remains may represent a harbinger of future events, describing the problems that museums face as more and more roadside attractions close.

While the name “Million Dollar Museum” implies this attraction was a museum, it only qualified as such in the loosest sense of the word. There are substantial differences between roadside attractions and museums. The example of the Million Dollar Museum described here illustrates the problems relating to the disposition of collections of roadside attractions. This establishment was by no means unique, and the issues discussed are likely to be seen repeatedly in the future with the closure of similar institutions.

WHAT IS A ROADSIDE ATTRACTION?

There is no generally accepted definition that constitutes an “attraction.” Roadside America, a website dedicated to attractions, includes everything from unusual statues by the side of the road, to private residences of unusual architecture, to large collections of various items, to both for-profit and non-profit museums, to national parks (Roadside America 1996). The American Automobile Association (AAA) tour book of New Mexico lists 189 attractions (AAA New Mexico 2009) including as wide a range of attractions as Roadside America. For comparison, Alaska has 128 attractions, Nebraska has 133, and the San Francisco area has 95 (there were too many in California for the site to list them all). However, not all of what is listed by AAA as attractions qualify as such as the term is used in this chapter.

In New Mexico, for example, five of the attractions listed are classified as amusements, nine are classified as education and research, 33 as historic sites, and 91 as museums and collections. Additional categories used by AAA to organize attractions include animal attractions; art, music and theater; burial grounds and monuments; local landmarks; military sites and exhibits; parks and natural wonders; religious sites; shopping; sports and recreation; tours and sightseeing; and transportation and industry. As the categories are used by AAA, both the Million Dollar Museum and the Maxwell Museum of Anthropology qualify as museums and collections (AAA New Mexico 2009).
However, in this paper, the word “attraction” will be limited to those institutions whose primary focus is to amuse and amaze rather than to educate its visitors. From the descriptions provided on the AAA website, it is unclear how many of the 91 museums and collections listed would qualify for the definition of a museum as described below.

To some, roadside attractions represent a vital component of American culture, appealing to our desire to see amazing and fantastic objects. “Ripley’s Believe it or Not” museums exemplify collection-centered attractions. These “odditoriums” or “amusement museum-type attractions” feature everything from a 24-karat gold plated, diamond studded Macintosh computer to shrunken heads, gumball portraits, and soccer playing elephants. There are 34 odditoriums worldwide, 27 of which are located in the United States. In addition to odditoriums, Ripley’s locations include two aquariums, six Guinness World Records museums, and four wax museums. Of these additional locations, all but two of the Guinness World Record museums and one wax museum are located within the United States (Ripley’s Believe It or Not 2007). Such institutions clearly demonstrate that many Americans are drawn to see the amazing and unusual. Some may see this appeal as objectionable, but many would argue that it is harmless. However, from both legal and ethical perspectives the collection practices of attractions are often less than benign.

WHAT IS A MUSEUM?

In contrast to attractions, a museum places emphasis on the education, rather than the pure amusement and amazement, of their visitors. The American Association of Museums (AAM) states that museums make a “unique contribution to the public by collecting, preserving, and interpreting the things of this world.” To be an AAM accredited museum, an institution must, among other qualifications, be essentially educational in nature, be a legally organized non-profit institution, and have a formal program of documentation, care, and use of collections (AAM 1999). The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 defines museums in a stricter sense specific to the purview of the law, as “an instruction that receives federal funds and whose collections include Native American cultural items” (NAGPRA 1990: 104 P.L.101-601 Stat. 3049 s 2[8]).

A third way to describe a museum is as an institution with four primary foci regarding their collections (Kreps 1998). The first focus is the accumulation of artifacts, without which the other aims of a museum cannot occur. The protection and preservation of objects, along with their use for research and education are two other important foci of a museum (Rohde and Roghaar 2004). The final focus of a museum is the exhibition of objects, especially in the service of education (Kreps 1998).

COMPARING ATTRACTIONS AND MUSEUMS

Working from Kreps’ (1998) description, the first component of a museum is the accumulation of objects. Both museums and attractions value objects. However, museums place equal or greater value on the context related to the object (Stone 1984). For objects of an anthropological nature, including human remains, this additional information is drawn from laboratory documentation, documentation from excavation, and other sources (Miller 1999). Museums also consider the source of their collections, often only purchasing items or accepting donations that are accompanied by all appropriate legal and contextual documentation. There is little evidence that many attractions are interested in the source of the items they display.

Second, museums dedicate substantial resources to the proper curation of collections (Rohde and Roghaar, 2004). Many museums have staff members whose primary responsibility is to ensure that the collections are safely maintained. In contrast, attractions seldom spend a significant percentage of their resources on curation, especially for any items not on display. In addition to preservation, the act of curation also includes collection management (Miller 1999), which associates objects and their contexts in perpetuity. This aspect of curation is generally ignored for the collections of attractions.
Third, museums use their collections for research and education. On the other hand, attractions focus on the novelty and aesthetic value of items with little if any interest in a larger sociocultural or scientific picture. Ripley’s Odditoriums exemplify attractions rather than museums in this regard.

The final component of a museum’s focus, the exhibition of collections, is related to the educational mission of the institution. Many museums choose to exhibit portions of their collections in order to educate the public on a specific topic (Maybury-Lewis 1997). These museums often choose the most intact and characteristic examples from their collections for exhibition. Of course, attractions also display collections. The difference is that, whereas museums, exhibit objects primarily for educational purposes, attractions display objects solely for their intrinsic and entertainment value.

**CASE STUDY: THE MILLION DOLLAR MUSEUM**

**History of the Collections**

The story of the “Million Dollar Museum” began when Charlie White settled in New Mexico in 1909 (Higgenbotham Auctioneer 2008). Like many others who moved to New Mexico around this time (DeMark 1982), he moved to the desert in the hope that the dry air would help him recover from tuberculosis. In 1927 White purchased 320 acres of land near the entrance to the Carlsbad Caverns (Roadside America 1996). There he founded White’s City, New Mexico. He built a hotel, gas station and garage, restaurant, grocery store, and a drug store. White also included an attraction, White’s City Museum, in his new town.

Over the years White’s City Museum would come to be known as the “Million Dollar Museum” though the origin of the name is obscure. In its heyday it boasted a wide variety of artifacts, including an electric chair, a carved miniature tableau of a western scene, European dollhouses, antique typewriters, beds, and a seventeenth century bathtub. There were also taxidermied animal remains including game heads, a room of cattle long horns, a double-headed turtle, and a double-headed snake. The collection also included human mummies and archaeological artifacts on display. One of the human mummies was a fetus, roughly eight months in utero. At some point while this fetus was on display, it acquired the label “alien baby” (Roadside America 1996).

In 2007 the Cherokee Nation’s cultural properties officer alerted the Federal Bureau of Investigation (FBI) to the presence of human remains on display at the Million Dollar Museum. According to NAGPRA, it is “illegal to sell, purchase, use for profit, or transport for sale or profit, the human remains of a Native American without the right of possession to those remains” (NAGPRA 1990: 104 P.L.101-601 Stat. 3052 s 4). By having the mummies on display, and using these remains to entice paying visitors, the Million Dollar Museum had been in violation of federal law for 17 years. Though they chose not to proceed with prosecution, the FBI confiscated all of the human remains and the prehistoric Native American artifacts on display with them in response to this legal breach. In this assemblage there were nine individuals. The FBI officer, Fernando Benavides III, working with Dr. Glenna Dean, then New Mexico State Archaeologist, brought the remains to the Laboratory of Human Osteology, Maxwell Museum of Anthropology, University of New Mexico, for curation and documentation.

The year after the confiscation of the displayed human remains, the Million Dollar Museum closed its doors. That same year, in 2008, the entire town was sold at auction, including some Native American artifacts that were still in the collections. The sale of the town took place over a three-day period from Monday, July 14th to Wednesday, July 16th (Higgenbotham Auctioneers 2008). One of the buildings auctioned was an old storage shed that had been used by the museum for many years. Unknown to the new owners, the storage shed held two old trunks containing human skeletal remains. If an inventory of the museum’s collections had been maintained over the years, the presence of these remains could have been known prior to the auction. Instead, according to
the Office of the Medical Investigator (OMI) agent Rick Wiedenmann, thieves broke into the shed in 2009 and discovered the remains. Fortunately, the would-be thieves contacted the new owners of the shed and reported their discovery. After being contacted by the owners, OMI collected the human remains. Once the remains in the trunks were determined not to be of medico-legal significance, this second assemblage of human remains from the Million Dollar Museum arrived at the Human Osteology Laboratory two years after the first assemblage of remains had been delivered by the FBI.

Disposition

As the Maxwell Museum fits the definition of “museum” according to both the AAM and NAGPRA, it is responsible for attempting to determine the cultural affiliation of human remains in its possession. Working without promise of funding, the Human Osteology Laboratory of the Maxwell began to coordinate with other university departments, including Biology and Earth and Planetary Sciences, to estimate an age and possible cultural affiliation(s) for the remains received in 2007. In 2008, two anthropology graduate students applied for and received research funding from the university’s graduate research development program that would cover some, but not all, of the testing required to attempt a determination of the cultural affiliation for the nine individuals. In 2009, during transfer from the OMI, it was realized that the two recently recovered trunks of remains had come from the same facility in White’s City as had the remains received from the FBI two years earlier.

In addition to NAGPRA’s requirement that the museum attempt cultural affiliation, New Mexico State Law requires the museum to determine the number of individuals, their sexes and ages, and make any determinations about the individuals’ health history (New Mexico Cultural Properties Act 1969: 18.6.1-23 NMSA; 4.10.11 NMAC). In order for the Maxwell Museum to document

<table>
<thead>
<tr>
<th>Individual</th>
<th>Age</th>
<th>Sex</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>fetus (8 months in utero)</td>
<td>male</td>
<td>This is the so-called “Alien Baby.” He is in a supine position. The left distal leg has broken off, with the tibia, fibula and the bones of the left foot separate from the femur. Some hair is visible on the skull. The fetus also feels much heavier than expected from its small size.</td>
</tr>
<tr>
<td>2</td>
<td>adult</td>
<td>probably male</td>
<td>Skeleton approximately 30 percent complete.</td>
</tr>
<tr>
<td>3</td>
<td>infant (10 months)</td>
<td>male</td>
<td>This infant was labeled as the “Cliff Dwelling Baby.” He is mostly intact and in a supine position. The distal half of the right arm is missing.</td>
</tr>
<tr>
<td>4</td>
<td>adult</td>
<td>possible male</td>
<td>The entire skeleton of this mummy is present. However, there is only minimal tissue present, with no intestinal organs retaining. There is some wire wrapped around the upper cervical vertebra, and the body is in a flexed position. This is the mummy for which there was a purchase receipt from Western Chihuahua, Mexico.</td>
</tr>
<tr>
<td>5</td>
<td>adult</td>
<td></td>
<td>Only the head of this individual is present. The tissue on the head is mostly complete. Hair is still present over the entire crown. The mouth is open, with severe wear evident all of the teeth. There is also some post mortem loss of maxillary and mandibular teeth.</td>
</tr>
<tr>
<td>6</td>
<td>adult</td>
<td>female</td>
<td>This is the most complete adult mummy. The individual is in a flexed position. The head is detached, and had been propped on a stick with the rest of the stick positioned into the neck.</td>
</tr>
<tr>
<td>7</td>
<td>adult</td>
<td></td>
<td>The majority of the skull is covered by tissue. The right half of the maxilla and mandible lacks its tissue. There are patches of short brown hair on the crown.</td>
</tr>
<tr>
<td>8</td>
<td>adult</td>
<td>possibly male</td>
<td>This mummified head is most skeletalized with some tissue remaining, especially on the cranial vault. The right ear is still partly visible. The teeth are well worn and there is some post mortem loss of teeth.</td>
</tr>
<tr>
<td>9</td>
<td>adult</td>
<td></td>
<td>Only the head is present from this individual. The anterior portion of the skull retains the most tissue covering. The tissue is flaky and peeling off in places. The left maxilla was fractured post mortem. The teeth appear worn, but are partly covered by remains of the lips. The mandible had been taped onto the cranium during exhibition.</td>
</tr>
</tbody>
</table>
these remains, three main questions are addressed: how many individuals are represented in these collections and what can be learned about them; how old are the remains; and from where had these individuals originated? In the case of the White’s City collections, while the remains are not of medico-legally importance the actual age of the remains is unknown at this time. Through NAGPRA’s future applicability regulation (NAGPRA 2007: 43 CFR Part 10 s 10.13) the Maxwell Museum is required to report to the relevant tribes the existence of these remains in order to enter into consultation, with the ultimate goal of repatriation. However, until the original locations of burials and ages of the remains are known with some degree of precision, it is impossible to know to which tribes these remains might be relevant.

How Many, When, and Where?

In the first assemblage brought by the FBI, there were eight full or partial mummified human remains, as well as one skeleton. Of these nine individuals, seven were adults, one was an infant and the ninth was a fetus. Table 1 provides a brief description of each individual. The second assemblage of remains, brought to the Human Osteology Laboratory in 2009 by OMI, consisted of the materials stored in the two trunks, which were in very poor condition (Figure 1). There were 205 bones in the larger trunk, and 36 in the smaller. Because each trunk contained incomplete remains of several individuals, both the minimum number of individuals (MNI) and the most likely number of individuals (MLNI) (Adams and Konigsberg 2004) were calculated. The larger of the two trunks contained elements from an MNI and MLNI of 12 individuals: six adults, two juveniles between 15 and 20 years old, two juveniles between 10 and 15 years old, one juvenile between two and four years old, and one infant younger than 18 months. The smaller trunk contained elements from two (MNI) or three (MLNI) adult individuals, two juveniles between two and four years old and one infant less than 18 months old. It was determined that a cranial fragment from the large trunk matched one of the two juvenile frontal bones found in the smaller trunk. Additionally, one adult thoracic vertebra from the large trunk articulated with one of the thoracic vertebrae from the small trunk. Due to these matching elements, it was clear that the two trunks shared remains from at least two different individuals, so that the total MNI and MLNI is 13. A brief summary of the skeletal inventory from the two trunks is included in Tables 2 and 3.

Dental wear on those teeth preserved indicated the likelihood of a prehistoric or early historic diet. Due to the lack of known context, the only way to estimate the ages of these materials will be $^{14}$C dating. The Western Heritage Museum Complex at New Mexico Junior College has indicated that funds for dating the mummified remains may be available in the future. Currently, there are no funds foreseeable for dating the skeletal remains that came to the Lab in 2009.

There are two approaches that can be attempted to determine the original location of interment of all of the remains. First, analyses of isotopic samples can be used to look at oxygen, nitrogen, and strontium signatures. These

![Figure 1. Two trunks.](image-url)
analyses should provide context about whether the individuals drank riverine or spring water during their lifetimes (Luz et al. 1984), as well as provide information about their diet (Schoeninger et al. 1983). Samples of teeth, bone, and hair will provide data about the water and food these individuals ingested as they developed, where they were over the course of the last few years of their lives, and where they were proximate to their deaths. Second, biological samples have been taken from the mummified remains, focusing primarily on gut tissues. These samples may provide information about both beneficial and parasitic gut flora, as well as the individuals’ diets. Each of these analyses is expensive, and despite their necessity, few if any funds are readily available to pay for them. Through the funding obtained by UNM anthropology graduate students in 2008, isotopic and biological analyses are currently in process for the mummified remains that were received in 2007, but not for the remains received in 2009. It should be noted that each of these analyses destroys a small sample of these human remains. The goals of these analyses are to learn about these specific individuals, as well as about the history of the Southwest more generally, and to match the remains to a geographical region that may suggest a tribal affiliation. Without knowledge of the approximate age and geographic region of origin for the remains, the appropriate tribes or groups cannot be contacted. For the moment, it is not even known what laws may apply to these remains, as there is currently no definitive proof that these mummies and bones are from Native Americans.
Table 3.
Inventory of Skeletal Remains in the Small Trunk.

<table>
<thead>
<tr>
<th>Bone</th>
<th>Side</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skull</td>
<td>Unsided</td>
<td>Right</td>
</tr>
<tr>
<td>frontal</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>mandible</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Torso</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ribs</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>cervical vertebra</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>thoracic vertebra</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>lumbar vertebra</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ulna</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>radius</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>radius</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>capitate</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>trapezoid</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>triquetral</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>metacarpal 1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>metacarpal 2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>metacarpal 3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tibia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>metatarsal 1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The only provenance information received from the Million Dollar Museum for the remains consists of one gift receipt (Figure 2) from Western Chihuahua, Mexico, for mummy #4. There were signs associated with many of the other individuals on display claiming origin, but no supporting documentation is known to exist. Records such as who discovered the remains, or where the remains were found could have potentially been useful in establishing tribal affinity for the remains without expensive, destructive analyses. Lacking such records and given present funding, this information is limited to what can be determined through the isotopic and biological analyses of the mummies. The potential for developing information about the skeletal remains from the two trunks is even lower.

Who is Responsible?

Two parties share responsibility for these remains. First, there are those who were responsible for the collecting of the remains. This includes both the individual(s) who purchased or in some way procured the remains, as well as those who stored some of the remains in old trunks in a shed, while putting others on display. NAGPRA came into effect on November 16, 1990 (NAGPRA 1990), and retroactively affected the collections of covered museums. The Archaeological
Resource Protection Act (ARPA) of 1979 made it illegal to “excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource” (ARPA 1979: P.L. 96-95 s 6). ARPA only covers Native American remains and artifacts on public or tribal land (ARPA 1979); it is not known whether these remains came from such lands. It is possible that these remains were procured before either law came into affect, although earlier existing state or federal laws may have been broken. As we do not know when any of these remains were acquired by the Million Dollar Museum, where the remains were excavated, or who was involved in their disinterment and possible sale, it seems unlikely that anyone will be held responsible for accumulating the remains.

The second part of the question of responsibility concerns who is responsible for the remains now. Currently the remains are housed in the Laboratory of Human Osteology, Maxwell Museum, at the University of New Mexico. It is the responsibility of any museum that receives federal funding and curates Native American human remains to consider the disposition of those remains. The Lab is subject to NAGPRA, so it is required to inform and consult with groups that may have descended from the Native American populations represented by the human remains in its collection. Toward that end, the Maxwell Museum has assumed responsibility for the remains, including properly housing them and conducting appropriate documentation. However, if cultural affinity cannot be established, then curating the remains will be the responsibility of the museum for the foreseeable future. If the remains are to be retained in perpetuity, then additional questions of space and funding for the storage must be addressed. Additionally, the Lab is a research facility, and will use its analyses of these individuals to contribute to our general knowledge about the human past.

CONCLUSION

Attractions have been a unique component of America’s historical cultural landscape. However, due to changes in interstate travel patterns, coupled with ever increasing awareness of cultural sensitivities, many of these collections-based attractions are closing. Some attractions present themselves as museums, but many attractions do not meet the minimum standards of a museum, under any definition. When these attractions close, the responsibilities related to proper curation of their collections fall to actual museums. This is clearly demonstrated in the case of the Million Dollar Museum presented here.

Is this a harmless situation, where only the dead are disturbed? In the case of the Million Dollar Museum, it was “only” remains that were affected, and “only” the sensibilities of Native Americans and other concerned citizens that were offended. Skeptics might claim that while the actions of the Million Dollar Museum may not have been respectful, they were not actively harming anyone. However, consider a situation where the collection consists of something different. Instead of human remains, what if the Million Dollar Museum housed a collection of living animals? There are numerous attractions that include live animals, such as zoos and small circuses. An example of an attraction which was forced to close as the legal and sociocultural standards for animal treatment changed is Bob and Mae Noell’s Chimp Farm in Tarpon Springs, Florida. If a zoo or circus closes, who is responsible for the animals? In the case of the chimp farm, it has reopened as the Suncoast Primate Sanctuary (Farlow 2008). Or, what if the collections included materials that were either tainted with toxic chemicals, such as arsenic in older taxidermy specimens, or radioactive, as minerals from areas of atomic explosions may be? Such collections may be hazardous to the viewing public, as well as to museum personnel that attempt to mitigate their affects. The burden to museums resulting from attraction closings is potentially enormous.
Regardless of the nature of the collections in the possession of an attraction—human remains, live animals, toxic or radioactive materials—the responsibilities related to those collections remains an issue. Owners of attractions themselves may not recognize their legal and ethical responsibilities to their collections. The owners of the Million Dollar Museum did not know, or if they did know, they chose not to acknowledge, any responsibilities they had in regard to the human remains in their collections. However, when attractions such as the Million Dollar Museum close, the responsibilities for the collections fall to those who accept this burden.

ACKNOWLEDGMENTS

The authors would like to express their deep appreciation to Dr. Glenna Dean, New Mexico State Archaeologist at the time of the events described in this paper, and to Special Agent Fernando Benavides III of the Albuquerque office of the FBI. We appreciate the helpful comments of C.L. Kieffer, M.A., on early drafts of this report.

REFERENCES CITED

AAA New Mexico

American Association of Museums

Adams, Bradley J., and Lyle W. Konigsberg

Archaeological Resources Protection Act

New Mexico Cultural Properties Act

DeMark, Judith L

Farlow, Rita

Higgenbotham Auctioneers

Kreps, Christina

Legends of America

Luz, B., Y. Kolodny, and M. Horowitz
Maybury-Lewis, David  

Miller, Mark E.  

Native American Graves Protection and Repatriation Act  

Native American Graves Protection and Repatriation Act Future Applicability Final Rule  

Prentice, Chris  

Ripley’s Believe it or Not  

Rohde, Brooke, and Tamara Pope Roghaar  

Roadside America  

Schoeninger, Margaret J., Michael J. De Niro, and Henrik Tauber  

Stone, Sheila M.  
OUT ON A LIMB: COCHINEAL PRODUCTION IN SPANISH COLONIAL NEW MEXICO?

Cochineal (grana, grana cochinilla), a red dyestuff produced from the bodies of the female beetle Dactylopius coccus native to the Oaxaca area of south-central Mexico, was used in pre-Columbian Mexico as a textile dye, mixed with a bitumen-like substance for use as a tint for furniture inlays and other wooden objects, and as tribute. Within a matter of years after the Conquest, some historians say as early as 1518, Spaniards began commercial cultivation of the small insect as a dyestuff for international export. Strictly controlled by Spanish law, cultivation of the small insects had been introduced by Spaniards to Guatemala by the seventeenth century, to Brazil, reintroduced into Peru, and by the eighteenth century to the Canary Islands. Cochineal might have been introduced into the San Antonio area of present-day Texas from the Canary Islands and possibly California, as well. It was never believed to have been native to or cultivated in New Mexico. In recent years, however, small, possibly remnant colonies of cochineal have been spotted in such diverse locations as La Cienega (LA 44), south of Santa Fe; Pecos (LA 625); Pot Creek (LA 260), south of Taos; and the Gobernador region of north-central New Mexico. In fact, within the last decade, anthropologist and santero Charles M. Carrillo successfully harvested a small colony of cochineal found in the Santa Fe area for use as a dyestuff. Was cochineal introduced into New Mexico, a Spanish colony until 1821, or were “wild” populations locally available during Colonial times? If introduced as the result of missionization and settlement of the colony, when and to what extent and under what circumstances? Some historians believe that cochineal was only available in New Mexico in minute quantities for use as a dyestuff beginning in the nineteenth century. Do historical textiles, santos and other religious pieces, furniture, and artifacts of hide offer any evidence of earlier use of the dyestuff during the Colonial period? Research in early documents, museum collections, and oral histories form the basis of the discussion.

WHAT IS COCHINEAL? A BUG—AND A RED DYE!

Cochineal is a small insect (genus Dactylopius) of the scale family comprising several species worldwide. All species feed on cacti, mostly prickly pear cactus (flat-stemmed Opuntia) although at least one species feeds on cholla cactus (cylindrical-stemmed Opuntia). One species of cochineal underwent human selection in Mexico, long before the voyages of Columbus, to produce a female of considerably larger size. This species is known as Dactylopius coccus Costa and is the cochineal of commerce today. The domesticated insect is of New World origin and only the females produce the famous red dye, known as carmine in its purified state. Although originally used to dye cottons in the New World, cochineal actually works best on substances with a high protein content such as wool, silk, and presumably, hides.

The tiny, 1/16-in male cochineal insects are white, winged, and mobile but lack mouthparts and cannot feed. During their brief existence they impregnate up to 300 wingless domesticated females (Sandberg 1994:45). The much larger red females reach a mature size of about 1/2 in as they fill with eggs. The eggs contain most of the carmine colorant (Schweppe and Roosen-Runge 1986:262). The mature females are harvested and either transplanted to new prickly pear pads using little baskets (“nidos”) to lay their eggs or are killed by various methods.
and then dried. The dried insects measure about 1/4 in and are blue-black or silver-gray in color. Once dried, they are ready to use for dye. From two to four harvests of female cochineal insects per year can be made (Schweppe and Roosen-Runge 1986:267). During the eighteenth and nineteenth centuries, cochineal "plantations" comprised 50,000 cactus plants (Sandberg 1994:48) and could yield about 1000 pounds of insects per year at the rate of 70,000 dried insects per pound (Schweppe and Roosen-Runge 1986:267).

Cochineal producers, as well as early Spanish texts, stress that cochineal colonies must be protected from sun, wind, and rain (Sandberg 1994:47; Del Río Dueñas, Oaxaca, Dean personal communication, 1999). Photographs of modern cochineal "ranches" show prickly pear pads under brush structures or roofs of woven mats to keep the large, unprotected insects from drying out or being blown off the cacti by the wind.

"Wild" cochineal populations produce filmy wax coverings for themselves as protection from heat, drying wind, and rain as they feed on the juices of the prickly pear host. Young cochineal insects ("crawlers") are blown from one prickly pear pad to another by the wind, and wind currents are the major mechanism by which wild colonies expand their range (Barbara Rudd, Texas Tech University, Dean, personal communication, 1998). "Wild" females are only about 1/4 in when filled with eggs, and dry to about 1/8 in. Like their domesticated relatives, they also contain carmine colorant but their diminutive size and waxy coatings make them much less desirable for dyeing (Dean, personal observation). The much larger size and lack of protective covering of domesticated cochineal insects sharply distinguish them from their undomesticated relatives.

How cochineal insects came to be domesticated as many as 3000 years ago in Mexico is an interesting question that hinges on the number of generations per year that a particular species might produce (Sandberg 1994:45). Speaking very generally, it is possible to produce a recognizably different kind of cochineal insect over, say, 30 years of selection using a species that produces many generations per year. It would take longer using a species that produces only two or three generations per year (Barbara Rudd, Texas Tech University, Dean, personal communication, 1998). Selecting for relatively minor characteristics takes less time to produce a desired result than selecting for major characteristics. The original progenitors of domesticated cochineal are unknown, and how long it took a prehistoric breeding program to produce this domesticated insect is sheer speculation.

The essence of domestication, however, is the removal or suppression of "undesired" characteristics in favor of "desired" characteristics. In the case of cochineal, the permanent loss of the protective waxy coating and the huge increase in size have made the insect unable to live in the wild without the protection of humans. Unlike domesticated animals that can sometimes manage fairly well without people (witness feral horses and cats), cochineal cannot revert to a feral or wild form—it is too susceptible to wind, rain, and predators. It is highly unlikely that "wild" populations represent the descendants of formerly domesticated colonies.

A BRIEF HISTORY OF RED DYES IN THE OLD WORLD (LAC, KERMES) AND WHY COCHINEAL COULD MAKE SPAIN RICH

In the Old World, prior to the colonization of Mesoamerica by Spain in the sixteenth century, red dyes were produced from three other organisms. Species of kermes (Kermococcus vermilis, Kermes biblicus, Margarodes polonicus [Poland]), and species of lac (Tachardia [Laccifer] lacca), ironically are two other varieties of scale insects and were imported from India and the Orient. Plants from the madder (Rubiaceae) family also were used for dye (Greenfield 2005:28). These dye sources produced reddish colors on textiles but the colors were not deep or rich and, because the dye principals were not concentrated, required large quantities of dyestuffs. These dye sources were also under foreign control. The famous Turkey Red-dyed cloths imported from the Middle East required madder roots, liquid manure, and other secret
ingredients in a process not fully understood in Europe until the middle eighteenth century (Greenfield 2005:28; Sandberg 1994:43-46, 102, 143).

The introduction of cochineal to Europe revolutionized dyeing, as the dried insect contains an amazing 10-20 percent carminic acid (Schweppe and Roosen-Runge 1986:266; Del Río Dueñas 1995:32). By comparison, kermes (a much smaller insect to begin with) contains only about one tenth as much coloring matter or about 1-2 percent (Schweppe and Roosen-Runge 1986:269). The Spanish were quick to capitalize on their fortuitous monopoly of this New World dyestuff, introducing cochineal to Europe as early as 1518; by 1549 cochineal is described as being common in Europe (Schweppe and Roosen-Runge 1986:261-262). The true nature of the dye source (an insect) was kept secret by the Spanish government for some three centuries, and the requirements of the delicate domesticated insects or their prickly pear cactus hosts frustrated most efforts to surreptitiously start colonies in other parts of the world (Greenfield 2005:102-109).

From the dyer's viewpoint, the dye is easily extracted in water and can be manipulated with acids, bases, and metallic mordants to produce colors ranging from scarlets and carmines through purples and violets—a far cry from most dyestuffs of the day. Lighter shades of rose, pink, mauve, and lavender can be obtained from the exhausted dyebaths. The colors are also very fast, and textiles woven in Peru, for instance, using cochineal-dyed yarns are still bright red, pink, and blue-violet after more than 1200 years (Sandberg 1994:43, 46).

TEXTILE PRODUCTION AND RED DYES IN COLONIAL NEW MEXICO

Centuries before the Spanish colonized the modern states of New Mexico and Arizona, Native Americans living in the Rio Grande Valley and elsewhere wove cotton to produce textiles for wearing apparel. This weaving tradition was continued after Spanish settlement in New Mexico by means of the encomienda, whereby tribute—mantas and other woven goods, hides and paintings on hides, and foodstuffs—was paid by Puebloan speakers to designated Spaniards in return for protection from marauding tribes, and for education in Catholicism. The earliest reference to an obraje, or workshop in New Mexico dates from 1638 when Governor Luis Rosas had quantities of goods produced for sale in Mexico (Bloom 1935:242-248). Although the invoice contained, among other items, "five bales of buffalo hides, painted (cueros de civola pintados)" no mention is made of designs or dyes used to paint the hides. Nor were dyes or colors mentioned in references to materials produced in New Mexico which appeared in the contents of two colonial stores in Parral in 1641 (Boyd-Bowman 1972), one of which may have contained items shipped by Governor Rosas a few years previously. Further, while quantities of painted elkskins are mentioned in an inventory of materials shipped from New Mexico to Mexico City in 1662, once again no mention is made of any media used to paint those hides (Esquibel 2006:286, note 39). However, because the more familiar, and common, painted hides of the Plains groups had been painted with mineral substances, some specialists have assumed that the same dyes were used on hides in seventeenth century New Mexico (Hotz 1991:68-70). This may not have been the case at all, since as noted elsewhere cochineal is a particularly good dye on high protein materials such as wool, silk, and presumably, hides. For example, in their tests on 13 retablos and samples from the altar screen and walls of the church at Laguna, Gettens and Turner (1951:7) found at least one instance where what appeared to be cochineal was used instead of vermillion. Carrillo (Snow, personal communication, 1999; see also Carrillo 1998) believes that the A. J. Santero—an otherwise unidentified New Mexican santero, or saint-maker—used cochineal, in the form of dregs of fabric dye, almost exclusively for his reds and pinks.

By the end of the sixteenth century, mere decades after the conquest of Mexico, the production of cochineal for use as a dyestuff became a major industry, with tremendous economic importance to Mexico and, ultimately,
Spain. In Spain, for example, between 1556 and 1562, woolen fabric dyed with *grana de polvo* (kermes) was among the most expensive of fabrics produced in Valencia and Puertollano. Exported to Mexico, these extravagant fabrics wholesaled for between 1125 and 1300 *maravedis* per *vara* (Boyd-Bowman 1973:345).

By the end of the eighteenth century, exportation of cochineal was second only to silver in economic importance and far outweighed that of sugar (Kicza 1983:71). Used as tribute and for trade, cochineal, or *nocheztli*, was not only used to dye fabric, but also mixed into a paste called *zulaque* used to produce marquetry on furniture.

In New Mexico, a Colonial Spanish-era man’s suit was recovered from excavations in Santa Fe (Pierce and Snow 1999:76). The suit, made of a mixture of wool and silk, is of a style that dates from ca. 1690 to ca. 1710. It was originally believed, and still believed by many, to have belonged to Don Diego de Vargas, yet research by Pierce and Snow (1999) has shown that the suit actually could have belonged to any fairly well-to-do man in Santa Fe. In fact, there is no reason to believe that the suit was not made in New Mexico of fabric transported over the Camino Real from Mexico City. As far as the current color of the suit, cochineal turns brownish after prolonged contact with damp soil (Charles Carrillo, Snow, personal communication, 1999).

Generally, specialists in southwestern textiles believe that cochineal, as a commercial dye was not introduced into New Mexico until the nineteenth century (Bowen 1994:4, 6-7; Bowen and Spillman 1984:209-210). Yet eighteenth and nineteenth century New Mexican wills and inventories reference carmine, indigo, and Campeche wood or logwood a century earlier. For example, what appears to have been the identical log of Campeche wood is listed in the inventories of the brothers Miguel and Cristobal Baca, both of whom lived in the Guicu area of La Cienega (SANM I:83; SANM I:88). The inventory of the estate of Diego Manuel Baca is dated 1727, while that of his brother is dated 1739; both inventories contain weaving implements suggesting that the brothers and/or their wives were weavers. Moreover, in 1776, Fray Atanasio Domínguez reported “a beautiful carpet dyed with cochineal, which the Indians wove in Father Pino’s time” below the altar in the church at Acoma Pueblo (Adams and Chavez 1975:191). Another carpet, also dyed with cochineal, was found before the high altar at Santo Domingo in 1776. Domínguez described the latter as “A very large carpet, dyed scarlet with the stuff called cochineal, in little squares (of the kind ordinarily used for tablecloths), which Father Zamora furnished” (Adams and Chavez 1975:133).

Do wild cochineal colonies represent earlier transplants of wild colonies from Mexico?

After the conquest of Mexico beginning in 1512, the Spanish introduced the cultivation of cochineal on prickly pear to neighboring regions in Mesoamerica, South America, and the Canary Islands. Its food source, prickly pear cactus, flourishes throughout much of the southeastern and southwestern United States and native “wild” cochineal is found in California, Arizona, Texas, and New Mexico—all formerly part of the Spanish Empire.

In New Mexico, native, non-domesticated cochineal, has been sighted at a number of locations, among them Santa Fe (where it has been harvested by Charles M. Carrillo, Snow, personal communication, 1999), the hills around La Cienega and Madrid, south of Santa Fe, Pecos Pueblo, Pot Creek Pueblo (between Taos and Picuris), the Governor area of north-central New Mexico, and at various locations in the Albuquerque area.

It is likely that the “wild” cochineal colonies in New Mexico and adjoining areas are truly native to the Southwest. However, until the exact species can be determined and compared with those of Mexico, the proof of the native status of current “wild” populations remains to be established.

Was cochineal present in New Mexico in pre-Columbian times? If so, was its traditional use adopted by “hinterland” Spanish colonists unable to obtain domesticated cochineal?

Obviously, cochineal was available and was used in colonial New Mexico, albeit in limited quantities. The ques-
tion remains: was the cochineal used for dye from native "wild" populations, or was the dye produced from domesticated insects transported from Mexico? The answer to this question must await more research aimed at identifying the sources of dyes in historic fabrics. Spectrophotometric analysis (Schweppe and Roosen-Runge 1986:279-280), which can identify cochineal on historic and prehistoric fabrics without destructive analysis, is an especially promising technique in this regard, and we look forward to new data from future research.

ACKNOWLEDGMENTS

"Out on a Limb: Cochineal Production in Spanish Colonial New Mexico?" originally appeared as a joint paper presented by Snow and Dean at the Costume Society of America Symposium held in Santa Fe, May 22-25, 1999.

ENDNOTES

1. According to Del Rio Dueñas (1995:32), a species of cochineal was domesticated in Mexico prior to the Toltec invasion of the Valley of Mexico. Fray Diego Durán (Heyden 1994:182), a Dominican friar, reported in the mid-sixteenth century that cochineal was bred in especially large quantities by the Mixteca of Oaxaca. Durán also noted (Heyden 1994:182) "in spite of its diminutive size it [cochineal] was one of the few domestic animals of Mesoamerica, others being the dog, turkey, duck, and bee."

2. Juan Agudo’s belongings included “two small blankets from New Mexico with the Virgin and Saint Nicholas hand painted on them and a chamois jacket, also from New Mexico,” (Boyd-Bowman 1972:240-241). It is tempting to speculate that the items were made in the workshop or obraje of Governor Rosas (see Bloom 1935).

3. The maravedí was a Spanish coin; the vara was a unit of measurement essentially equivalent to the English yard.

4. Zulaque was a “bitumen-like paste made of burnt lime, oil and vegetable dye...black from the palo tinte tree or red from the cochineal beetle,” (Fane 1996:102).

5. Fray Pedro Ignacio Pino was stationed at Acoma between May 23, 1745 and June 15, 1749, and again between August 20, 1750 and November 20, 1767. He died at Acoma December 9, 1767. When the carpet was woven is unknown (Adams and Chávez 1975:337).

6. Fray Antonio Zamora was stationed at Santo Domingo in 1760 and 1764 (Adams and Chávez 1975: 340).
REFERENCES CITED

Adams, Eleanor B., and Fray Ángelico Chávez (translators)

Bloom, Lansing B.

Bowen, Dorothy Boyd

Bowen, Dorothy Boyd, and Trish Spillman

Boyd-Bowman, Peter


Carrillo, Charles

Del Río Dueñas, Ignacio J., Ing.
1995 Instructivo para Teñir con Grana Cochinilla. Tlapa-nochestli, Oaxaca, Mexico.

Esquibel, José Antonio

Fane, Diana (editor)

Gettens, Rutherford I., and Evan H. Turner

Greenfield, Amy Butler

Heyden, Doris (editor)

Hotz, Gottfried

Kicza, John E.

Pierce, Donna, and Cordelia Thomas Snow

Sandberg, Gösta

Schweppe, Helmut, and Heinz Roosen-Runge

State of New Mexico Records Center and Archives
1621-1821 Spanish Archives of New Mexico (SANM). State of New Mexico Records Center and Archives, Santa Fe.
The concept of "ethnicity" has a relatively recent history among anthropologists (Baumann 2004), but the term, as well as the concept, are already becoming controversial in much the same way that "tribe" and "culture" have. For succinct considerations of the term, concept, history, and variation in usage, the reader is referred to Baumann (2004) and Cordell (2008). Nevertheless, many scholars still believe that the concept has validity in ways that are useful in their studies of human interaction and movement.

In this matter, I follow what Lyons and Clark (2008:194-195) refer to as the "Social Constructionist" model of ethnic identity as excerpted from Jenkins (1996:20, 1997:13). According to them, ethnicity "is internalized during childhood," "is centrally concerned with culture but...also rooted in social interaction," "is primary but not primordial," "is not necessarily fixed and unchanging," "can be salient and durable," "is not what someone has but is what one does," "may be imposed by outsiders," "is simultaneously collective and individual", has cultural differences that "do not [necessarily] equate with...group boundaries, but...are the raw materials from which such boundaries are constructed," and is denoted by "groups [that] choose relevant ethnic symbols based on the context of their interaction and their histories." (Bracketed words added.) But rather than use the socially (and racially) "loaded" term ethnicity, from this point forward, I will use the term "collective social identity" or even shorter, "social identity." Additionally, by using the term social identity, rather than ethnicity, I avoid some of the more prominent implications which, for many scholars, evokes questions of social and economic power structures and association with state level societies (Stone 2003:40).

While it is true that social identity is signaled in myriad ways by various groups, many of those signals do not survive in the archaeological record. For instance, social identity can be signaled by hair styles, clothing styles and the ways they are worn, and by face and body painting and tattooing. But as archaeologists we usually have only durable remains such as projectile point styles, pottery, and architecture with which to work (Grosboll 1987; Weissner 1983). If one has a sufficiently large and detailed data base, then subsistence information, intra- and inter-site patterning, and other aspects may be helpful as well (Santley et al. 1987). No matter the situation, we must keep in mind that the individual archaeological culture, as a constellation of specific traits, does not necessarily constitute social identity in and of itself. This is in spite of the fact that many archaeologists often speak of them as if they were, or were (for instance, Anasazi and Mogollon). Nor, it is important to note, must we assume that social identity does not, in some instances, equate with a specific archaeological culture. We should not automatically rule out either possibility.

To date, some scholars have made reasonable cases for the identification of specific social groups, most of them in the context of migration studies. Two recent examples involve prehistoric socio-cultural groups moving from (1) northeastern Arizona to southeastern Arizona (Adams 2002:249; Clark 2001; Haury 1958; Lindsay 1987; Lyons 2003; Neuzil 2005; Stone 2003) and (2) from the Mesa Verde region of Colorado to west-central New Mexico (Baker and Durand 2003; Davis and Winkler...
The archaeologists' success in these demonstrations is based on perceivable differences between the contents and characters of the archaeological sites of the migrant groups versus those of the host communities in the destination regions. That is, they demonstrate that the social identity of the migratory people differed from that of their hosts on the basis of pottery, architecture, and internal village organization.

Through time it can be expected that migrant peoples either move to yet other regions or else eventually integrate with their hosts (Stone 2003). As far as durable (archaeologically visible) remains are concerned, the integrative process, or assimilation, often results in partial or full loss of the migrant group identity. While both the migrant group and the host group may be changed in some manner, the whole often retains most of the outward character of the dominant host group.

But what if two or more groups come together but none is dominant? Can they form a group that is, in reality, a new group in and of itself, one that bears relatively little overall resemblance to any one group and which has its own social identity and distinctive material culture? Is this the kind of event that is responsible for the "appearance" of an archaeological "culture" that has no clear predecessor? Examples of this possibility are the prehistoric Gallina culture of north-central New Mexico and the early historic Jemez (as seen in initial rooms built at Unshagi, LA 123, and Nanishagi, LA 541 [Reiter 1938 and Reiter et al. 1940]).

THE GALLINA CULTURE AND THE GALLINA/JEMEZ CONNECTION

The Gallina culture (or Largo-Gallina), dated approximately A.D. 1050 to 1300, is noted for its distinctive architecture, its somewhat less distinctive pottery, and its location in what might be called the Gallina highlands. This rugged, high elevation terrain lies south of the San Juan river, south and west of the Chama river, west of the Jemez mountains proper, and east of the San Juan (Chaco) basin. Gallina sites are also noted for their relative isolation from contacts with peoples in surrounding regions, as gauged by a near absence of outside products such as pottery, by what is generally believed to be a high incidence of violent deaths, and by the presence of towers that some believe were defensive in nature. The few Gallina sites that appear to have engaged in greater contact with outside peoples are those located in the lower elevation headwaters of the Rio Puerco of the East in the vicinity of the modern village of Cuba, Sandoval County.

Some archaeologists believe that the Gallina culture developed from the Rosa culture of the upper San Juan river drainage when Rosa peoples moved southeastward into the Gallina highlands (Cordell 1979:48-49; Hall 1944:60-62). However, other archaeologists remain skeptical (Anschuetz 2006:238-240). Likewise, some archaeologists believe that the Gallina peoples eventually moved southward to become the Jemez peoples of Jemez Pueblo (Ellis 1951; Reiter 1938; Wendorf and Reed 1955; Wiseman 2007), but, again, others disagree. Regarding the latter position, Michael Elliot, in a written but unpublished document (Elliot 1991), indicates his belief that the Jemez developed from Coalition period populations situated in the valleys of the Jemez River and its headwater tributaries in the vicinity of modern Jemez Pueblo (see Kulisheck 2001:83 for an outline). In these documents, Elliot does not address the idea of a Gallina-Jemez relationship. But, in response to questions in workshops, he states his belief that any similarities in Gallina and Jemez architecture and pottery are coincidental (New Mexico Archaeological Council workshop on the Jemez, spring 2006). Elsewhere I have taken issue with this position (Wiseman 2007).

While I still see strong evidence for a Gallina-Jemez connection, heretofore minimally reported evidence, now available (Wiseman 2008, 2009, and this paper), supports both Elliot's and my positions and broadens the base of Jemez social identity. To that end, this paper presents an analysis of the three Lagunitas project sites located in the upper Rio Puerco valley of the East. I conclude that an additional part of the Jemez identity de-
rives from an ethnogenesis that occurred among perhaps at least three cultural groups that moved into the upper Puerco valley around A.D. 1100.

THE LAGUNITAS SITES NEAR CUBA, NEW MEXICO

The Lagunitas project consisted of three small sites situated on a tiny mesa located in the Rio Puerco valley of the East and about 6 kilometers south of Cuba, NM (Figures 1 and 2). The work was accomplished for the New Mexico Department of Transportation by the Museum of New Mexico. Laurens C. Hammack (1965) believed that the main site, Lagunitas ruin (LA 6865), could be categorized as Gallina in culture and that the other two, Bull Snake Hill (LA 6866) and Palisade (LA 6864), were probably attributable to the Rosa culture. In a continuing analysis of the three sites, I still concur with Hammack that Lagunitas ruin is a Gallina site, but I find that Bull
Snake Hill and Palisade cannot be characterized as Rosa phase.

The three sites are similar in a few particulars (see Wiseman 2008 and 2009 for more details): each has a single, deep, south-oriented pit-house, a pottery assemblage dominated by Gallina Utility ware, and varying percentages of Gallina Black-on-white painted pottery. Rosa Black-on-white, a hallmark of the Rosa phase, was not identified in any of the assemblages. The pottery assemblages indicate that the occupations at all three sites were short and took place within the period A.D. 1050 to 1150 (Table 1 and Figure 3). One or more occupations of Lagunitas ruin took place through the entire period. But, that

<table>
<thead>
<tr>
<th>Pottery Type</th>
<th>Bull Snake</th>
<th>Palisade</th>
<th>Lagunitas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Gallina Utility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallina Plain, gray variety</td>
<td>17</td>
<td>19</td>
<td>178</td>
</tr>
<tr>
<td>Gallina Plain, brown variety</td>
<td>28</td>
<td>31</td>
<td>93</td>
</tr>
<tr>
<td>Gallina Plain undifferentiated</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Gallina Smoothed</td>
<td>30</td>
<td>34</td>
<td>18</td>
</tr>
<tr>
<td>Gallina Indented</td>
<td>6</td>
<td>7</td>
<td>61</td>
</tr>
<tr>
<td>Utility Total</td>
<td>81</td>
<td>91</td>
<td>350</td>
</tr>
<tr>
<td>Painted and Intrusive Utility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallina B/W</td>
<td>3</td>
<td>3</td>
<td>107</td>
</tr>
<tr>
<td>Prewitt B/W</td>
<td>4</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>Wingate B/R</td>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Kwahye’s B/W</td>
<td>19</td>
<td>4</td>
<td>94</td>
</tr>
<tr>
<td>Cebolleta B/W</td>
<td>1</td>
<td>&lt;1</td>
<td>18</td>
</tr>
<tr>
<td>Taos B/W</td>
<td>1</td>
<td>&lt;1</td>
<td>3</td>
</tr>
<tr>
<td>“Chacoan”</td>
<td>1</td>
<td>&lt;1</td>
<td>6</td>
</tr>
<tr>
<td>Mancos B/W</td>
<td>2</td>
<td>&lt;1</td>
<td>6</td>
</tr>
<tr>
<td>Red Mesa B/W</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Socorro B/W</td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Tseh-so Corrugated</td>
<td></td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>Painted/Intrusive Utility Total</td>
<td>8</td>
<td>9</td>
<td>131</td>
</tr>
<tr>
<td>Assemblage Totals</td>
<td>89</td>
<td>100</td>
<td>481</td>
</tr>
</tbody>
</table>

B/W=Black-on-white, B/R=Black-on-red.
of Bull Snake Hill was restricted to the earlier part of that same period, and that of Palisade took place during the later part. Whether the occupations of Bull Snake Hill and Palisade were precisely contemporaneous with that of Lagunitas cannot be established with certainty. No tree-ring or other independent dates are available for dating any of the sites. Since fill sampling for flotation recovery of small plant remains was not a standard practice at the time of the excavations, this important source of information is not available for documentation of subsistence practices at the Lagunitas sites.

Here, the similarities among the sites diverge. The Lagunitas pithouse is nearly square with decidedly Gallina floor features and layout (Figure 4). A surface storage unit of two very long rooms built of mostly (?) perishable materials lies to the west. The pottery assemblage, the largest of the three sites, includes all types recovered from both Bull Snake Hill and Palisade, plus several not present at either (Table 1). Evidence of farming by the Lagunitas occupants is present in the form of several manos and plentiful burned corn remains. Two individuals were interred at the site.

The Bull Snake Hill pithouse is very small and round (3.5 m diameter, 1.6 m deep), with a hearth/ash-pit/deflector complex interconnected by a single adobe rim (coping), and a two-metate mealing bin, but no interior roof-support post holes (Figure 5). A three-room surface storage unit of nearly square rooms with masonry footings is located to the west; one of the rooms was subsequently subdivided into two compartments. The pottery assemblage includes only three painted types (in numerical order, Prewitt Black-on-white, Gallina Black-on-white, and
Wingate Black-on-red) (Table 1). The pottery assemblage is the smallest of the three sites. Four manos, one metate, and the mealing bin in the pithouse indicate the site occupants processed corn. No macroremains of cultigens were recovered. One individual was interred at the site.

The Palisade pithouse is also very small and round (3.6 m diameter, 2.1 m deep), with an adobe-rimmed fire pit and a deflector as the only floor features (Figure 6). Surface rooms are absent, and aside from a small outdoor work area(?) of rocks and burned materials, the only extramural feature of note is a vertical-post fence or palisade that surrounded the site. The painted pottery assemblage is dominated by Gallina Black-on-white with Kwahe’e Black-on-white running a poor second (Table 1). No ground stone artifacts or macroremains of cultigens were recovered from the site. No human interments were recovered.

Figure 5.
The Bull Snake Hill site, LA 6866.
CULTURAL AFFILIATIONS AND SOCIAL IDENTITY OF THE LAGUNITAS SITES

As previously discussed (Wiseman 2008), the cultural affiliation of Lagunitas ruin as Gallina is clearly indicated by the attributes of the pithouse. Gallina architecture is so distinctive that it surely denotes a specific social identity of the builders/occupants.

The excavators of Bull Snake Hill and Palisade believed them to be attributable to the Rosa phase (Hammack 1965), presumably an assumption based on the utility pottery and the facts that the pithouses, being circular and lacking the more definitive attributes of Gallina structures, could represent the predecessors of the Lagunitas ruin. However, since the pottery assemblages of both Bull Snake Hill and Palisade indicate contemporaneity with Lagunitas ruin, they cannot be Rosa phase. Currently documented Rosa phase sites date at least 100 years earlier than the Gallina phase.
Figure 7.
Rosa phase structures.

**Type 1 - Structures with four main support posts and ventilators**
- with benches and wing walls - a.
  House A, Site 12 (Hall 1944);
- b. House B, Site 12 (Hall 1944);
- c. House C, Site 1 (Hall 1944);
- d. Room 1, LA 3320 (Peckham 1963); with partial benches - e. House A, Site 1 (Hall 1944); f. House B, Site 1 (Hall 1944); g. Pit House 2, LA 4103 (Dittert and Eddy 1963); h. Pit House 1, LA 4103 (Dittert and Eddy 1963); with wing wall - i. Fea. 8, LA 4408 (Dittert and Eddy 1963); lacking benches and wing walls - j. Pithouse, LA 4406 (Dittert and Eddy 1963);
- k. Room 3, LA 3320 (Peckham 1963);

**Type 2 - Structures with peripheral posts as main roof supports and no ventilators**
- l. Structure 55, LA 78861 (Yost 1997); m. Pit House 1 (Carlson 1964); n. Fea. 1, LA 72831 (Ayres et al. 1993);

**Type 3 - Structures with irregular shapes**
- o. Structure 46, LA 78861 (Yost 1997); p. House C, Site 12 (Hall 1944); q. Fea. 4, LA 4408 (Dittert and Eddy 1963); r. Room 2, LA 3320 (Peckham 1963).

Illustrations adapted from sources indicated. Scale and orientation to magnetic north (toward top of page) are approximately the same for all structures. The diameter of n is 3.8 m, and that of f is 11.3 m. The ventilators of structures g, h, and i may have been missing due to poor preservation or perhaps were missed during excavation. Hatchured areas in g and n were left unexcavated or were removed by machinery.
But to be more certain about the matter, a comparison of the Bull Snake Hill and Palisade pithouses with Rosa phase structures is helpful. A search of the literature provides a sampling of houses that have been identified as Rosa (Figure 7). These can be grouped into three types: (1) structures with ventilators and two or four interior roof-support posts, including five variations based on differences in floor features; (2) structures lacking ventilators and having roofs supported entirely by peripheral posts; and (3) structures with irregular shapes and feature arrangements. Of these, only the second type of structure might pertain to the Bull Snake Hill and Palisade structures because of the absence of interior roof support holes (Figure 7 l-n). However, these structures lack ventilators and are generally believed to be warm-weather (seasonal) habitations. Clearly, then, the structures at Bull Snake Hill and Palisade do not conform to any of the Rosa house categories.

Therefore, architecturally and temporally speaking, the Bull Snake Hill and Palisade sites cannot be considered Rosa phase. This conclusion is buttressed by the earlier observation about the absence of Rosa Black-on-white (a hallmark type of the Rosa phase) at Bull Snake Hill and Palisade.

This leaves us with the question: Can Bull Snake Hill and Palisade be assigned to any other cultural area(s) or phase(s)? It is clear from the results of two separate, region-wide studies by Gerow (1999) and Lakatos (2007) that the Ancestral Puebloan pithouses of northwestern New Mexico and the middle and northern Rio Grande embody a vast variation in terms of most attributes, including but not limited to room size, shape, and orientation, and types, placement, construction materials, and details of floor and wall features.

In an earlier paper (Wiseman 2007), I advanced an argument that the details of housing reflect the world view and social identity of the builders and occupants. If this thesis is correct, then it follows that the variability in pithouse design documented by Gerow and Lakatos for Ancestral Puebloan pithouses reflects the presence of numerous different social groups in north-central and northwestern New Mexico and not just one (Anasazi or Ancestral Puebloan), as many archaeologists seem to imply.

Playing devil's advocate, one might point out that many individual sites in this vast area have structures bearing more than one floor and wall feature plan. In other cases, the houses in a village are fairly homogeneous in this regard. As far as I am aware, in the former cases, the archaeologists have usually assumed that, where variation occurs, it is part of the cultural "pattern" of a single people and have not asked whether it might signal the presence of peoples bearing different social identities. In many cases, the individual structures within such villages cannot be sufficiently closely dated to determine whether or not the occupations of the different types of structures were contemporaneous. In the absence of such information, the possibility of sequent occupations by different social groups cannot be ruled out. It is also possible that members of more than one social group can simultaneously occupy the same site.

What, then, is an appropriate scale for investigating social identity? At the very real risk of committing another sin of scale, I tried the opposite approach—looking for examples of structures that are like those at Bull Snake Hill and Palisade. If we impose the additional criterion of looking mainly at those areas where the appropriate pottery types were made, then we have some interesting results. In the examples that follow, it should be noted that simple circular pithouses (in some cases, "kivas") with few floor features are found in three districts—Prewitt, Cochiti, and Chaco.

Regarding Bull Snake Hill, my search found a close match in the characteristics of certain pithouses (and "kivas"), associated surface room-units, and pottery of the Prewitt district along the upper Rio San Jose in western New Mexico. True, sites in that part of New Mexico (as in most) display a significant variety of pithouse and
kiva forms. However, Jack Smith’s (1965:84-93) synthesis makes clear the fact that many of those sites have small (less than 3 m diameters, 1 to 2 m depths), simple, round pithouses bearing few floor features and a near absence of post holes. A series of small sites excavated by the Museum of New Mexico for the New Mexico Department of Transportation’s Prewitt Project provided an important corpus of information in this regard. Additional data include a southerly orientation, small surface pueblos situated west of the pithouses, and pottery assemblages including Prewitt Black-on-white pottery and related types (Figures 8 and 9).

Perhaps the best comparison for the Palisade site from the standpoint of architectural detail (especially the simple circular outline with few floor features) can be found at site 29SJ627 in Chaco Canyon. There, two structures pertinent to our discussion were excavated (Figure 10)—Kivas D and G (A.D. 1000-1050) (Truell 1992, Figures 2.5 and 2.7, respectively). “Kiva” D is a little more complex than the Palisade pithouse in that it has a one-place mealing bin, a small rectangular pit of undefined function, and several small auxiliary post holes (but not in a four large-post pattern) in addition to a fire pit and deflector (Truell 1992:Fig. 4.13). “Kiva” G is much more similar to Palisade, though the western, unexcavated third of its floor might hide unexcavated features. The two main problems with this comparison are that Site 29SJ627 also has an 18-room, temporally associated pueblo and plentiful evidence for corn farming, both lacking at Palisade. The pueblo contained several habitation rooms as well as a number for storage, indicating that the occupants of this site had gone through the transition from subsurface to surface habitation. This step evidently had not been taken by the occupants of the Palisade site, at least not during their stay at that location.

Another comparison of the Palisade site pithouse architecture with examples in the literature is especially good from the standpoint of the associated pottery, Kwahe’e Black-on-white. It involves certain Kwahe’e period pithouses in the Cochiti district of the middle Rio Grande north of Albuquerque. There, small, simple pithouses with southeasterly orientations have been found at the
SPECULATIONS

The correspondences in architecture and pottery among certain sites of the Prewitt, Chaco, and Cochiti regions with the Bull Snake Hill and Palisade sites are not perfect. They may be coincidental—or, they may not be. But, they are unmistakable and could well signal the presence of groups from one or more of these regions, plus the Gallina, in the upper reaches of the Rio Puerco of the East. Did their presence together result in an amalgamation of peoples and cultures, leading to an ethnogenesis of the Jemez and perhaps other Puebloan peoples now living in the Rio Grande? Moore (2008) suggests this scenario with regard to migrations of Mesa Verdean peoples into the same area at a slightly later date. The phenomenon of prehistoric sites such as those on Mesita Lagunitas is certainly provocative and provides avenues for continued investigation.

FINAL THOUGHTS

Whether or not the reader accepts the interpretations offered here, a few nagging questions remain. I generally believe that architecture can be, but is not always, indicative of social identity and that pottery can be of assistance in the matter. However, precisely because pottery is utilitarian, easily moved, and attractive as a trade item, its reliability as a social indicator can always be questioned.

One of the more problematic aspects of the Lagunitas Project pottery assemblages is the fact that the primary utility pottery at all three sites is Gallina Utility. We would expect this to be the case for the Lagunitas ruin, the site presumably built and occupied by Gallina people. But why is it also the primary utility pottery associated with both Bull Snake Hill and Palisade, if, as I propose, the builders and occupants of those sites were migrants to the area? Is this a case where the migrants obtained their utility pottery from the residents of Lagunitas ruin or other Gallina sites in the area? After all, at least initially, the local people would have had the most experience in working with the local clays and could have produced those vessels on a more reliable basis.
Kwahe'e period pithouses from the Cochiti district. Pithouses a and g are from the Red Snake Hill site (LA 6461), and all others are from the North Bank site (LA 6462). Pithouse d is 3.0 m in diameter, and i is 4.5 m in diameter. Adapted from Lange 1968.

Figure 11.
As for the painted vessels represented by sherds of Pre­witt B/W, Kwahe’e B/W, and the other imported types are concerned, those vessels are few enough in number to have been brought in by the migrants themselves. Perhaps these imported painted vessels were bartered to the inhabitants of Lagunitas ruin for vessels of the local utility pottery? These and any number of other scenarios, or combinations of scenarios, could be conjured up to explain the situation.

REFERENCES CITED

Adams, E. Charles

Anschuetz, Kurt F.

Ayers, David O., L.S. Reed, A.C Reed, and G.L. Moore

2003 Prehistory of the Middle Rio Puerco Valley, Sandoval County, New Mexico. Archaeological Society of New Mexico Special Publication 3, Albuquerque.

Baumann, Timothy

Carlson, Roy L.

Clark, Jeffrey J.

Cordell, Linda S.


Davis, Emma Lou, and J. H. Winkler

Dittert, Alfred E., Jr., and Frank W. Eddy (assemblers)
1963 Pueblo Period Sites in the Piedra River Section, Navajo Reservoir District. Museum of New Mexico Papers in Anthropology 10, Santa Fe.

Elliot, Michael D.

Ellis, Florence H.


Hammack, Laurens C. 1965 The Lagunitas Highway Salvage Project. Laboratory of Anthropology Notes No. 33. Museum of New Mexico, Santa Fe.


Reiter, Paul A.
1938  *The Jemez Pueblo of Unshagi, New Mexico*. Monograph of the School of American Research No. 5, Santa Fe.

Reiter, Paul, W. T. Mulloy, and E. H. Blumenthal, Jr.

Robinson, William J., J. W. Hannah, and B. G. Harrill
1972  *Tree-Ring Dates from New Mexico I, O, U, Central Rio Grande Area*. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Roney, John R.

Santley, Robert, C. Yarbrough, and B. Hall

Smith, Jack E.
1965  *The Archaeology of the Upper San Jose Valley, Northwestern New Mexico and Its Relationship to the Developmental Stage of the Chaco Branch of the Anasazi Tradition*. Ph.D. dissertation, Department of Anthropology, University of California at Los Angeles. University Microfilms, Ann Arbor.

Stone, Tammy

Truell, Marcia L.

Weissner, Polly

Wendorf, Fred, and Erik K. Reed

Wilson, John P.

1962b  *The Excavation of LA 6386, Burro Valley Pueblo*. Laboratory of Anthropology Notes No. 117b. Museum of New Mexico, Santa Fe.

Wiseman, Regge N.


Yost, Stephen W.
*Data Recovery at Nine Sites Within the Fruitland Coal Gas Development Project Area, San Juan and Rio Arriba Counties, New Mexico*, Book 1. Western Cultural Resource Management, Inc., Farmington, New Mexico.
## ANNUAL PAPERS

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Year</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>La Frontera: Papers in Honor of Patrick H. Beckett</td>
<td>1999</td>
<td>$24.95</td>
</tr>
<tr>
<td>26</td>
<td>The First 100 Years: Papers in Honor of the State and Local</td>
<td>2000</td>
<td>$24.95</td>
</tr>
<tr>
<td></td>
<td>Archaeological Societies of New Mexico</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Following Through: Papers in Honor of Phyllis S. Davis</td>
<td>2001</td>
<td>$24.95</td>
</tr>
<tr>
<td>29</td>
<td>Climbing the Rocks: Papers in Honor of Helen and Jay Crotty</td>
<td>2003</td>
<td>$24.95</td>
</tr>
<tr>
<td>30</td>
<td>Ever Westward: Papers in Honor of Elizabeth Kelley</td>
<td>2004</td>
<td>$24.95</td>
</tr>
<tr>
<td>31</td>
<td>Inscriptions: Papers in honor of Richard and Nathalie Woodbury</td>
<td>2005</td>
<td>$24.95</td>
</tr>
<tr>
<td>32</td>
<td>Southwestern Interludes: Papers in honor of Charlotte J. and Theodore Frisbie</td>
<td>2006</td>
<td>$29.95</td>
</tr>
<tr>
<td>33</td>
<td>Texas and Points West: Papers in honor of John A. Hedrick and Carrol P. Hedrick</td>
<td>2007</td>
<td>$29.95</td>
</tr>
<tr>
<td>34</td>
<td>Chasing Chaco and the Southwest: Papers in Honor of Frances Joan Mathien</td>
<td>2008</td>
<td>$29.95</td>
</tr>
<tr>
<td>35</td>
<td>Between the Mountains, Beyond the Mountains: Papers in honor of Paul R. Williams</td>
<td>2009</td>
<td>$29.95</td>
</tr>
</tbody>
</table>

## SPECIAL PUBLICATION SERIES

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ancient Communities in the American Desert, by E.L. Hewett</td>
<td>$20.00</td>
</tr>
<tr>
<td>2</td>
<td>Three Rivers Petroglyph Site, by M.S. Duran and H.K. Crotty</td>
<td>$10.00</td>
</tr>
<tr>
<td>3</td>
<td>Prehistory of the Middle Rio Puerco Valley, edited by L.L. Baker and S.R. Durand</td>
<td>$22.00</td>
</tr>
</tbody>
</table>
CONTRIBUTORS

Kurt Anschuetz
6228 Calle Piñon NW
Albuquerque, New Mexico 87114

Jeffrey L. Boyer
Office of Archaeological Studies
Museum of New Mexico
P.O. Box 2087
Santa Fe, New Mexico 87504

David M. Brugge
4300 Bryn Mawr NE, #31
Albuquerque, New Mexico 87107

Carol J. Condie
Quivira Research Associates
1809 Notre Dame NE
Albuquerque, New Mexico 87106

Linda S. Cordell
School for Advanced Research
P.O. Box 2188
Santa Fe, New Mexico 87504

Nicholas E. Damp
Department of Anthropology
University of New Mexico
Albuquerque New Mexico 87131

Glenna Dean
P.O. Box 658
Abiquiu, New Mexico 87510

Heather Edgar
Department of Anthropology
University of New Mexico
Albuquerque, New Mexico 87131

Catherine S. Fowler
Department of Anthropology
University of Nevada
Reno, Nevada 89557

Hayward H. Franklin
1127 Marigold NE
Albuquerque, New Mexico 87122

Dody M. Fugate
MN/M/ARMS
P.O. Box 2087
Santa Fe, New Mexico 87504

Stephen A. Hall
Red Rock Geological Enterprises
3 Cagua Rd.
Santa Fe, New Mexico 87508

David Kirkpatrick
Human Systems Research, Inc.
P.O. Drawer 728
Las Cruces, New Mexico 88004

Richard Loose
P.O. Box 278
Organ, New Mexico 88052

James Moore
Office of Archaeological Studies
Museum of New Mexico
PO Box 2087
Santa Fe, New Mexico 87504

Jesse B. Murrell
Parametrix
8901 Adams St. NE, Suite D
Albuquerque, New Mexico 87113

Anna Rautman
Department of Anthropology
University of New Mexico
Albuquerque, New Mexico 87131

Tammy M. Rittenour
Department of Geology
Utah State University
Logan, Utah 84322

Cordelia Thomas Snow
MN/M/ARMS
P.O. Box 2087
Santa Fe, New Mexico 87504

Regge Wiseman
Office of Archaeological Studies
Museum of New Mexico
P.O. Box 2087
Santa Fe, New Mexico 87504
CONTRIBUTORS

Kurt F. Anschuetz
Women are Corn, Men are Rain: Agriculture and Movement Among the Tewa in North-Central New Mexico Between A.D. 1250 and 1598

Jeffrey L. Boyer
Identifying Volcanic Material Sources in the Taos Valley

David M. Brugge
El Gran Tequayó and Trans-Great Basin Trade

Carol J. Condie
Costilla Grande—Where a Bison Made a Fatal Mistake on the Sandia Gravel Tongues in 365 B.C.

Linda S. Cordell and Nicholas E. Damp
Adobe Melt-Down

Catherine S. Fowler
Bertha P. Dutton and the Girl Scouts in the Southwest, 1947-1957

Hayward H. Franklin and Jesse B. Murrell
Ceramic Artifacts from Sites at Cerro de Los Lunas and Albuquerque's South Valley, with Observations on Pueblo III Pottery in the Middle Rio Grande Valley

Dody M. Fugate
Pueblo Dogs: The Oldest Companions

Stephen A. Hall and Tammy M. Rittenour
Optical Dating and New Mexico Prehistory

David Kirkpatrick
Metal Projectile Points from the Cimarron District, Northeastern New Mexico

Richard Loose
Archaeoacoustics: Adding a Sound Track to Site Descriptions

James L. Moore
Classic Period Farming in the Ojo Caliente Valley

Anna Rautman and Heather Edgar
Attractions, Museums, and Responsibilities: A Case Study of the Million Dollar Museum

Cordelia Thomas Snow and Glenna Dean
Out on a Limb: Cochineal Production in Spanish Colonial New Mexico?

Regge Wiseman
Mesita Lagunitas: Prelude to Ethnogenesis?