Layers of Time

Papers in Honor of Robert H. Weber

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David W. Love
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Cam Wade
Robert H. Weber
John P. Wilson
Regge N. Wiseman

The Archaeological Society of New Mexico: 23
Edited by Meliha S. Duran and David T. Kirkpatrick
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<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A BIOGRAPHY OF ROBERT HARRISON WEBER</td>
<td>1</td>
</tr>
<tr>
<td>THE MOQUINO SITE REEVALUATED</td>
<td>13</td>
</tr>
<tr>
<td>TIME SERIATION USING RATIOS OF PAINTED CERAMIC TYPES</td>
<td>21</td>
</tr>
<tr>
<td>THE BEGINNINGS OF ETHNOLOGY AT HOPI</td>
<td>37</td>
</tr>
<tr>
<td>HISTORIC ARCHAEOLOGY AT RAYADO</td>
<td>51</td>
</tr>
<tr>
<td>IMPLICATIONS FOR MODELS OF ARROYO ENTRENCHMENT AND DISTRIBUTION OF ARCHAEOLICAL SITES IN THE MIDDLE RIO PUERCO</td>
<td>69</td>
</tr>
<tr>
<td>ETHNOHISTORIC GROUPS IN THE CASAS GRANDES REGION: CIRCA A.D. 1500-1700</td>
<td>85</td>
</tr>
<tr>
<td>TOTAL ECLIPSES OF THE SUN IN THE ANASAZI COUNTRY, A.D. 700 TO 1700</td>
<td>99</td>
</tr>
<tr>
<td>GEOLOGY OF MOCKINGBIRD GAP SITE IN CENTRAL NEW MEXICO</td>
<td>115</td>
</tr>
<tr>
<td>MOCKINGBIRD GAP PALEOINDIAN SITE: EXCAVATIONS IN 1967</td>
<td>123</td>
</tr>
<tr>
<td>CHARACTERISTIC CAMPSITES FOR NATIVE AMERICANS OF THE SOUTHERN HIGH PLAINS</td>
<td>129</td>
</tr>
<tr>
<td>A PRELIMINARY LOOK AT EVIDENCE FOR LATE PREHISTORIC CONFLICT IN SOUTHEASTERN NEW MEXICO</td>
<td>135</td>
</tr>
<tr>
<td>ERRATA</td>
<td>147</td>
</tr>
</tbody>
</table>
FIGURES AND TABLES

ALEXANDER
Robert H. Weber.

BECKETT
Figure 1. Stratigraphy of the Moquino Site, showing Zone 4a. 15
Figure 2. Moq. 1 and 2 projectile points and bases (Beckett 1973:Plate XIII). 16
Figure 3. Sudden side-notched projectile points and bases (Holmer 1978:Figure 17). 17
Figure 4. Moq. 3 and 4 projectile points and bases (Beckett 1973:Plate XIV). 18
Figure 5. San Rafael projectile points and bases (Holmer 1978:Figure 18). 19

BICE
Figure 1. LA 13197 Site; dotted areas show excavations beyond exposing wall tops. 23
Figure 2. Date span for occupation of LA 13197 Pueblo. 24
Figure 3. LA 13197 composite ceramic signatures, with global and LA 13197 availabilities. 25
Figure 4. San Ignacio Black-on-white to Santa Fe Black-on-white ratio date gauge. 26
Figure 5. LA 13197 dump trench across wall base; northeast trench face. 28
Figure 6. Dump ratio of San Ignacio/Santa Fe versus levels. 28
Figure 7. Predicted dates versus SI/SF ratio dates. 33
Figure 8. Numbers of early and late sherds in dated locales. 33
Table 1. Locale Testing of Ceramic Seriation Method. 32

HIEB
Figure 1. 1890 census map of Moqui Country. 39
Figure 2. Dr. Jeremiah Sullivan, 1884. 40
Figure 3. Location of two residences attributed to Sullivan and a possible Government House on First Mesa. 42

KIRKPATRICK
Figure 1. Portion of Springer 30' by 60' quadrangle map showing Rayado and historic trails of northeastern New Mexico (Scott 1986). 52
Figure 2. Narciso Abreu Map of Rayado Plaza drawn in 1933, as it might have looked in 1859. 54
Figure 3. Plan view of Rayado Ranch (Kells 1994). 56
Figure 4. Wall and soil contact, Test Trench 5, south exterior wall of Room 18. 60
Figure 5. Rayado Ranch during the Abreu period. 67
Table 1. Summary of Artifacts by Material Type by Year. 58
Table 2. Tree-ring Samples from Maxwell/Abreu House, LA 86000, Area 1. 64
LOVE
Figure 1. Southwest corner of the U.S. Geological Survey reconnaissance
topographic map of 1888. 72
Figure 2. Southwest corner of U.S. Department of Agriculture Soil
Conservation Service photomosaic of the Rio Puerco valley, ca.
1935. 74

SCHAAFSMA
Figure 1. Casas Grandes interaction sphere, circa 1200–1425. 86
Figure 2. Ethnohistoric groups in the Casas Grandes interaction sphere
region, circa 1500–1700. 87
Table 1. Chronology of Areas Related to Casas Grandes Culture. 88

WADE
Figure 1. Solar eclipse shadow geometry. 100
Figure 2. Total solar eclipse of 1991 July 11. 101
Figure 3. 12 total solar eclipses between A.D. 700 and 1700. 105
Figure 4. Total eclipse on 804 April 13. 106
Figure 5. Total eclipse on 1097 July 11. 107
Figure 6. Total eclipse on 1257 June 13. 108
Figure 7. Total eclipse on 1259 October 17. 109
Figure 8. Total eclipse on 1372 September 27. 110
Figure 9. Total eclipse on 1379 May 16. 111
Figure 10. Total eclipse on 1397 May 26. 112
Figure 11. Total eclipse on 1557 April 28. 113

WEBER
Figure 1. Stratigraphy of the Mockingbird Gap Site. 118

WEBER and AGOGINO
Figure 1. Clovis points and end scrapers from the Mockingbird Gap Site. 125

WISEMAN
Figure 1. Locations of cultural areas in southeastern New Mexico. 136
Figure 2. Filingen Site map (LA 16297). 139
Figure 3. Feature 4 at the Smokey Bear Site (LA 2112). 141
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Papers</th>
<th>Pages</th>
<th>Year</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Collected Papers in Honor of Lyndon Lane Hargrave.</td>
<td>20</td>
<td>267</td>
<td>1974</td>
<td>$7.00</td>
</tr>
<tr>
<td>2</td>
<td>Collected Papers in Honor of Florence Hawley Ellis.</td>
<td>20</td>
<td>489</td>
<td>1975</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>3</td>
<td>Collected Papers in Honor of Margorie Ferguson Lambert.</td>
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<td>264</td>
<td>1976</td>
<td>$14.00</td>
</tr>
<tr>
<td>4</td>
<td>Collected Papers in Honor of Bertha Pauline Dutton.</td>
<td>11</td>
<td>206</td>
<td>1979</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>5</td>
<td>Collected Papers in Honor of Helen Greene Blumenschien.</td>
<td>12</td>
<td>252</td>
<td>1980</td>
<td>$14.00</td>
</tr>
<tr>
<td>6</td>
<td>Collected Papers in Honor of Erik Kellerman Reed.</td>
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<td>273</td>
<td>1981</td>
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<td>Collected Papers in Honor of John Runyon.</td>
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<td>202</td>
<td>1982</td>
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<td>8</td>
<td>Collected Papers in Honor of Charlie Steen Jr.</td>
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<td>287</td>
<td>1983</td>
<td>$14.00</td>
</tr>
<tr>
<td>9</td>
<td>Collected Papers in Honor of Harry L. Hadlock.</td>
<td>15</td>
<td>175</td>
<td>1984</td>
<td>$14.00</td>
</tr>
<tr>
<td>10</td>
<td>Southwestern Culture History: Collected Papers in Honor of Albert H. Schroeder.</td>
<td>21</td>
<td>258</td>
<td>1985</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>11</td>
<td>Prehistory and History in the Southwest: Collected Papers in Honor of Alden C. Hayes.</td>
<td>14</td>
<td>176</td>
<td>1985</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>12</td>
<td>By Hands Unknown: Papers on Rock Art and Archaeology in Honor of James G. Bain.</td>
<td>13</td>
<td>164</td>
<td>1986</td>
<td>$15.95</td>
</tr>
<tr>
<td>13</td>
<td>Secrets of a City: Papers on Albuquerque Area Archaeology in Honor of Richard A. Bice.</td>
<td>18</td>
<td>237</td>
<td>1987</td>
<td>$15.95</td>
</tr>
<tr>
<td>14</td>
<td>Reflections: Papers on Southwestern Culture History in Honor of Charles H. Lange.</td>
<td>19</td>
<td>288</td>
<td>1988</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>16</td>
<td>Clues to the Past: Papers in Honor of William M. Sundt.</td>
<td>25</td>
<td>387</td>
<td>1990</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>17</td>
<td>Puebloan Past and Present: Papers in Honor of Stewart Peckham.</td>
<td>18</td>
<td>227</td>
<td>1991</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>18</td>
<td>Archaeology, Art, and Anthropology: Papers in Honor of J. J. Brody.</td>
<td>20</td>
<td>241</td>
<td>1992</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>19</td>
<td>Why Museums Collect: Papers in Honor of Joe Ben Wheat.</td>
<td>20</td>
<td>267</td>
<td>1993</td>
<td>(Out of Print)</td>
</tr>
<tr>
<td>22</td>
<td>La Jornada: Papers in Honor of William F. Turney</td>
<td>17</td>
<td>225</td>
<td>1996</td>
<td>$19.95</td>
</tr>
</tbody>
</table>

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Preface

In the Fall of 1990, we were on a field trip to Ojo Caliente, near Monticello, Socorro County. One of the stops was the Indian Agency for Chiénde, also known as the "Red Paint People" or the Warm Springs band of the Chiricahua Apache. While walking up a side canyon, we came to a small mine with numerous small shafts dug into a reddish formation. Several of us wondered if this was the mine the Chiénde used to obtain the material for the red paint. A small sample was collected and sent to Bob. He promptly sent a note to me saying that the sample was a sandy clay with a reddish iron oxide, probably hematite. Bob suggested the material was probably swirled in water to separate the sand and clay and then the water was allowed to evaporate, thus concentrating the pigment for later use.

Many of us who have worked with Bob in the past have similar stories to share, especially about how he gives unselfishly of his time and knowledge. Bob has been a long-time supporter of the Archaeological Society of New Mexico and its activities. His involvement with the Society in many different roles has made the Society a better organization.

*Layers of Time* honors Bob for his outstanding contributions in geology, geomorphology, and archaeology to New Mexico and the Southwest. The Archaeological Society of New Mexico thanks you, Bob, for your work, time, and knowledge through the years.

David T. Kirkpatrick
Meliha S. Duran
Editors
March 1997

The editors wish to thank Bonnie E. Elder (*Busy B.E.E.'s Typing*, Las Cruces) for her assistance with and contributions to the desktop publishing for this volume.
Robert H. Weber at Soda Dam, Jemez Mountains
New Mexico Geological Society Field Conference, September 1996.
Lynn Alexander, Photographer.
If I were to rewrite my dad's story, the date and setting I would choose would look much different than that in which he has lived. His days would be filled with exploring ancient Indian villages, hunting, trapping, and panning for gold. His friends would include miners, trappers, ranchers, and Indians living along the Rio Grande Valley in the 1800s. Little would he know that, in the wake of his exploits, would come many changes: covered wagons leading westward, followed by the stagecoach and railroads. Nor would he be able to comprehend highways superseding rivers as principal arteries of transportation, the Great Plains tilled and planted, and the hum of great industries that would echo throughout towns and cities. Bob Weber was truly born in the wrong century. To his great benefit, though, he has been able to vicariously experience the lives of our antecedents through his unending quest for knowledge, research, hobbies, and stories of the past. These factors have had a great influence on the successful life he has lived as a son, a husband, and a father.

EARLY YEARS

Dad was born on February 8, 1919, in Wauseon, a small town in northwestern Ohio. His father, Joseph C. Weber, was a mechanic and merchant in Wauseon. His mother, Gladys Harrison Weber, held down the home front and made sure that the two active men in her life were well taken care of.

As a youth, Dad was an avid reader. He spent countless hours in the local Carnegie Public Library, devouring books on travel, exploration, history, and natural history, along with ancient tomes on geology. Unfortunately, at that time, there were no books on archaeology. The local region, however, was steeped in Indian lore, and he developed an unending interest in the local Indians and their artifacts.

Outdoor activities were the mainstay of Dad's life. The family's favorite recreational pursuits included hunting, fishing, camping, and boating. This also provided him with the opportunity to collect minerals, rocks, and artifacts from various parts of northwestern Ohio and southwestern Michigan. Boxes of rocks and fossils that Dad collected were a frequent source of concern to my grandfather, especially when packing up camping gear from their annual summer vacations on the eastern shore of Lake Michigan.

Closer to home, Dad's bicycle provided access to cultivated fields, gravel pits, and stone quarries within a 25-mile radius of Wauseon, where he collected artifacts, rocks,
and yes, more fossils. This part of Ohio was covered by a blanket of glacial drift and deposits of Lake Maumee, the more extensive glacial ancestor of Lake Erie, that contained a wide variety of exotic rocks and minerals scoured by the glacier from the Canadian Shield and northern Michigan. These deposits also provided a source of many of the lithic materials used by the local Indian tribes to manufacture artifacts.

The depression years of the 1930s required Dad to find an independent source of income. His jobs were many and varied—delivering papers, running a trapline, mowing lawns, and doing other household maintenance chores around town, manning the gas pump at a local filling station, and helping in the agricultural field. Since Wauseon is located in the heart of an extensive agricultural region and most of Dad’s relatives lived on farms, he developed a love of the land and a work ethic that got him safely through the War years. His roots were firmly planted in rural America.

Dad’s school years were agonizing, largely because the classroom confined him from the ever-beckoning outdoors. He did, however, enjoy science classes in the college prep curriculum, which he chose because of his burgeoning interest in the world around him. Regrettably, there were no earth-science courses, nor anything relevant to his archaeological interests, offered in Wauseon’s small-town high school. Lack of a mentor within the community compounded the problem.

COLLEGE

Upon graduation from Wauseon High School in 1937, Dad welcomed the challenge of preparing for a profession. Ohio State University at Columbus was selected as his most logical choice since it offered courses in his field of interest and was relatively affordable. The choice between a professional career in geology or archaeology was resolved by the economic conditions of the 1930s; there were essentially no jobs in archaeology although there might be a few in geology. Dad’s advisor tried to steer him into the more lucrative field of chemical engineering, but that did not fit his personal interests. Research in a laboratory setting could not begin to compare to research in the great outdoors. Obviously, one can guess what path he chose.

Dad’s college years as a geology major passed rapidly but, to his disappointment, a minor in archaeology was not possible. Dad had also chosen the Bachelor of Science degree rather than a Bachelor of Arts degree, because of its heavy dose of science rather than humanities. This, coupled with his ideology that archaeology was a distinct discipline (as in European institutions), Dad steered away from required courses in anthropology and sociology.

Jobs on campus were almost nonexistent, so, to help cover expenses, it was back to odd jobs of household maintenance at 25 cents per hour, augmented by short-term jobs measuring pine-tree seedling roots for the Forest Service and compiling data and structural contour maps for oil- and gas-exploration companies. Dad also had summer jobs waiting for him back home that ranged from weighmaster on a pea viner and in the bean fields to work on the canning line at a local factory, in addition to road work with local highway crews. Whenever time permitted, Dad hitchhiked 155 miles between Columbus and Wauseon in order to visit his parents and Margaret, the girl he left behind. He still recalls a snow-packed January night when he was sitting on his suitcase under the only stoplight on the main street of a little town. He was 9 miles from home and it was 3:30 AM before he
finally hitched a ride home to his loved ones. Imagine trying to do that in the world we live in today.

With graduation approaching in the spring of 1941, Dad decided to wed his girlfriend of 12 years during spring break. Dad and Mom were married on March 22 at Mom’s home in Wauseon. Margaret Ruhlin, Dad’s childhood sweetheart, became Margaret R. Weber, and the marriage was followed by a brief honeymoon at the Commodore Perry Hotel in Toledo, Ohio. Unfortunately, soon Dad returned to school and Mom returned to her job in Wauseon.

Soon after graduating in May of 1941, having received a Bachelor of Science with Distinction in geology, Dad’s highest priority was finding a job. The country had not fully recovered from the depression, and jobs were hard to come by. There were a few job possibilities for employment with the TVA (Tennessee Valley Authority) on hydroelectric power projects and with the U.S. Geological Survey, but it would take months before any jobs would materialize. So in June, Dad took his hitchhiking thumb West with stops in Indiana and Illinois, which also proved to be unproductive. He finally struck pay dirt in Tulsa, Oklahoma, where he was offered two jobs—one with Texaco on a seismograph crew and another with Shell Oil on a field-mapping crew. Dad chose Shell Oil and set off for Wichita Falls, Texas, for a week of familiarization with Texas geology, and then on to Olney for work with a field geologist with a bad back and a mean temper. Dad’s course in plane-table and alidade surveying at Ohio State paid off, and he was assigned to “run the gun” in mapping the geologic structure of two counties in north Texas. Dad immediately secured a room in a local boarding house and purchased (on time) a second-hand 1938 Chevrolet coupe that paved the way for his new bride to join him. Grandma and Grandpa Weber delivered Mom to Texas, as promised, and their full and rewarding life, comprising 56 years of marriage and companionship, finally got under way.

Their stay in Olney was short-lived, as Dad was transferred to Graham, Texas. It proved to be a pleasant town, and Dad was assigned a new crew chief—a tall, lanky, ranch-raised geologist whose only irrational fear was of rattlesnakes, of which they encountered many over the ensuing months.

THE MILITARY

My parents peaceful life came to an abrupt end following the December 7, 1941, bombing of Pearl Harbor. In the spring of 1942, Dad was transferred to Tulsa and was assured by his company that oil was critical to the war effort and his job was considered essential. However, after being confined to an office, Dad began to question just how essential his present position really was, and he ended up enlisting in the U.S. Army Air Force in August, but was not called to active duty until October. As a geologist, he was accepted into the Aviation Cadet program at Lowry Field near Denver, Colorado, for training in aerial photography. Mom found lodging in a small log cabin in Golden, which was primitive to say the least. Even though it lacked indoor plumbing and she had to cook on a small wood-burning stove, she made the best of it. Dad’s Cadet class was transferred to Yale University in New Haven, Connecticut, in January of 1943. It was a cold and vicious winter where they endured deep snow, sub-zero temperatures, blackouts, and no gasoline or heating fuel. Mom found quarters in Hamden with some other cadet wives, and, lacking fuel for the furnace in their two-story house, they attempted to heat only the living

Lynn E. Alexander

3
room with a fireplace. They had to use expensive cannel coal, purchased by the bag, and green oak cordwood that could not be ignited with a blow torch. A new and lasting meaning for the word “cold” soon developed.

With graduation from cadet school in March and a commission in hand, they headed back to Denver, detouring for a brief visit with Grandma and Grandpa Weber in Hopewell, Virginia, where Grandpa was stationed at Camp Lee. In Denver, Dad received training in photogrammetry (the preparation of maps from aerial photographs, primarily by the trimetrogon system). Upon certification as photogrammetric officers, the class was transferred to Peterson Field near Colorado Springs, where Dad was assigned to a squadron in the 6th Photo Group. Photogrammetric squadrons consisted of 2 officers and 26 men. Dad’s assistant proved to be a congenial oil-company geologist from Wyoming.

While in Colorado Springs, Mom and Dad wandered into a small gift shop where they were attracted to a shelf of matte black-on-black pottery signed by Marie and Julian. The names were unfamiliar to my parents, but they liked the pottery and decided to buy two pieces. Space and financial limitations dictated that their purchases be limited to one small bowl for themselves, costing $4.00, and a slightly larger one for Grandma and Grandpa Weber, which cost $4.25. It was years later that they learned what a mistake they made in not purchasing the larger plates and ollas on display.

In October, when Dad’s unit training was completed, he was alerted for shipment overseas. His unit, the 27th Photo Reconnaissance Squadron, was slated to join an 8th Air Force Photo Group in England.

Dad’s Squadron shipped out of New York Harbor on the *Athlone Castle*, a British cruise ship with a capacity of 900 that was now packed with 3,500 troops! It was part of a slow convoy, the largest assembled to date. In mid-ocean, a German propaganda broadcast reported that the *Athlone Castle* had been sunk at sea by a submarine, evoking a rousing cheer from the GIs packed on board. The conditions on the ship were so appalling that everyone on board could only hope that the ship would meet such a fate.

The 7th Photo Group included four squadrons, the 13th, 14th, 22nd, and 27th, which were located at Mount Farm near Dorchester and Oxford. Later on, foul weather over England and the Channel limited photographic missions and as a result, Dad’s squadron was transferred to a German airfield near Valenciennes along the Belgium border in northern France. Dad’s base later served as the forward supply point for transmitting materials to our troops during the Battle of the Bulge in Belgium, during the winter of 1944.

Dad returned to the United States on the *Queen Mary* in November of 1945. This trip proved to be much quicker (three days), while the troops were rewarded with balmy weather and calm seas. The sight of the Statue of Liberty as they hove into New York harbor was a sight to gladden the hearts of all on board.

**GRADUATE SCHOOL**

Shortly after Christmas, Mom and Dad headed west for the University of Arizona at Tucson, where Dad planned on enrolling for graduate school. All went well with their little Chevy packed to the hilt with their household necessities, until they reached Abilene, Texas. A State Police roadblock informed them that travel beyond that point was not permitted,
because of hazardous highway conditions resulting from heavy snowfall. They laughed and assured the police that Ohioans were used to coping with such conditions, and to their relief, they were permitted to continue. Later that night they arrived in El Paso, Texas, and found that eastbound travel had been halted and all accommodations were occupied. They decided to push on to Las Cruces, which was also blanketed with 8 inches of snow. Arriving at 12:00 AM, tired and hungry, the only sign of life was a light in the window of the local Chamber of Commerce. A friendly man, still on duty, informed them that there were no vacancies in town. A quick phone call to the man’s friend found them in a comfortable bed, which included a frigid, moonlit outdoor privy for their convenience. The next morning they traveled on to Tucson through a winter fantasyland of snow-mantled yucca and cactus.

Dad continued to major in geology with a minor in mining and metallurgical engineering. A graduate fellowship and a waiver of tuition along with the GI Bill allowed Dad to continue with his education. At this point, Mom and Dad decided that it was time to start a family, as the medical facilities were excellent at the University of Arizona, and they knew they would be there long enough to follow through with this new adventure. As a result, their older daughter, Laura Anne, was born in December of 1946.

The summer of 1947 was again spent in the Huachucas, but this time the accommodations were a miner’s shack at the end of a steep mountain road that ate automobile tires faster than they could be replaced. My parents lived right next door to the inactive Tungsten Reef mine, a gold mine until it began providing much-needed tungsten for the War effort. Dad’s summer pursuits became more diverse, as he also collected rattlesnakes for the Chicago Museum of Natural History.

The academic year passed quickly and, as the summer of 1948 approached, Dad was offered a job in the uranium fields on the Colorado Plateau with the Atomic Energy Commission. Appropriations failed to come through, so Mom and Dad decided to make a trip back to Ohio to visit their families before I arrived on the scene. They headed north, then eastward, stopping at the Grand Canyon and Bryce Canyon along the way. Disaster struck in Limon, Colorado, where the timing gear on the old Chevy expired after a long and courageous career. Eventually, they made it back to Ohio for a much-needed vacation.

Mom’s advanced pregnancy required her to fly back to Tucson while Dad, Grandma
Weber, and Laura traveled back by car. Grandma planned on taking care of the family while awaiting my arrival. I was born in September, which completed Mom and Dad’s intended nuclear family. Dad’s year passed quickly with weekends and holidays spent in the Huachuca Mountains picking up loose ends on his doctoral dissertation. Little did Dad know that several Clovis mammoth kill sites would be discovered later in the San Pedro Valley that bordered the Huachuca Mountains on the east. There was little evidence of archaeological manifestations in the heavily wooded mountains where Dad was working. Although preparation of his dissertation proved painfully slow, Dad’s completed manuscript was approved by the University of Arizona faculty in the spring of 1950.

**A CAREER IN GEOLOGY**

Dad’s new career, which spanned 35 years, began immediately at the New Mexico Bureau of Mines and Mineral Resources, a division of the School of Mines in Socorro. An eminent geologist, Dr. Eugene Callaghan, director of the Bureau, along with one other geologist, two mining engineers, and a chemist-assayer, rounded out the professional staff. In June, Dad returned to Tucson for graduation ceremonies and was rewarded with a diploma for a Ph.D. in geology.

Dad’s early assignments at the Bureau were varied and professionally rewarding. He mapped two perlite deposits, completed the mapping of the Carrizozo 15-minute quadrangle, followed by reconnaissance mapping of several 30-minute quadrangles in western New Mexico for the new state geologic map. Because the staff at the Bureau, as well as the college, was limited, Dad received a variety of assignments, including teaching courses in igneous petrology, the geology of ore deposits, and the microscopic and microchemical identification of ore minerals. Additional duties included interim service as mineralogist and the curator for an expanding mineral museum. The increasing demands of public-service work with prospectors, miners, and promoters during the uranium boom of the 1950s limited his fieldwork on other projects.

In the succeeding years, until his retirement in August of 1985 as Senior Geologist Emeritus, Dad found his time increasingly consumed by office and laboratory work. Much to his regret, many of his projects were put on hold in order to accommodate the public. At the same time, preliminary investigations of the Plains of San Agustín as a possible site for the VLA (Very Large Array) radiotelescope system were under way. This stimulated geologic mapping on a scale of 1:24,000 of 28 quadrangles over a period of years in which suitable topographic base maps were slowly made available. The results of this work have been only partially reported, so it will continue to be a source of future publications.

**AN AVOCATION IN ARCHAEOLOGY**

In the course of Dad’s geologic field investigations and as an avocational pursuit, the archaeological manifestations of New Mexico took on increasing significance. Of particular interest from a geologist’s perspective was the elusive evidence of a succession of Paleoindian complexes, which until recently had received little attention in central and western New Mexico. Through a series of investigations, Dad found a number of Paleoindian sites, among which the Mockingbird Gap site is most noteworthy for its record of major occupation as a Clovis campsite. In the ensuing years, Dad, in cooperation with Dr. George A. Agogino of
the Paleoindian Institute at Eastern New Mexico University, conducted a series of field schools sponsored by ENMU. These were the best years of my life, as my sister and I looked forward, with much anticipation, to helping with the “digs” that took place each summer. In the Weber household, this was considered a vacation, along with trips to Chaco Canyon, Mesa Verde, Canyon de Chelly, and other archaeological sites within the four-state region. It was not until I was 35, when my husband and I took our daughter to Disneyland for a “traditional” vacation, that I discovered what my friends in high school had really missed. The two-week campouts and explorations of various Indian sites were the most valuable experiences of my life.

Archaeological, as well as geological, investigations of Mockingbird Gap site, Blackwater Draw, Billy the Kid Cave, Agogino Cave, Lemitar (San Lorenzo 1) rock shelter, and the Ake site, along with other sites on the Plains of San Agustín, rewarded Dad with certification in Archaeological Geology by the Archaeological Society of New Mexico. Dad has been an active member of this society for a number of years, serving on the board of trustees, as president, as the recipient of an Archaeological Achievement award, and currently as an ex-officio member. Other related memberships include the Society for American Archaeology, the Albuquerque Archaeological Society, the Geological Society of America (Senior Fellow), New Mexico Geological Society, New Mexico Historical Society, Socorro County Historical Society and the Meteoritical Society. His interest in meteoritics has led to the discovery of 11 new meteorites and recognition and description of another from a New Mexico archaeological site.

Dad’s interest in the recognition of archaeological sources of lithic materials provided the basis for a series of seminars presented at the Gallup Field School on lithic materials and lithic typology. His experience in excavation techniques and laboratory analysis have ranged widely in a cultural sense, from two Clovis camp sites, a seventeenth-century pit house at the Mockingbird Gap site, PIII pit houses at the Tajo 2 site, a Piro pueblo at LA 282 near Socorro, Lemitar (San Lorenzo 1) Archaic rock shelter, the Belen Bridge site, pre-Revolt sites in Socorro, and the officers’ quarters, the hospital, and the laundresses’ quarters at Fort Craig.

Educationally, my parents always looked forward to the series of annual seminars offered in the 1970s at Ghost Ranch, directed by Dr. Florence Hawley Ellis, along with other certification-oriented seminars sponsored by ASNM. A course in Southwestern archaeology at New Mexico Tech provided a unique perspective on environmental constraints, and Dad’s attendance at annual meetings of the Archaeological Society of New Mexico, the New Mexico Archaeological Council, and other programs of archaeological papers, plus an extensive personal library, have enriched his understanding of a very challenging and rewarding discipline.

Whether Dad’s life took place in the 1800s or the 1900s, it would have been filled with a deep love and abiding interest in the people, the land, and the cultures of the surrounding area. There are few people in this world who can truly say that their career and hobbies have given them the ultimate fulfillment in life that we all seek to achieve, but in Dad’s case, this would certainly be true.

—Los Alamos

Lynn E. Alexander
ROBERT H. WEBER
RÉSUMÉ

Archaeological Society Affiliations

Society for American Archaeology
Archaeological Society of New Mexico
Albuquerque Archaeological Society
Center for the Study of the First Americans
Southwestern Mission Research Center

Offices Held

Archaeological Society of New Mexico
   President
   Board of Trustees
   Certification Council
   Advisor
   Instructor, Lithic Materials, Lithic Typology, Ghost Ranch Seminar, ASNM Field School
   (Heaton Canyon).

Awards

Archaeological Achievement Award, Archaeological Society of New Mexico, 1987.
Certification as Specialist in Archaeological Geology, Archaeological Society of New Mexico.

Publications and Manuscripts


   Ph.D. dissertation, Department of Geology, University of Arizona, Tucson.


1953   Raw Materials for the Chemical Industry in New Mexico (with Morris F. Stubbs).

1955a  Ardennite (Santafeite) from the Grants Uranium District, New Mexico (abstract) (with Ming


1957a *Geology and Petrography of the Stendel Perlite Deposit, Socorro County, New Mexico*. Circular 44. New Mexico Bureau of Mines and Mineral Resources, Socorro.


During the projectile point workshop, a part of the 1996 Archaic Conference, hosted by the New Mexico Archaeological Council, Tim Kerns brought out a projectile point and several illustrations of an undated Archaic point style that had been found in the San Juan Basin and did not fit into the local Archaic Oshara tradition. At that time, I told Tim about the Moquino excavations, which had contained a number of these projectile points, and how different the rest of the material culture was from the Oshara tradition projectile points and artifacts. The excavation also provided several radiocarbon dates. In addition, Pat Hogan (University of New Mexico), explained that a number of these points came out of the Sudden Shelter excavations in Utah. We both agreed that these points were named Sudden and San Rafael points.

The Anasazi Origins Project, conducted by Cynthia Irwin-Williams in the last half of the 1960s, was never written up as a complete project report. The Moquino Site was part of this overall project. The only published references to the Moquino Site were my thesis (Beckett 1973), a thesis on the lithic debris by Rex Adams (1980), and a brief mention of the site and its artifacts by Cynthia Irwin-Williams (1979). It seems worthwhile at this time to put this site and its cultural affiliation into its proper perspective.

THE MOQUINO SITE

Thirty years ago, Dr. Cynthia Irwin-Williams and I looked at an Archaic site in north-central New Mexico that had been previously identified by Dr. Jerry Dawson, then at the University of New Mexico, who kindly provided the Anasazi Origins Project with the surface collection he had made from the site. The surface artifacts and the radiocarbon samples that we collected, along with the dates that we extracted from hearths eroding out of the dune area, suggested that the occupants were entirely different from those of the Oshara tradition. This site appeared to have a distinctive material culture (both tools and material types), and we were so intrigued by this artifact assemblage that a two-year excavation project was conducted during the summers of 1968 and 1969.

The surface and excavated artifacts were looked at by Dr. Robert Weber, Dr. Vance Haynes, Dr. Irwin-Williams, and myself at different times. During the first year’s excavation, Dr. Herbert Dick spent a week with us in the field. All of us at that time agreed that the earlier level looked and dated to the Chiricahua Cochise occupation.

THE MOQUINO SITE

REEVALUATED

Patrick H. Beckett
The Moquino Site is located in Valencia County, New Mexico, north of the Laguna Indian Reservation. It is situated on the Cebolleta Land Grant, 2 km (1.25 mi) east of the village of Moquino. The site is situated on top of a sandstone bench at an elevation of 1,880 m (6,170 ft) above sea level. The site is in an eolian sand-dune zone situated on the southern half of the bench. The site overlooks a vast floodplain and is bounded on three sides by steep cliff faces making the access up to the site difficult unless approached by the southeast.

The Moquino Site had two distinct time periods represented: Zones 2a and 4a. Both are distinguished by distinct charcoal-darkened levels and radiocarbon dates. These two distinct levels were at that time labeled San Pedro and Chiricahua time horizons. I have questioned this distinction at least for Zone 4a for the last 20 years, as information from archaeological surveys in the San Juan region had been accumulating. It should be stated that Dr. Irwin-Williams firmly held fast to these artifacts being Cochise culture artifacts just prior to her death, as we discussed this particular artifact assemblage many times through the years.

Zone 4a, the level we are concerned with here, was characterized by a hard, packed, dark sand that covered a living floor (Figure 1). The excavated floor area was covered by broken and complete tools and nonindigenous flakes resulting from tool manufacture. Seven hearths and several manos and metates, some in direct association with specific fire hearths, were excavated on this level. One hearth yielded a $^{14}$C date of 3920 B.P. ± 155 or 1950 B.C. (based on its age, this date is probably not calibrated [Beckett 1973:208]). The predominant projectile points in Zone 4a are types Moq. 1–4 (Beckett 1973:Plates XIII, XIV). These are all side-notched with a straight to deeply concave base. All are unground and unserrated. Cryptocrystalline quartz and obsidian appear to be the dominant lithic material for projectile points.

DISCUSSION

There is no doubt that this projectile point assemblage is a distinct regional assemblage. It is Cochise as I originally labeled it (Beckett 1973), before any cultural-resource work or published site reports were done on similar sites in this region. They were definitely not Oshara, as we determined before of the Moquino Site was excavated.

The Moquino projectile points and their associated artifacts are very similar to those regional assemblages appearing in the eastern Great Basin and western Colorado and extending south into the San Juan Basin of New Mexico.

The projectile points from Moquino, labeled Moq. 1–4, were later named Sudden side-notched and San Rafael side-notched from excavations in Utah and described by R. N. Holmer (1978) in his doctoral dissertation and further delineated in the Sudden Shelter report (Holmer 1980) and in an essay in honor of Jesse D. Jennings (Holmer 1986). Moq. 1 & 2 are the same as Sudden side-notched (Holmer’s Figure 17; see Figures 2–3); Moq. 3 is the same as San Rafael side-notched (Holmer’s Figure 18; see Figures 4–5). The common name for these points in the Intermountain West is Northern side-notched. Holmer (1986:104) states that “By 2400 B.C. the Sudden and Hawken Side-notched points at Sudden Shelter were replaced by what I have called the San Rafael Side-notched.” This compares very favorably with the 1950 B.C. date from the Moquino site.
Figure 1. Stratigraphy of the Moquino Site, showing Zone 4a.
Figure 2. Moq. 1 and 2 projectile points and bases (Beckett 1973:Plate XIII).
Figure 3. Sudden side-notched projectile points and bases (Holmer 1978:Figure 17).
Figure 4. Moq. 3 and 4 projectile points and bases (Beckett 1973:Plate XIV).
Figure 5. San Rafael projectile points and bases (Holmer 1978:Figure 18).
As a result of all the cultural-resource survey and excavations in the regions to the north and northwest of the Moquino Site, it now appears that the site has closer relationships to the eastern Great Basin than to the southern Cochise culture, as was originally thought. A thorough study of these points, their associated artifacts, and their cultural affiliation is needed and should be a major research project in the San Juan area of New Mexico. On the other hand, many of the associated points found in zone 4a greatly resemble Chiricahua Cochise type points.

—COAS Publishing and Research, Las Cruces

REFERENCES CITED

Adams, Rex  

Beckett, Patrick H.  
1973  *Cochise Culture Sites in South Central and North Central New Mexico.* Unpublished M.A. thesis, Department of Anthropology, Eastern New Mexico University, Portales.

Holmer, Richard N.  


Irwin-Williams, Cynthia  
The dating of sites and their individual parts is important to archaeological projects. The process is known as seriating artifacts through time. Some fortunate field projects obtain enough dendrochronology, archaeomagnetic, or radiocarbon samples for fine-grained dating of the various site elements. However, when these types of date samples are limited but other temporal indicators, such as pottery and projectile points, are present, time seriation may be available to help fill the dating needs.

The initial use of pottery techniques for dating was based on Breternitz' (1966) correlation between tree-ring dates and pottery types obtained from many sites. Since that time, much additional information has been published, allowing Sundt (1987) to update Breternitz' correlation for northern and central New Mexico.

From these studies, a graphical time signature, in the form of a triangle, has evolved for each painted ceramic type. The base of the triangle represents the manufacturing time span for the type and provides the beginning and end dates. The apex of the triangle, rising above the mean point halfway along the base, represents the time of maximum popularity.

Gomolak (1980) suggested that the mean date be replaced by a date that is located two-thirds of the way along the base. His theory rests on a phenomenon in nature—that it usually takes longer for something to mature than it does for it to decline. The two-thirds position, sometimes referred to as the mode date, is the configuration adopted by Sundt (1987) and is the one used in my study.

In recent years, a number of researchers have made advances in using pottery techniques for time seriation. South (1977) recommended ways in which the mean dates could be used effectively for many applications, while Kruskal and Wish (1978) applied sophisticated statistical techniques called multidimensional scaling to significantly improve dating in certain situations. Goetze and Mills (1993) provide a review of these various techniques and their applicability to archaeological projects.

Faced with completing the report on the LA 13197 (AS-8) project of the Albuquerque Archaeological Society, I sought alternate means of using pottery for time seriation and developed the ratio program described in this paper. I use the data from site LA 13197 as a trial and proof-test of this program. Under prescribed circumstances, it should be applicable to other sites.
Late in the 1980s, the Albuquerque Archaeological Society completed its fieldwork on LA 13197, a project that it had undertaken at the request of the Bureau of Land Management. The objectives of the program were to map a 46-room pueblo, to obtain as much archaeological information as possible by fully excavating vandalized rooms and other limited areas, and to stabilize the site against further vandalism.

The pueblo, shown in Figure 1, is L-shaped, consisting of a northern wing and a western wing. On the plaza side of the west wing, a small kiva and associated dance platform had been built, and across the plaza/dump, a diagonal wall was constructed as a partial enclosure. In the 1950s, a bulldozer trench had been cut across the west wing near its south end, leaving a spoils pile noted as F-2 on Figure 1.

THE RATIO SERIATION PROGRAM

This seriation program was begun by choosing an occupation period between about A.D. 1170 and 1310 for the LA 13197 site. The beginning date of A.D. 1170 was based on the presence of a few sherds of Kwahe'e Black-on-white, which ceased production by A.D. 1175, and on a dendrochronology date of A.D. 1177, which came from Level D of the dump trench. The end date of A.D. 1310 was selected to include the A.D. 1300 start date for early Rio Grande Glaze wares, of which trace sherds were found.

After selecting the date span, the triangular signatures of the principal types of painted wares were fitted to that span, as shown in Figure 2. The individual triangles were based on Sundt (1987) and on the San Ignacio signature proposed by Bice (1994).

The next step was to produce a ceramic signature for the LA 13197 site as a whole. The full procedure is shown in Figure 3, which consists of Charts 1 and 2 and related Graphs 1 and 2.

The areas of each 10-year span in each of the triangles shown in Figure 2 were measured, totaled, and then converted to percentages, as shown in Figure 3, Chart 1. They represent the theoretical time distribution of the site's painted pottery, if each type were present on site in accordance with its global availability.

Global availability, of course, could not have prevailed on the site, since only two of the painted ceramic types, Santa Fe Black-on-white and San Ignacio Black-on-white, were abundant, either because they were made locally or by nearby neighbors. The rest of the painted pottery was imported as trade wares, in far fewer numbers. Thus, it was necessary to modify the theoretical percentages by weighting them with the actual percentages of types found on the site. This procedure produced Chart 2.

Graph 1, at the bottom of Figure 3, presents the global availability data from Chart 1. The stacked percentages through time of Santa Fe Black-on-white (bottom), San Ignacio Black-on-white (middle), and Other (top) result in a dome-shaped signature for the site. The Other types predominate, since the chart assumes that all types were fully available in accordance with their individual signatures.

Graph 2, presenting the information of Chart 2, weights the data by local availability. The Other types have shrunk to a small band at the top of the graph, and most of the area is now occupied by Santa Fe Black-on-white and San Ignacio Black-on-white.
Figure 1. LA 13197 Site; dotted areas show excavations beyond exposing wall tops.
Figure 2. Date span for occupation of LA 13197 Pueblo.
**Chart 1. Global AS-8 Site Ceramic Signature in Percent.**

<table>
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<tr>
<th>YEARS AD</th>
<th>1175</th>
<th>1185</th>
<th>1195</th>
<th>1205</th>
<th>1215</th>
<th>1225</th>
<th>1235</th>
<th>1245</th>
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<th>1275</th>
<th>1285</th>
<th>1295</th>
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</thead>
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<td>POTTERY TYPE</td>
<td>Kwaha'a</td>
<td>Tularosa</td>
<td>San Juan McElmo</td>
<td>Santa Fe</td>
<td>San Ignacio</td>
<td>St. Johns</td>
<td>Vallecitos</td>
<td>Gallisteo</td>
<td>Early RG Glaze</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>0.19</td>
<td>2.18</td>
<td>2.22</td>
<td>0.44</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TOTAL</td>
<td>0.19</td>
<td>2.18</td>
<td>2.22</td>
<td>0.44</td>
<td>0.05</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>5.1</td>
<td></td>
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**Chart 2. AS-8 Site Ceramic Signature. Global weighted by Site Percentages.**

<table>
<thead>
<tr>
<th>YEARS AD</th>
<th>1175</th>
<th>1185</th>
<th>1195</th>
<th>1205</th>
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<th>1225</th>
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<th>1285</th>
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<tbody>
<tr>
<td>POTTERY TYPE</td>
<td>Kwaha'a</td>
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<td>San Juan McElmo</td>
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<td>San Ignacio</td>
<td>St. Johns</td>
<td>Vallecitos</td>
<td>Gallisteo</td>
<td>Early RG Glaze</td>
<td>Total</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>%</td>
<td>0.73</td>
<td>0.22</td>
<td>0.33</td>
<td>1.11</td>
<td>0.09</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.73</td>
<td>0.22</td>
<td>0.33</td>
<td>1.11</td>
<td>0.09</td>
<td>0.02</td>
<td>0.00</td>
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<td>0.00</td>
<td>2.5</td>
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</tbody>
</table>

**Figure 3. LA 13197 composite ceramic signatures, with global and LA 13197 availabilities.**
Figure 4. San Ignacio Black-on-white to Santa Fe Black-on-white ratio date gauge.

**CHOICE OF SERIATION METHOD**

In Graph 2, the two dominant types of pottery, Santa Fe Black-on-white and San Ignacio Black-on-white, vary in relative amounts through time. In the early years, San Ignacio builds up more slowly than Santa Fe, but Santa Fe terminates in the later years. The ratio between the two pottery types, as it changed through time, was chosen as the gauge to be used in assessing dates for various locales throughout the site. This gauge is shown in Figure 4, which drew upon 1,946 painted sherds. Of these, 1,652 were of the San Ignacio and Santa Fe types that went directly into the gauge ratios. The dates are more sensitive to the ratio change in the early and late years than in the middle years.

Using the gauge requires very much smaller numbers. Goetze and Mills made a very exhaustive application of various methods of obtaining dates from pottery. When applying the Mean Dating method, which uses the center points of pottery signatures, they recommended that a minimum sample size of 10 sherds be used for any one date. In their applications, the sample included all of the painted types that were collected. My conclusion was that the same number of 10 be used as a guide, which would be conservatively appropriate when applied to only the San Ignacio/Santa Fe part of the collections.

Eighteen groups of sherds from various locales were dated. The average sample size was 45 sherds, excluding one very large sample. Two small samples were used: the first with 12 sherds, and the second with 8 sherds, which, although below the general minimum, was included on a judgmental basis.
As shown at the bottom of Figure 4, the total time span of the gauge was broken into five equal, 20-year eras. For date predictions to be made subsequently in this paper, the following mid dates of each era are used:

- Early: A.D. 1185
- Mid Early: A.D. 1205
- Mid: A.D. 1225
- Mid Late: A.D. 1245
- Late: A.D. 1265

**TESTING THE SERIATION RATIO GAUGE**

Verification of the gauge as a tool requires that it be tested by means independent of the pottery ratios. The most obvious first test was provided by a layered excavation in the LA 13197 dump.

**Dump Stratigraphy**

In the dump, a trench was excavated across the still-standing base of the enclosing wall that had bounded the dump/plaza. This trench, 1 m wide by 6.3 m long, was dug in 10-cm levels to a maximum depth of 60 cm. Its main purpose was to obtain stratigraphy and artifact counts inside and outside the wall.

As shown in Figure 5, the trench was excavated to bedrock in all but two places: one place at the east end where sterile soil rose to near the surface, and the other, immediately under the wall base. The total sherd count (not just San Ignacio and Santa Fe Black-on-whites) found in each level and grid is noted in Figure 6. Three sherds were recovered from within the otherwise sterile soil, having probably been carried to this depth by rodent action. The sterile boundary should approximate the ground surface that prevailed prior to dumping.

As a general property of stratigraphic excavations, it would be predicted that the deep levels would contain earlier materials than the shallow levels. Exceptions would occur if special circumstances had seriously mixed or inverted the strata.

There were no indications of mixing or inversion in the below-surface levels of this part of the LA 13197 dump, but there were strong indications of mixing on the surface, probably as a result of the construction of the wall.

Thus, the bar chart of Figure 6 shows San Ignacio surface ratios of Santa Fe Black-on-white that represent nonroomblock areas of the site. Within the below-surface grid levels, it was necessary to merge levels D, E, and F in order to provide a statistically significant number of deep sherds. Noted in parentheses are the number of these two types of sherds in each level.

With one exception, the bars show that the ratio progressively increased from the lowest levels (D, E, and F), through levels Cw, B, A, and Surface.

The anomalous ratio of 2.2 that appears east of the wall in Level C is believed to be real, representing 30 sherds total. Causes for the anomaly could include the possibility that during the Level C time frame, this part of the dump was used by a household favoring San Ignacio pottery. However, the remaining evidence is solid, indicating that the ratio of San Ignacio/Santa Fe pottery did indeed increase with shallower depths and thus with time.

Therefore, trusting that surface deposits of the site and the below-surface deposits, by levels, broadly represent the site’s ceramic history, the graph supports the validity of the
Figure 5. LA 13197 dump trench across wall base; northeast trench face.

Figure 6. Dump ratio of San Ignacio/Santa Fe versus levels.
ratio of San Ignacio to Santa Fe as a time
seriation gauge.

Seriation of Other Locales
Within the LA 13197 Site

Another check on the validity of the
seriation method was made by applying it to
other areas within the site where era or date
predictions, based on excavation observations,
could be made. These locales were generally
centered on partially vandalized rooms, those
targeted by the project research design for full
excavation.

The types of collections that lent
themselves to making date predictions were
special volumes and fill volumes.

Special volumes included collections from
excavation volumes that were thought to
contain artifacts covering a limited time span.
Three criteria were found to be applicable:

1. Floor surfaces and/or roof fall in
structures that showed artifactual
evidence of having been occupied until
the time of site abandonment. Expected
to date Late.

2. Floor surfaces that had seen little use
for some time or were used for trash
disposal. Expected to date Early or
Mid-Early for bottom layers and later
for upper layers.

3. Subfloors or subsurfaces that contained
artifacts imbedded over an extended
period of time. Expected to date Early
or Mid-Early.

The fill for rooms was defined as the
volume above roof fall. For nonroom features,
it was a described fill. The dating was based
on comparisons that indicated earlier or later
times than other fills or special volumes.

With these guides in mind, nine site locales
are discussed. Each locale has one or more
sublocale volumes that held a minimum of 10
San Ignacio and Santa Fe sherds and complied
with one of the above definitions.

North Wing

North Wing-West. A special volume in
Rooms W-1 and W-2 contains sherds
associated with the floors and firepits, which
appear to have been abandoned with some
occupation materials in place. A Late era with
a mid date of A.D. 1265 was predicted. The
archaeomagnetic date of A.D. 1265 was taken
from the firepit in Room W-1.

North Wing-Central. The special volume
for this group came from the roof falls and
floors of Y-8 and Y-5.

Room Y-8 had three probable periods of
occupation. The first was as a large circular
or oval ramada built prior to the masonry
pueblo. The second occupation occurred as the
masonry rooms were built, and the third
occupation followed the reshaping of an
opening into the adjacent Room Y-5. Cultural
material on the floor of Y-8 was miscellaneous
and complicated by vandalism, disturbing
the interface between the early circular
ramada and the later pueblo occupations.
Thus, the material is a mixture of predicted
eras, Early and Mid, which converts to
Early-Mid at A.D. 1205.

Room Y-5 was a later outside ramada with
no south wall and only a stub west wall. It
communicated with Y-8 through a wall
opening that, at an earlier time, had been
larger. This later ramada contained the
abandoned remnants of a double mealng bin
and evidence of use as a local trash depository with occasional small fires.

The fill-volume sherd, reflecting trash deposition, were predicted to be much later than the special-volume sherds, which reflected earlier occupation surfaces. The predicted date was A.D. 1260.

One dendrochronology date of A.D. 1273 was obtained from charcoal in the trash. The nature of the charcoal's position indicated that it was deposited or burned in place after the room was abandoned.

North Wing-East, South Row. A special volume came from Rooms X-5 and Y-1, which were completely excavated. The cultural material resting on the floor and in the roof fall represented artifacts in use at the time the rooms were abandoned. The predicted era was Late, or A.D. 1265. An archaeomagnetic date of A.D. 1265 was taken from the firepit in Room Y-1.

North Wing-East, North Row. Room X-7 was completely excavated, and wall outlines for the rest of the rooms in this section were exposed. The only set of sherds large enough to analyze was from the fill volume. The room joints indicated that this set of rooms should predate the previously described contiguous rooms in the south row. Thus a MidLate era was assigned, equal to A.D. 1245.

West Wing

West Wing-Central. The special volume included the fill below roof fall in Room Z-9 and the floor contents. The room had been converted to storage, and contemporary late materials, if any, were cleaned out when the site was abandoned. An Early era, or A.D. 1185, was predicted.

Kiva and Associated Room F-7. The special volume was defined as the depressed floors of the kiva F-8, the higher floor of the kiva on the east side (F-20), and the three floors of F-7. Most materials in the kiva had been left in-situ at time of abandonment. However, when combined with Room F-7, which contained some earlier materials imbedded in the floor, the predicted date was chosen as MidLate, or A.D. 1245.

The dates of the fill volume sherds were predicted to be later than those of the special volume, since they did not reflect the earlier sherds imbedded in the floors of F-7. The prediction was A.D. 1260.

A dendrochronology date of A.D. 1283 was obtained from a post in the fill of the kiva. It could not be determined if it was roof material or possibly a misplaced floor post. In any event, it is the latest discrete date on the site and probably comes from some relatively late remodeling.

The fill volume came from two features, F-22 and F-23, that were excavated outside the kiva's south wall, while searching for a ventilator. No vent was found, but the fill volume, by its nature, should predate the kiva occupation period. The predicted era was MidLate, or A.D. 1245.

Feature 1 is the dance platform near the kiva. A low retaining wall bounded it on the west side. A special volume included sherds from preconstruction of the platform surfaces, which also held an early ash pit. A Mid-era prediction was made, converting to a date of A.D. 1225. A fill volume included the material between the surface of the platform and the early occupation surfaces. The predicted era should be later than these occupation surfaces and also later than the special volume of the kiva, which had been
influenced by F-7 earlier floor levels. The prediction was A.D. 1250.

**West Wing-South, Z Room Complex.** The special volume contained materials from the floor, firepits and below-the-roof fall of vandalized rooms Z-2, Z-4, and Z-6. The informality of the firepits and the condition of the artifacts suggested greater antiquity than other rooms that had been excavated, and the few materials left on the floor were not indicative of late abandonment. These factors provided a predicted era of MidEarly, or A.D. 1205.

Three tree-ring dates were obtained from these rooms, two at A.D. 1212 and one at A.D. 1221 (average A.D. 1215).

**Summary of Dating**

A summary of these observations and predicted dates is contained in Table 1. The first two columns list the Locale Codes and their associated locales. The third column contains sublocale volumes, indicating the special volume or fill volume, previously defined.

The observations used in making era or date predictions are listed in the fourth column, and the fifth column holds the dates deduced from the observations, in the form of middle dates of eras (defined in Figure 4) or other specific dates. The sixth column contains the dates derived from the ratio of San Ignacio and Santa Fe Black-on white, while the seventh column reflects applicable tree-ring or archaeomagnetic dates. The eighth column contains special comments.

The demonstration of the seriation gauge's integrity is the comparison of the predicted dates against the dates from the ratio of black-on-white sherds, and against dendrochronology or archaeomagnetic dates. Figure 7, containing this comparison, shows that the correlation is very good, with an average difference between predicted dates and the ratio dates of about seven years.

The tree-ring/archmagnetic dates also closely reflect the predicted and ratio date patterns, except in subgroup KIVb, which is from the kiva fill. This tree-ring date comes from the remnants of a post or small beam, and is the latest date obtained anywhere on the site. It is believed to represent some remodeling or other late activity.

**DATED SUBGROUPS CONTAINING EARLY AND LATE SHERDS**

As a final check of the seriation method, a study was made of the location of early and late sherd types within the dated subgroups. Referring to Graph 2 of Figure 3, little platforms exist at each end of the graph, consisting of largely Kwahe’e Black-on-white (early) and Rio Grande Glaze (late) sherds, respectively.

Each of the Kwahe’e and Rio Grande Glaze sherds associated with a dated sublocale was logged. Figure 8 shows the percentage of early and late sherds against the dates of the sublocales in which they were found. There are two distinct distributions in which the early sherds are widely scattered from A.D. 1190 to 1265, and the late sherds are tightly clustered between A.D. 1250 and 1265. The distributions demonstrate a modest correlation with early sherds in early dated areas and late sherds in late dated areas.

However, it is probable that the early sherds would have clustered much more tightly had they matched the late sherds in the amount of time that they represented on the site during the occupation period of the
<table>
<thead>
<tr>
<th>Locale Code</th>
<th>Locale</th>
<th>Sublocale Volume Containing Sherds</th>
<th>Observations</th>
<th>Predic Date</th>
<th>SI/SF Date</th>
<th>Dendro. Archmag.</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWW</td>
<td>North Wing-West</td>
<td>a Special-floor and firepits</td>
<td>Household materials in-situ, Late</td>
<td>1265</td>
<td>1275</td>
<td>1265</td>
<td></td>
</tr>
<tr>
<td>NWC</td>
<td>North Wing-Central</td>
<td>a Special-early floors &amp; below-roof fall</td>
<td>Pothunter mix of Early and Mid</td>
<td>1205</td>
<td>1180</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b Fill-above roof fall</td>
<td>Much later than special, above</td>
<td>1260</td>
<td>1275</td>
<td>1273</td>
<td></td>
</tr>
<tr>
<td>NWES</td>
<td>North Wing-East, S Row</td>
<td>a Special-floor and fill below roof fall</td>
<td>Household materials in-situ, Late</td>
<td>1265</td>
<td>1265</td>
<td>1265</td>
<td></td>
</tr>
<tr>
<td>NWEN</td>
<td>North Wing-East, N Row</td>
<td>a Fill-upper wall excavation</td>
<td>Earlier than South Row per wall joints</td>
<td>1245</td>
<td>1255</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>WWC</td>
<td>West Wing-Central</td>
<td>a Special-floor and fill below roof fall</td>
<td>Without late habitation, thus Early</td>
<td>1185</td>
<td>1195</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>KIV</td>
<td>Kiva F-8 &amp; Room F-7</td>
<td>a Special-floor of Kiva F-8 and Rm. F-7</td>
<td>Late in-situ items &amp; earlier F7 floors</td>
<td>1245</td>
<td>1250</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b Fill-kiva</td>
<td>Later than special, above</td>
<td>1260</td>
<td>1260</td>
<td>1283</td>
<td></td>
</tr>
<tr>
<td>OSK</td>
<td>Outside of Kiva F-8</td>
<td>a Fill-external to south kiva wall</td>
<td>Should predate kiva</td>
<td>1245</td>
<td>1250</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>DPL</td>
<td>Dance Platform</td>
<td>a Special-preplatform occupation surface</td>
<td>Much earlier than kiva</td>
<td>1225</td>
<td>1215</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b Fill-surface to base of retaining wall</td>
<td>Later than preplatform occupation surface</td>
<td>1250</td>
<td>1255</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>WWS</td>
<td>West Wing-South</td>
<td>a Special-floor and fill below roof fall</td>
<td>Informal firepits and patina, MidEarly</td>
<td>1205</td>
<td>1200</td>
<td>1215</td>
<td>Av. 1212, 1212, 1221</td>
</tr>
</tbody>
</table>
Figure 7. Predicted dates versus SI/SF ratio dates.

Figure 8. Numbers of early and late sherds in dated locales.
pueblo. The Kwahe'e Black-on-white sherds were subject to many more decades of dispersal by living activities than were the glaze ware sherds.

**SUMMARY AND CONCLUSIONS**

The pottery-ratio method for seriating dates, described here, was developed for the LA 13197 project. Two locally and/or regionally made varieties of painted ware, Santa Fe Black-on-white and San Ignacio Black-on-white, were abundantly available on the site. The signatures of the two types were sufficiently different in time span and period of maximum popularity so that they could provide time-dependent ratios to be used as a tool for time seriation.

The dates derived from these ratios reflect some type of middle date for each lot, since the sherds in each collection accumulated over a distinct period of time.

A number of different areas from within the site provided date-related information independent of the pottery ratios, so that the validity of the method could be tested. The first test was the stratified dump levels, in which the lower levels provided earlier ratio dates than did the upper levels. Validity checks also came from 12 sublocales (Table 1, column 3) from throughout the site, each of which contained a sufficient number of ratio sherds to allow ratio dating. The correlation between the independently predicted dates and the San Ignacio/Santa Fe ratio dates was very good. Finally, when early and late sherd types were associated with dated locales, they provided a modest correlation between type and date.

It is concluded that the overall validity of the method is demonstrated by these tests.

The broad applicability of the method to other sites rests on the requirement that two or more dominant types of pottery with different time signatures be present. If this requirement is met, the system should also be applicable for seriation among different sites that have the same general pottery mix. The method is now being applied to a complex of sites associated with LA 13197, and it appears to work for such intrasite comparisons.

**ACKNOWLEDGEMENTS**

I wish to acknowledge with much appreciation the cataloging system designed by Bill Sundt for the LA 13197 ceramics, the all important ceramic sorting and classifying largely carried out by Bettie Terry, and the compilation of superior computer databases by Phyllis Davis.

—Albuquerque Archaeological Society, Albuquerque
REFERENCES CITED

Bice, Richard A.

Breternitz, David A.

Goetze, Christine E., and Barbara J. Mills

Gomolak, Andrew R.

Kruskal J. B., and M. Wish

South, Stanley

Sundt, William M.
This essay provides something of the story of two men—Alexander MacGregor Stephen and Jeremiah Sullivan, M.D.—and their accounts of the Hopi people of First Mesa in the 1880s. As Trouillot (1995) has noted, "any historical narrative is a particular bundle of silences." What breaks the silence of what we know about Stephen and Sullivan is mainly the descriptions written by those who traveled to the Hopi villages at that time, often to see the Snake ceremony performed in the village of Walpi. My interest in these two men was prompted by an occasion to reread "The Hopi Indians of Arizona," a manuscript without author or title that F. W. Hodge edited and published in serial form in *The Masterkey* in 1939–1940 and reissued in the Southwest Museum's *Leaflet* series ([Stephen] 1939–1940).

The author of the manuscript wrote after seeing the 1885 Snake ceremony performed at Walpi and makes reference to "the last three occasions" (i.e., the performances of 1881, 1883, and 1885). Given the place, the date, and the content, Hodge reasoned the article to be that of Alexander MacGregor Stephen, who lived at Keams Canyon, Arizona, 10 mi east of the Hopi First Mesa from 1880 until his death in 1894. Stephen said he was an "explorer" and a "prospector" in the 1880 census, but he is remembered today for his detailed accounts of Hopi social, ceremonial, and intellectual life at the end of the nineteenth century.¹

Like the many others who have used "The Hopi Indians of Arizona" in their research, I accepted the reasoned authority of the editor that it was Stephen's work. But in rereading the work, I realized for the first time that the manuscript lacked the formal elegance of Stephen's essays. On comparison, the orthography of Hopi words as well as the content of the descriptions of the Walpi Snake ceremony in the 1885 manuscript differed significantly from those of Stephen's notebook of the same year. Curiously, there was a maturity of understanding of many features of Hopi religion here that exceeded Stephen's work of the 1890s. There were enough differences to make me ask: who else might have written this work? And, when I was provided the opportunity to study the original manuscript in the collections of the Southwest Museum (Los Angeles), it became clear that the author may not be Stephen. It was, I will suggest, Jeremiah Sullivan, M.D., the son of a former Hopi agent, who lived on the Hopi First Mesa from 1881 until 1888—a young man whose presence forever changed Hopi history.
TWO MEN

Stephen and Sullivan were not only contemporaries, they were both observers of daily life on First Mesa and in the Hopi villages of Walpi and Sichomovi and the Tewa-speaking village of "Tewa" (or Hano) (Figure 1). Both left manuscripts that were published by others, Stephen's being superior in quality and quantity. And yet, in 1888, Sullivan wrote, "I have a vast quantity of material, which is now being put in shape for publication." The 1885 manuscript is not in Stephen's hand nor that of Sullivan, but Sullivan's statement may be understood to mean that a clean copy was being prepared. Sullivan did not title his brief ethnographic accounts but signed them at the end. This manuscript, without signature, stops at the end of a page and may be incomplete.2

While a comparison of the manuscript with Stephen's work is enough to raise some uncertainty concerning his authorship, the chronology of ethnological research on the Hopi First Mesa gives priority to a claim for Sullivan’s authorship of "The Hopi Indians of Arizona."

Stephen

Alexander MacGregor Stephen was born in Scotland. He came to the United States in 1862 and served in the New York Infantry during 1862–1866. His kinsman, Thomas V. Keam, came to the United States from Wales and served in the First California Cavalry beginning in 1862 and later in the First New Mexico Volunteer Cavalry, 1865–1866. In 1869, Keam became the Spanish interpreter at the Fort Defiance Agency and then a special agent to the Navajo, 1872–1873. From 1875–1902 he was licensed to trade with the Hopi and operated a trading post in the canyon which bears his name (McNitt 1962).3

Stephen’s name reappears in 1880 in the census of "Keam’s Kanyon," where he is listed as a “boarder” with Keam and 40 years old. In 1881, John Gregory Bourke (1884:80) described Stephen as “a bright Scotchman who, during the past twelve years, has had considerable experience as a metallurgist and mining prospector in Nevada and Utah,” a period of time coincident with Keam’s employment among the Navajo and Hopi.

As is clear from his publications,4 Stephen had mastered the Navajo language before beginning to learn Hopi; indeed, even in the 1890s he used Navajo in gathering materials from Hopi (e.g., in 1893: “this I don’t understand...it may be for lack of language, he of Navajo and I of Hopi”). Between 1883–1885, Stephen recorded in English a number of Hopi tales and migration traditions, a project he was to repeat in 1893 (Stephen 1889, 1893). Elsie Clews Parsons, who edited them for publication, commented:

These earlier tales, although heard from some of the same informants as the later tales, seem in many ways different in character, almost giving the impression at times of a different culture. This is perplexing to the editor who suggests it may be due largely to the recorder’s comparative unfamiliarity with the Hopi people and their language at the earlier period, perhaps to his greater familiarity with the Navaho, for the narrative has something of a Navaho character, perhaps also to the form his inquiry may have taken, along the lines of historic origins. [Stephen 1929:2]

By 1883, Stephen had begun to collect and study Hopi pottery—prehistoric and contemporary—and was to complete a detailed manuscript, “Pottery of Tusayan: Catalogue of the Keam Collection,” in 1890 (Green

38 ASNM 23: Papers in Honor of Robert H. Weber
Figure 1. 1890 census map of Moqui Country.
Although he continued to prospect, in 1885 Stephen contributed to Victor Mindeleff’s (1891) *A Study of Pueblo Architecture in Tusayan and Cibola*, providing information on the construction and meaning of the Hopi ritual structure, the kiva, as well as material for the “Traditional History of Tusayan.” “Stevens” attended the Snake ceremony at Walpi with Bourke’s party in 1881; however, 1885 also marks the first of his efforts to record Hopi ceremonial life—a fragmentary description of the public performance of the Snake ceremony at Walpi (Parsons 1935:580–586).6

Stephen again made partial records of the 1887 and 1889 Walpi Snake performances. In a newspaper account of the 1889 Walpi observance coauthored by Stephen, he is described as “an Ethnologist who has been studying these people for the past ten years” (Stephen and Messenger 1889). However, it was not until 1890, when Jesse Walter Fewkes, as director of the Second Hemenway Expedition, enlisted Stephen’s assistance in recording Hopi ceremonial and daily life, that extensive documentation took place. In 1892, if not earlier, Stephen periodically stayed on First Mesa to facilitate his research and to write in his journals. It is these accounts that Watson Smith characterized as “astoundingly rich, profusely illustrated by eye-witness sketches, and filled with minutely detailed descriptions of almost every event that he experienced.”

On February 28, 1894, Stephen wrote to Dr. Washington Matthews, “I think that with one more year up here I will have sufficient data for a comprehensive monograph, but an interruption now would really be a disruption of my scheme of work and would about ruin me” (Stephen 1894). He died in Keams Canyon, April 18, 1894.

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**Sullivan**

Jeremiah Sullivan arrived at the Moqui [Hopi] Indian Agency on Christmas day, 1880, a little over two months after his father, John H. Sullivan, began serving as agent. Jeremiah Sullivan’s home had been in Madison, Indiana, but little else is known of his background—including the nature and extent of his medical training. Already on December 2, Agent Sullivan had petitioned the Commissioner of Indian Affairs seeking a waiver of the Bureau’s nepotism rules to permit the appointment of his son as agency physician, a request which was granted January 31, 1881 (McCluskey 1980:372).7

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**Figure 2. Dr. Jeremiah Sullivan, 1884.**

Frederick J. Dellenbaugh photograph.

In order to better serve the people of First Mesa, Agent Sullivan wrote of his son, “the physician, who spends much of his time in their villages, has his office and lodges in the government building located in the second village” (Sullivan 1881:5). In his survey of
the architecture of Sichomovi in September, 1882, Victor Mindeleff noted “three small detached houses, each composed of but a single room, a feature not at all in common with the spirit of pueblo architecture.” Mindeleff continues, “Of these single-room houses, one, near the south end of the long row, was being built by an American [Jeremiah Sullivan], who is now living in another such house near the middle of the row” (Mindeleff 1891:62; Figure 3).8

In August, 1881, Jeremiah Sullivan attended the first of three, alternate-year, performances of the Snake ceremony in Walpi that he was to observe before the 1885 manuscript was written. On this occasion he facilitated the research of John Gregory Bourke, whose visit resulted in The Snake-Dance of the Moquis of Arizona (1884). Respecting the secrecy of kiva activities, Bourke wrote in his diary, “Dr. Sullivan told me that no one was to enter the Estufas,” but “for the sake of Science” Bourke and his men did and made notes of all they saw (Sutherland 1964:534-536).9 Sullivan provided information which Bourke confirmed, and Bourke interviewed Hopi and confirmed what he had learned from Sullivan, Bourke using Spanish and Sullivan the Hopi he had acquired.

Overshadowing these events, however, was a conflict between the Presbyterian missionary to the Hopi, Reverend Charles A. Taylor, and Agent John H. Sullivan, a conflict between the Grant “peace policy” of civilizing (assimilating/acculturating) the American Indian through evangelism and education and the perspective of the Agent: “They have a civilization peculiarly Moqui which we magnanimously denominate half-civilized” (Sullivan 1882:102).10 Reverend Charles A. Taylor’s brother William, who had also sought the position of Agent, became the teacher at the Agency school, which failed, a failure which the Taylors blamed on the influence of the Agency Physician, Jeremiah Sullivan. At about the same time, Agent Sullivan lost support for the $15,000 bond required in order to disperse government funds, which resulted in his demotion to “Farmer-in-Charge” (McCluskey 1980:375). Because of John H. Sullivan’s inability to raise his bond and continued attacks by the Taylors and Sheldon Jackson (Superintendent of Indian Schools of the Presbyterian Denomination), he was removed and Jesse Fleming was nominated as his replacement as agent in November 1881. With Fleming’s arrival, John H. Sullivan left on February 22, 1882, and moved to Albuquerque, New Mexico.

Two weeks later, on March 7, Agent Fleming informed Jeremiah Sullivan of his dismissal as agency physician. From the Taylors’ and Fleming’s perspective, the doctor had turned the Grant “peace policy” on its head: he had moved into a Hopi village; was learning their language, eating their food, and planting corn; and was studying and recording Hopi culture. How could the Hopi be convinced to abandon what was being respected and valued? Fleming attempted various means to force Jeremiah Sullivan to leave, accusing him of a “secret hostility to my administration” (quoted in McCluskey 1980:381).

As Stephen McCloskey has documented in a brilliant essay on the creation of the Hopi Indian Reservation (McCluskey 1980), the efforts to remove Jeremiah Sullivan revealed the lack of a legal basis to do so. Earlier agents had recommended the establishment of a Hopi reservation to ward off Navajo encroachments from the east and Mormon settlements to the west (Irvine 1877:160). However, the “immediate cause” of establishing the 2.6 million acre Executive
Figure 3. Location of two residences attributed to Sullivan and a possible Government House on First Mesa.
Order Moqui [Hopi] Indian Reservation on December 16, 1882, was the “bureaucratic need” to evict Jeremiah Sullivan, M.D. (McCluskey 1980:384). Ironically, Agent Fleming resigned the very same day the reservation was created and the Moqui Pueblo Agency was dissolved in 1883. Although later efforts by Dr. Washington Matthews and others to reinstate Jeremiah Sullivan as agency physician failed, there were no further pressures on him to leave.

Soon after Jeremiah Sullivan moved into Sichomovi village in 1881, he wrote to the Bureau of Ethnology expressing an interest in documenting Hopi ceremonial and medical practices. Moreover, beginning with John Gregory Bourke, he appears to have worked with every ethnologist who visited the First Mesa villages in the 1880s. In November 1882, Jeremiah Sullivan submitted a 140-page vocabulary to the Smithsonian Institution in response to John Wesley Powell’s request for information regarding the Hopi language (Sullivan [1882]).

The next summer, in August 1883, Sullivan was host to the Dutch anthropologist Herman F. C. ten Kate. The two men witnessed the Snake ceremony at Walpi as well as at Mishongnovi (as did Cosmos Mindeleff [1886a, 1886b]). Like Bourke before him, ten Kate depended on Sullivan for the information on the Snake ceremony he published in his book, *Reizen en onderzoekingen in Noord-Amerika* (1885). Ten Kate was a physical anthropologist, and the doctor proved to be a rich source of information regarding Hopi physiology and health. They visited Shipaulovi on Second Mesa as well, and ten Kate notes, using Sullivan’s Hopi name, “Oyiwisha [He Who Plants Corn] is everywhere warmly received, and at various places we are invited to eat” (ten Kate 1885:261). Stephen was away from Keams Canyon at the time of these 1883 Snake ceremonies.

Alexander MacGregor Stephen and Jeremiah Sullivan must have had frequent interaction at Keam’s trading post as well as on First Mesa. However, it is only in a letter from Stephen to Frank Hamilton Cushing dated December 15, 1883, that we get some sense of Stephen’s assessment of Sullivan. After referring to his own “chaotic notes” on Keam’s pottery collection, he writes:

I have been trying to get some information from our friend “Jere”; he sent me yesterday his—what shall I call it—a manuscript. I hope I am not betraying his confidence, but really I had, before I saw this—manuscript—an opinion that under his buffoonery there was some—brightness. But dear me, he sent me some terrible rubbish. Amongst [which] was an essay on “pottery”—I don’t know whether or not it was the draft of something sent for publication (does he publish anything, or contribute to the Bureau?), but I think not. However, he advances, after a fashion, two ideas... [Green 1990:320]

The following year, beginning on October 20, 1884, Colorado River explorer and artist Frederick Dellenbaugh took up residence in “Tewa” on First Mesa. The day after his arrival he wrote, “In the middle village is one white man, named Sullivan, but a three year residence here has made him almost the same as the Indians.” The next day, however, Dellenbaugh accompanied Sullivan to a dance in Mishongnovi on Second Mesa where, “The doctor went up into one of the houses to dress a head wound—the result of a kick from a horse.” At another house Dellenbaugh met “a warm friend of the doctor who had healed a bad wound on his arm,” and “at another

Louis A. Hieb
house the doctor dressed fingers of a boy of eighteen, afflicted with a loathsome disease." 

Jeremiah Sullivan had unparalleled opportunities to acquire a working knowledge of Hopi and to learn songs and other oral traditions. As Dellenbaugh wrote,

Last evening I went down to Tochee’s in the next village having heard that there was to be a dance there. Heard singing in the “Doctor’s” house so went in and found the room full of men singing. The “Doctor’s” house is also that of the head “war chief.” This chief was beating a big drum in time with the singing and instructing the younger men in songs with which they were not familiar. A single candle on the floor gave light.

Dellenbaugh was soon both ill and ill-at-ease on First Mesa and on November 13, he decided to return to Keams Canyon to continue a portrait of a Navajo posing with a Hopi throwing stick. Before he left, he records, “Gave Sullivan my kitchen outfit.”

Sullivan appears to have lived in Sichomovi, year round, from January 1881 until he left in 1888. On May 22, 1885, Herbert Welsh, Corresponding Secretary of the Indian Rights Association, visited the Hopi and discussed their medical needs with Sullivan (Welsh 1885:34).

In September 1885, Charles R. Moffet and his ranch partner visited Keams Canyon, where they “made the acquaintance of Mr. A. M. Stephen” and went on to First Mesa to find “Dr. Jeremiah Sullivan,—the only white man living in the villages,” who was host and interpreter during their stay. Moffet wrote, “I found the Doctor in the act of putting his brand upon a fee that he had just been fortunate enough to collect. The fee was a very good two-year-old pony” (Moffet 1889:246).

There is no record of Sullivan or Stephen for 1886. On October 18, 1887, Stephen notes, “Jere and I went with Sally and her man south [to visit a Snake Clan ruin]. I told the old fellows if they did not care to tell us their stories it was well. We sought for no information they were not willing to tell” (Parsons 1935:608, note 1). Again in early 1888, Stephen records payment to Sullivan for assistance with Stephen’s ethnographic research (McCluskey 1980:384).

Jeremiah Sullivan was also a contemporary of Frank Hamilton Cushing, who lived at Zuni Pueblo from 1879 to 1884. Both were accepted/tolerated by their respective tribes, and both served similar roles in the indigenous political structures. Cushing (Tentasali—The Medicine Flower) was joined by his wife and sister-in-law as well as a Black cook in 1883 in a Zuni house that was furnished in “a singular mixture of Indian and Japanese aesthetic taste and Oscar Wilde’s ‘esthetic’” (ten Kate 1885). Sullivan (Oyiwiwi [He Who Plants Corn]) built a single-room dwelling in 1883 with “a table, cook stove, a shelf or two with bottles, and a wooden bench,” its ceiling “so low we could not stand upright without striking our heads against it.” Even to his admirer, Herman F. C. ten Kate, Cushing dressed as a “fantasy Indian”—complete with wig and fringed buckskin; Sullivan, “his red shirt outside his trousers,” added Hopi shoes to an otherwise Western attire—clothes already common among young Hopi men. Cushing, the ethnologist, went to Zuni to collect and to learn; Sullivan, the doctor, went to Hopi to earn a living and, in time, to understand. Contemporaries found occasion to compare the two, regarding Cushing as the superior
ethnologist but finding fault with the behavior of both men. Cushing was supported—politically and financially—by the Smithsonian Institution and the Bureau of [American] Ethnology; Sullivan was subjected to various governmental pressures to leave First Mesa. Cushing’s participant observation became a model for anthropological fieldwork, yet Sullivan’s very existence as well as his unintended role in Hopi history have been largely forgotten.

Jeremiah Sullivan seemingly represented a rival to Frank Hamilton Cushing and, in a July 8, 1888, article in The Daily Examiner (San Francisco), Cushing (1888:12) wrote:

The Moquis wanted me to live with them as I had done among the Zunis, and a fellow has actually done it—the son of the former agent. He went into it with the avowed intention of studying the people, as I had done with the Zunis. He was a young fellow, quite bright and a good physician, but he has degenerated into a “squaw man.” That is dangerous to him, dangerous to his purpose, and also dangerous to the people themselves. But they were so delighted with the idea of having something that the Zunis had, that they have done everything they could for him, and have put up with all kinds of things from him. His opportunities are unexampled.20

Sullivan, who had recently moved his medical practice to Holbrook, Arizona, wrote to his “friend” Cushing on July 20 expressing his “astonishment” and calling the statements above “a gross misrepresentation”:

None other I can assure you, was ever farther away from becoming a “Squaw Man” than your humble Servant. I never placed any indignities upon the Mokis, nor did I ever admit of any familiarities. I received compensation for all my services while among them, and when the pay ceased, I left, and am now practicing my profession at this place...21

Jeremiah Sullivan, perhaps because of Cushing’s attack, abandoned his efforts to publish his “observations” of the Hopi. While working as a physician (“Private Diseases a Specialty”) in Holbrook, he also ran a drug store. In 1890, he moved his medical practice to Winslow (Quebbeman 1966:373). Sullivan then left the Southwest and completed a degree in the Medical Department of the University of Louisville in 1894.

Alexander MacGregor Stephen died the same year, apparently of tuberculosis, after having gone to Yellow Bear of the Poshwimkia, a Hopi healing society, for a cure (McCluskey 1980:387, note 24; Stephen 1894).

THE PUBLICATION

Seen from the perspective of a different authorship, “The Hopi Indians of Arizona” (Sullivan 1885) takes on new dimensions. In recording aspects of the intellectual basis of certain Hopi religious practices, the author provides a particularly sensitive account of the means of communication and exchange between the world of the Hopi and the world of the spirits. Moreover, there is in the voice of the narrator a recognition of and respect for the privileged and stratified nature of Hopi sacred knowledge. We understand, as the author of this manuscript understood but did not always accept, that this sacred knowledge is the property of Hopi clans (living and extinct) and societies, and even within these groups certain sacred knowledge is restricted.
to defined elders. As a doctor, Jeremiah Sullivan had something to give. In return, Hopi elders shared much sacred knowledge and practice with Jeremiah Sullivan. But they withheld some, as well, for to reveal these domains of knowledge, their substance, was and is to lessen if not destroy the power, value, and meaning they have. Elsie Clews Parsons recalled, “In 1920 I was told that ‘the doctor danced with us’” (Parsons 1935:1117). Sullivan’s essay, for it is his, is a sensitive and significant introduction to Hopi religious thought and practice.

ACKNOWLEDGMENTS

At an early stage in my writing, Peter Steere, Special Collections, The University of Arizona Library, provided significant information regarding Stephen’s field notes. Sharon Aller, Shirley Brittingham, Erika Bsumek, Barbara Kramer, Sally McBeth, and Marilyn Norcini reviewed early drafts and made helpful comments. Finally, thanks to Joyce Raab and the Chaco Culture National Historical Park for providing the facilities for research and writing. I am in the process of reediting “The Hopi Indians of Arizona” for publication using another version of this manuscript as an introduction.

NOTES


2 Jeremiah Sullivan to Frank Hamilton Cushing, July 20, 1888. MS.6.HAE.1.12. (Southwest Museum, Los Angeles). Very little of Sullivan’s ethnographic work survives. A brief manuscript on “The Somai’koli of the Hopitu…,” which Frederick J. Dellenbaugh acquired from Sullivan about 1885, is an example of an untitled manuscript signed at the end (Dellenbaugh Papers. Special Collections, The University of Arizona Library, Tucson). Elsie Clews Parsons published a “Spanish Folk-Tale Recorded on First Mesa, Arizona, in 1885” (Sullivan 1921) which appears to have been untitled and is signed at the end by J. Sullivan. The “Supplementary Legend,” included in Victor Mindeleff’s (1891:40–41), “A Study of Pueblo Architecture in Tusayan and Cibola,” is the only other publication of Jeremiah Sullivan’s work.

3 Thomas V. Keam (1883) provides an account of the 1881 Snake ceremony at Walpi.

4 See also, Washington Matthews (1893), in which Stephen supplies information on Navajo humor.

5 Stephen’s manuscript (3282 Archaeology, Bureau of American Ethnology), located in the National Anthropological Archives, Smithsonian Institution, has been published in Alex Patterson (1994). Patterson (1994:7) notes that Jesse Walter Fewkes purchased the Keam Collection in 1892 for $10,000.

6 Three years later Stephen (1888) was published. The first, full account of the Walpi Snake ceremony using Stephen’s materials appeared in Jesse W. Fewkes (1894) (“Assisted by A. M. Stephen and J. G. Owens”), which is based on the 1891 and 1893 performances.

7 Jeremiah Sullivan lived in Madison, Indiana, prior to his employment as agency physician and appears to have been about 30 years old. His dates are not known.

8 McCluskey (1980:388) reports, “The ‘government house’ was apparently established in late 1869 or early 1870 during the tenure of the first Moqui Agent, Captain Appleton D. Palmer. He stored agency goods at Sichomovi and stayed there when he visited the Hopi villages.” This structure
apparently served as Sullivan’s first residence in 1881.

That Bourke and Sullivan worked closely together while members of Bourke’s party surveyed the kivas in Walpi is evident in the artist Peter Moran’s (1893) account of his activities.

In writing “The Great Snake Dance of the Moquis,” the Reverend John A. Taylor (1881) relied on a “witness” who would have seen the Snake Ceremony at Shipaulovi or Shungopavi on Second Mesa or Oraibi on Third Mesa in 1880. Taylor prayed the Moquis would turn from “such horrible practices.”

Ten Kate collected skulls from graves among several of the Native American peoples he visited in the Southwest. During their visit to Second Mesa, ten Kate noticed a Hopi burial but was warned by Sullivan not to disturb it “as not to make his stay among the Indians untenable.” However, ten Kate reported that Sullivan sent him “a magnificent male Moqui skull” about nine months later.

Frederick J. Dellenbaugh to Belle, October 20, 1884. Dellenbaugh Papers (Special Collections, The University of Arizona Library, Tucson).


Dellenbaugh, Diary: November 2, 1884. Compare this account with Stephen’s song text from the 1885 Snake ceremony to which he notes, “Get this song again” (Hopi Journal, p. 586, n. 1), acknowledging his inadequacy.

Dellenbaugh, “Diary: November 13, 1884.”

Moffet’s (1889) account is clearly enriched with Sullivan’s knowledge, and the result is a vivid account of Hopi daily life. Moffet’s statement that Stephen had “thoroughly mastered the language of the Moquis” is disputed by Parsons (1935), who says, “Stephen was learning to speak Hopi. Had his accomplishment in the language continued, he would have been distinguished in interpreting the ceremonials as well as in recording them” (“Preface,” p. xxi).

A translation of ten Kate’s Travels and Inquiries in North America is in preparation by William J. Orr. An earlier translation of a brief but relevant portion of ten Kate’s work appears in Elliot G. McIntyre and Sandra R. Gordon (1968).

Frederick J. Dellenbaugh, Diary: September 29, 1884 (Dellenbaugh Papers. Arizona Historical Society, Tucson; Welsh, 1885:34). Ten Kate (1885) gave Sullivan’s Hopi name as “Oyiwhisa”; Jesse Walter Fewkes (1922) has it as “Urwica” in “Oraibi in 1890,” where Sullivan was said to be “remembered as the American who amputated the arm of the mother of Pautiwa, the chief of the Bow priesthood.”

Frederick J. Dellenbaugh, Diary: October 20, 1884.

From an article in a series by Cushing.

Jeremiah Sullivan to Frank Hamilton Cushing, July 20, 1888. MS.6.HAE.1.12. (Southwest Museum, Los Angeles). It is not clear what prompted Sullivan to move to Holbrook. The staff of the Moqui [Hopi] Boarding School established in Keams Canyon, July 1887, included a physician and his availability may have competed with Sullivan’s medical practice.

For an insightful discussion of the issues involved, see Arnold Krupat (1996:22–24).

—Director of the Center for Southwest Research, General Library, University of New Mexico, Albuquerque

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REFERENCES CITED

Bourke, John Gregory

Cushing, Frank Hamilton

Fewkes, Jesse W.

Green, Jesse

Irvine, Alexander G.

Keam, Thomas V.

Krupat, Arnold
1996 The Turn to the Native. University of Nebraska Press, Lincoln.

Matthews, Washington
1893 The Suppressed Part: "The Mountain Chant": A Navajo Ceremony. Fort Wingate, New Mexico.

McCluskey, Stephen C.

McIntyre, Elliot G., and Sandra R. Gordon

McNitt, Frank

Mindeleff, Victor
1886a An Indian Snake Dance. Science o.s. 7:174 (June 4):507–514


Moffet, Charles R.

Moran, Peter

Parsons, Elsie Clews (editor)

Patterson, Alex

Quebbeman, Frances E.

Stephen, Alexander M.


Stephen, Alexander M., and H. J. Messenger

Sullivan, Jeremiah

[1885]  The Somai'koli of the Hopitu... Unpublished manuscript on file, Dellenbaugh Papers, Special Collections, The University of Arizona Library, Tucson.
1921 Spanish Folk-Tale Recorded on First Mesa, Arizona, In 1885. *Journal of American Folk-Lore* 34:221.


Rayado is a unique and important historical settlement on what was the Mountain Branch of the Santa Fe Trail in Colfax County, New Mexico. The site contains the remains of over 140 years of architectural and archaeological history relating to commerce with travelers along the trail and to ranch settlement in northeastern New Mexico.

Philmont Scout Ranch is developing a program to interpret and preserve the cultural and historical resources at Rayado. One aspect of this program involves archaeological research to locate, recover, and interpret architectural features and artifacts relating to the history of Rayado.

Human Systems Research, Inc. (HSR), conducted archaeological test excavations as part of an archaeological research program during four sessions in 1992, 1993, and 1994. The 1994 program was conducted as a field school with the Archaeological Society of New Mexico. The analysis of the artifacts recovered from the 1993 and 1994 test excavations is being conducted as part of an ongoing volunteer program between the Dona Ana County Archaeological Society in Las Cruces and Human Systems Research, Inc. I summarize the results of the test excavations and special studies conducted at Rayado.

HISTORY

Rayado and its inhabitants played an important role in the settling of northeastern New Mexico. The site was founded in the winter of 1848, when Lucien B. Maxwell and Kit Carson built homes here and brought in others to establish farms and ranches and thereby to develop the region. Livestock and agricultural products were sold to Fort Union. Travelers on the Mountain Branch of the Santa Fe Trail stopped at Rayado before proceeding to Santa Fe, the capital of New Mexico Territory (Figure 1). Raids by Jicarilla Apaches and other Indian tribes resulted in U.S. Army troops being stationed at Rayado to protect area settlers and their livestock, as well as travelers and merchants on the Santa Fe Trail. By 1859, Rayado consisted of the Kit Carson and Maxwell-Abreu plazas, La Posta or the stage station, other structures, and orchards and fields.

After Maxwell moved his ranching headquarters to Cimarron in 1858, José Pley served as Maxwell’s store manager and then probably ranch manager through 1859 or 1860 (Kammer 1994). In 1864, Jesús Abreu, also related to Maxwell by marriage and an employee or business partner, purchased the ranch. By 1870, he had 164 acres under
Figure 1. Portion of Springer 30' by 60’ quadrangle map showing Rayado and historic trails of northeastern New Mexico (Scott 1986).
cultivation, along with horses, mules, oxen, milk cows, beef cattle, swine, and sheep. Until 1911, the Abreu family was one of the leading ranch families of the region.

In 1911, the Rayado property was the focus of an ambitious but short-lived land development plan. The Rayado Colonization Company attempted to settle the region by developing and selling small irrigated farms. After this failed, from 1915 through 1941, Rayado formed part of several larger ranches, including Waite Phillips’ ranch after 1929. In 1941, Phillips donated the Rayado property and the rest of his ranch to the Boy Scouts of America. Since then, Rayado has been an important part of Philmont Scout Ranch and its programs.

The present settlement consists of the Maxwell-Abreu House, North House (formerly the Martinez House), La Posta, Kit Carson Museum, Chapel of the Holy Child, an adobe shed, and an adobe barn. Historic photographs show other outbuildings and corrals, the remains of which are not currently visible. The most recent building is a 1950s dining hall built by the Boy Scouts. Rayado is recorded as a historic archaeology site in the files of the Historic Preservation Division, Santa Fe. The official site number is LA 86000.

The Rayado site is a historical and archaeological site with few parallels in the Southwest. The Maxwell-Abreu House, La Posta, and associated structures, constructed of adobe, have been standing for over 100 years. Additional adobe structures and some built of sawn lumber may only remain as foundations and/or packed dirt floors. Structures, features, and associated artifacts provide insight into the lifeways of the Rayado inhabitants from the 1850s to the present. Inhabitants include the Maxwell and Abreu families, other ranchers, farmers, military, travelers, turn-of-the-century farmers, and the early Philmont staff. In 1933, Narciso Abreu drew a map of Rayado as he remembered it in his youth, although he claimed that the map represented the site from 1859, before his father began developing the property (Figure 2).

LOCATION

Rayado is located in southwestern Colfax County on a part of the Beaubien and Miranda (Maxwell) Land Grant. The settlement, on the south side of the Rayado Creek, is situated on both sides of New Mexico Highway 21. Cimarron is 11 mi to the north, and Miami is 7 mi to the east. Rayado is located on the lower Rayado Creek, a perennial drainage from the eastern slopes of the Cimarron Range of the Sangre de Cristo Mountains. The settlement is at the junction of the base of the Cimarron Range and the upper end of the plains of the Las Vegas Plateau.

RESEARCH DESIGN

Our research focused on data recovered from archaeological contexts and on historical documentation provided by Stephen Zimmer, Philmont Museums. A set of research goals was developed to look at the Maxwell-Abreu Plaza, La Posta, and other areas of Rayado as part of a multiyear study. The archaeological, historical, and architectural studies provided data for a future museum and expanded interpretive program. As the project developed, specific research questions were addressed at appropriate periods during the excavation and the analysis. The excavations and associated analyses focus on four major research goals common to historic archaeology sites of this type:
Figure 2. Narciso Abreu Map of Rayado Plaza drawn in 1933, as it might have looked in 1859.
1. Identifying and defining the Maxwell-Abreu Plaza and La Posta through the architectural remains:
   a. Identifying and locating the buried foundations and wall fall.
   b. Placing test pits and test trenches in relation to the Maxwell-Abreu Plaza as defined on the 1859 map.
   c. Identifying the nature and types of preservation of the architectural remains (e.g., burned adobe, charred wood from roofs and floors, uncharred wood).

2. Interpreting the material culture:
   a. Identifying the variability of the material culture.
   b. Identifying the material culture in relation to rooms, using as a reference the Narciso Abreu map of 1933 showing Maxwell-Abreu Plaza in 1859.
   c. Studying the recovered artifacts as indicators of change in frontier life on the Santa Fe Trail and ways the artifact assemblage changed through time.

3. Studying specific research questions:
   a. What was the lifestyle of the Maxwell and Abreu families?
   b. What were the foods eaten by the families (indicated by bones and containers), and how were they prepared (indicated by cooking utensils, etc.)?
   c. Do the artifact data support the historical data on the families and their use of the structures and rooms within the house?
   d. What types of artifacts were locally manufactured and what types were obtained from Santa Fe Trail traders. Where did these trade items originate?

4. Establishing a database for future research at Rayado and using the results of the first season of excavations to provide recommendations for future excavations and data analysis.

**EXCAVATION STRATEGY**

A grid system was established using as datum the USGS benchmark brass cap (elevation: 6,508 ft above sea level) set in the porch of La Posta, a nearby building located southeast of the Maxwell-Abreu House. Wood stakes marked 20-ft intervals on the baselines. Elevations for ground contours and the buildings were shot using various stations on the baselines. Lengths of pipe set in concrete mark selected grid corners for future subdatum points. The grid number was inscribed in each selected grid corner. Kirkpatrick and Hart (1993) and Kirkpatrick (1996) provide detailed results of the 1992, 1993, and 1994 test excavation programs.

**1992 Strategy**

The 1992 goals were to conduct limited test excavations to locate architectural remains, primarily wall foundations, and to evaluate the potential for subsurface cultural deposits. Excavation of subsurface architectural remains was designed to contribute data for the concurrent architectural study that was being conducted by Steven Kells, Kells and Craig, Inc., Albuquerque. This approach allowed the architect and the archaeologist to compare goals and to design a complimentary approach for studying the Maxwell-Abreu House.

That year, archaeologists excavated 7 test trenches and 10 backhoe trenches. Five test
trenches were located around the foundations of the Maxwell-Abreu House, one test trench was inside the Maxwell-Abreu House, and one was placed along the rock foundations of the North (Martinez) House.

1993 Strategy

The 1993 scope of work was based on discussions with Steve Kells, who requested to have excavations conducted under the three porches in order to obtain data on porch construction details to meet the needs of the architectural study. The excavations for 1993 primarily focused on the three porches of the Maxwell-Abreu House and the South Placita area. The HSR archaeologists mapped the east and north porches in detail. Seven test pits were excavated—four on the east porch, one on the south porch, one at the corner of the east and north porches, and one at the west end of the north porch.

In an unrelated activity, Philmont staff exposed a buried trash deposit in a trench excavated for a buried electric line. HSR archaeologists then screened the backfill, and various artifact types were recovered. These include fragments of glass, ceramics, and metal; parts of cowboy and irrigation boots; and fragments of a wool blanket, possibly a saddle blanket. A complete natural-colored beer bottle was recovered.

Based on the results of the July 1993 excavations, during October 1993, HSR archaeologists excavated three test pits in the South Placita to check for subsurface features and artifacts. The South Placita is thought to be an area where domestic activities occurred, including baking bread, washing clothes, and other chores.

1994 Strategy

The 1994 test excavations were conducted as part of a field school for the Archaeological Society of New Mexico under the supervision of HSR staff. The goals were to identify subsurface deposits near the buildings and to identify any interior floors. Excavations focused on the west side of the North House, on the west side of Room 20 of the Maxwell-Abreu House, subfloor in Room 8 (the bathroom) and Room 13 (the modern kitchen), and in the South Placita.

ARTIFACTS

The majority of artifacts and remains are associated with building activities or trash disposal (Table 1). These include adobe fragments with plaster and/or paint or wall paper, charcoal, milled lumber fragments, fragments of wooden floor boards, window-glazing compound, flecks of paint, fragments of red bricks, and clear window-pane glass. Besides window glass, glass fragments are primarily from brown bottles. Barbed- and coated-wire fragments are common. Numerous nails were recovered, a usual occurrence for a historic building. Several plastic buttons were found, primarily from the mice nests. The nests also contained fragments of piñon shells and other botanical remains. Numerous kernels of burned corn were recovered from the fill, resulting in the high number of botanical remains.

ARCHITECTURE

The focus of the 1992, 1993, and 1994 excavations was to identify subsurface architectural and archaeological remains in the vicinity of the Maxwell-Abreu Plaza (Figure 3). This was accomplished by placing test pits adjacent the Maxwell-Abreu House and the
Table 1. Summary of Artifacts by Material Type by Year.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>1992</th>
<th>1993</th>
<th>1994</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramics</td>
<td>75</td>
<td>3</td>
<td>136</td>
<td>214</td>
</tr>
<tr>
<td>Glass</td>
<td>669</td>
<td>487</td>
<td>1,572</td>
<td>2,728</td>
</tr>
<tr>
<td>Metal</td>
<td>626</td>
<td>107</td>
<td>685</td>
<td>1,418</td>
</tr>
<tr>
<td>Leather</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Fiber</td>
<td>1</td>
<td>4</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>Plastic</td>
<td>61</td>
<td>14</td>
<td>134</td>
<td>209</td>
</tr>
<tr>
<td>Rubber</td>
<td>7</td>
<td>6</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Paper</td>
<td>52</td>
<td>31</td>
<td>46</td>
<td>129</td>
</tr>
<tr>
<td>Building Material, nonwood</td>
<td>574</td>
<td>116</td>
<td>395</td>
<td>1,085</td>
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<tr>
<td>Wood</td>
<td>146</td>
<td>249</td>
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<td>879</td>
</tr>
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<td>Stone</td>
<td>143</td>
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<td>453</td>
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<td>Shell Artifacts</td>
<td>2</td>
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<td>Bone Artifacts</td>
<td>8</td>
<td>200</td>
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<td>430</td>
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<td>Multiclass Artifacts</td>
<td>132</td>
<td>670</td>
<td>907</td>
<td>1,709</td>
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<tr>
<td>Botanical Remains</td>
<td>256</td>
<td>210</td>
<td>548</td>
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<tr>
<td>Faunal Remains</td>
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<tr>
<td>Shell Samples</td>
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</tr>
<tr>
<td>General Samples</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,758</td>
<td>2,129</td>
<td>5,493</td>
<td>10,380</td>
</tr>
</tbody>
</table>

North (Martinez) House foundations and backhoe trenches in areas where buried walls and foundations might be located and under interior rooms of the Maxwell-Abreu House.

The excavations began with the assumption that the adobe walls of the Maxwell-Abreu and North Houses were built on a rock foundation, possibly placed in a trench and extending above ground. This type of foundation would protect the adobe walls from soil moisture moving up into the adobe bricks, eventually causing the bricks to deteriorate.

Maxwell-Abreu House

The test pits around the Maxwell-Abreu House were placed both parallel and perpendicular to the walls to expose the contact between the adobe walls and the presence of the foundation. Test excavations did not expose a rock foundation. The adobe brick and soil contact were obscured in most of the test pits by the presence of a more recent concrete apron that had been poured along the wall base. Concrete aprons are used to protect the base of adobe walls from water damage and to prevent coving of the adobe wall. This is a short-term solution. In the long term, the concrete holds soil moisture against the adobe and water damage still occurs.

Test Trench 5 was located next to a doorway where the concrete apron was absent. The soil in this area lacks structure, indicating it is recent in age or is disturbed in nature.
Charcoal is present in the soil removed from the test trench, in the trench side walls, and in the soil under the adobe bricks. This indicates the wall was built on land that had been previously disturbed, with the charcoal probably coming from the cooking and heating fires of the earlier Rayado inhabitants. The adobe bricks here were placed directly on the soil (Figure 4).

The remains of at least three dirt floors were exposed in Test Trench 7 in Room 5. Flecks of whitewash or plaster were present on the compacted surfaces. The dirt floors appear to be present under the wooden floor in the area north of Test Trench 7, east half, but not in the west half of Test Trench 7. Similar dirt floors were observed in Rooms 8 and 9 during the 1994 excavations. The presence of stratified dirt floors is important. Artifacts between the different layers can provide clues to when each room was used, the room function, and the specific activities that occurred in each room. Pollen analysis can provide data on the general climate and changes made by humans to the local environment, the function of the room, and other details of the time period.

The excavations of portions of the east, north, and south porches revealed a major building event. This activity removed evidence of the original porch and artifacts associated with any activities that occurred on the porches. The remodeling of the east and north porches was indicated by the railings that were located higher on the columns than originally constructed. Photographs show this occurred during the years of the Waite Phillips period of ownership, probably during the early 1930s.

A single excavation unit was placed in the south porch. No evidence of a wooden porch was found here. It is assumed the original porch was similar to the east and north porches. The south porch was remodeled when Rooms 4 and 6 were built. Prior to this remodeling, a shed roof extended south from the porch. This is indicated by a mark in the plaster of the exterior wall of Room 12 and the two concrete post bases found in the South Placita. The date of the removal of this feature is unknown. It probably occurred when the porch was remodeled by adding an extension to bring the roof flush with the south wall of Rooms 4 and 6.

The tree-ring study yielded three dates from beams in Rooms 16 and 20 (see discussion below). Based on current data, the roomblock consisting of Rooms 16 through 20 was constructed sometime after 1856. If the trees were cut between 1858 and 1860, the roomblock was built under the direction of Pley. If the trees were cut between 1860 and 1864, José Abreu, as manager of Rayado, built the rooms. If the trees were cut after 1864, then Abreu built the roomblock as the owner of Rayado.

**North (Martinez) House**

A linear alignment of rocks is visible on the north side of the Martinez House. The alignment resembles a segment of a rock foundation. Test Trench 6 was placed around the feature. The excavations exposed the basal course of a rock foundation. Several of the rocks had a thin layer of concrete with the impression of rocks from an upper course. This foundation probably represents a later construction period than the rest of the building. No data were found either archaeologically or in historic photographs that describe this missing room. The buttress may be the remains of a wall to this missing room.
Figure 4. Wall and soil contact, Test Trench 5, south exterior wall of Room 18.
Backhoe Trench 6 was placed near the southwest corner of Room 3 to look for evidence of foundations. Because of the high artifact density, this trench was expanded in size to expose the base of the wall. Another concrete apron was found, obscuring the contact between the adobe wall and the soil. No rock foundation was found below the apron. It appears that the wall was built directly on the ground, similar to the walls of the Maxwell-Abreu House. An early 1900s photograph shows a more extensive roomblock was present, lending support to the map drawn by Narciso Abreu in 1933.

ARCHAEOLOGY

Several research questions were identified in a previous section. Because the primary focus of the excavation in 1992 and 1993 was to expose architectural remains, a very limited amount of data were obtained to address these specific questions. The areas adjacent to walls are often disturbed during construction and maintenance activities. This had occurred during the pouring of the concrete apron on the east and north porches. Soil was removed from near the wall, and a form was put in place. After the concrete was set, the form was removed and the surface was probably smoothed and leveled. Extra soil was placed along the north side of the Maxwell-Abreu House when the irrigation ditch was dug. A historic photograph shows more exposed concrete apron than is now present along the north wall. The concrete block along the porches and the south wall near the bay window is another example of ground disturbance near walls.

The fill from various test trenches yielded a variety of artifacts, including Jicarilla Apache micaceous sherds, a top-hat style musket percussion cap, a 1941 (S) Wheat penny, eye glasses, clock parts, plus numerous fragments of glass, ceramics, and metal. The high artifact density from Backhoe Trench 6 is unusual. The backhoe trench is located along the west wall of the North (Martinez) House. Bird feathers and small animal bones were found, plus the usual glass, metal, and ceramic artifacts. The deposit resembles that found at dumps. Deposits like this are not normally located immediately adjacent to a dwelling.

The excavations during the 1994 season focused on identifying the nature of this midden deposit west of the North House, identifying any evidence of the missing room west of Room 20 of the Maxwell-Abreu House, identifying any evidence of the horno in the South Placita, and identifying the subfloor deposits in Rooms 8, 9, and 13 of the Maxwell-Abreu House. The excavations west of the North House confirmed the presence of a dense artifactual midden. The midden begins next to the house and extends west an unknown distance. Surface artifacts suggest the midden continues to the west past the access road and into the remains of the pear orchard. A dump may be nearby, and recent contouring of the area may have disturbed it, pushing fill against the house.

No architectural evidence, such as dirt floors, was found of the missing room west of Room 20, Maxwell-Abreu House. A row of five juniper posts was found in what would have been the middle of the room. Due to time restrictions, these posts were not totally excavated to their bases, only approximately 2 to 4 in. of the posts were exposed. They appear to be 3 to 4 in. in diameter but are too eroded to make more accurate measurements. The posts may be the remains of an early jacal-style building or possibly a fence. It was not possible to excavate adjacent grids to trace out the extent of this feature and to identify it.
The machine-cut nails, the thicker window-pane glass fragments, the bottle fragments, and the ceramic sherds date from the turn of the century to post-1951. Bottle fragments, for example, have manufacture dates that range from 1880 to after 1951. Several of the bottles date to the early 1900s, after the Abreu family had sold the ranch. None of the ceramics had diagnostic makers’ marks. The patterns on the ceramics range from none to bits of gold gilt. Dating ceramics by patterns is very difficult.

Artifacts that are recent in age include items recovered from Test Trench 7 in the Maxwell-Abreu House. These include the “Starburst” candy wrapper, a plastic letter R, and probably the Crayola crayon paper fragments. These artifacts are probably associated with the occupation of the house by various Philmont employees and their families.

SPECIAL STUDIES

Two special studies were conducted to support the architectural and archaeological studies. The soils, adobe, and mortar material study focused on descriptive aspects of the materials. The soils and building materials were analyzed by Dr. H. Curtis Monger and Alice Janavaris, Department of Agronomy, New Mexico State University, Las Cruces. Detailed results are presented by H. Curtis Monger (1993). The dendrochronological study was concerned with dating the construction of the house based on cutting dates of the major support beams and lintels over interior closets. The following section summarizes the results of the studies.

Soil, Adobe, and Mortar Study

This pilot study had three goals: (1) to identify the characteristics of the adobe bricks, mortar, and plasters; (2) to locate possible source areas for these building materials; and (3) to identify the original 1848 ground surface. The study included laboratory analysis of the materials and field examination of soils around the Maxwell-Abreu House and adjacent areas.

The Maxwell-Abreu House adobe bricks have a sandy-loam texture. The pH and calcium carbonate (CaCO₃) values are similar to the native soils in the area. The mud mortar and plasters have similar chemical properties to the adobe bricks. The mud plasters have a higher clay content and less sand than the adobe bricks. Various adobe-brick and mud-plaster samples contained fragments of straw, wood chips, charcoal, newspaper or magazine paper, and sawdust. The lime plaster samples contained sand grains of mixed mineralogy but similar to the sand grains in the adobe and mud-mortar samples.

Test soil pits were excavated in the former agricultural fields to the west of the Maxwell-Abreu House. The soils in these areas were either too clayey or too sandy to match the bricks. The soil pit near the North House contained similar soils with a sandy-loam texture. It is possible that the material for the adobe bricks, mortar, and mud plasters was obtained on site, possibly in the plaza. It is possible that the adobe brick makers mixed materials from other areas to create bricks with the appropriate sandy-loam texture.

It was difficult to identify the original ground surface because of the lack of soil development and potential disturbance since 1848. The best evidence is the contact between the adobe bricks and the soil material in Test Trench 5. This contact is 5 to 6 in. below the modern ground surface (Figure 4).
**Dendrochronology**

Tree-ring samples were taken from the Maxwell-Abreu House in 1992 to help determine the age of the building and the sequence of construction. The dendrochronology samples were collected by Ron Towner and analyzed under the direction of Dr. William Robinson, Laboratory of Tree-Ring Research, University of Arizona, Tucson. If the Maxwell-Abreu House is part of the original Maxwell Plaza complex, then tree-ring samples from roof vigas, lintels over doors and windows, and other unmodified construction wood should date to the late 1840s. If the samples date to the post-1840s years, then the building was not necessarily part of the original compound but possibly constructed later by Maxwell, Pley, or Abreu.

Eleven tree-ring samples were collected from vigas in the Maxwell-Abreu House and one from a viga in the breezeway of La Posta near by (Table 2) for analysis at the Laboratory of Tree-ring Research (Robinson 1993). Samples were collected from only those vigas that could be easily reached without removing any portions of the roof or ceiling materials. Based on the spacing of a few observable vigas, Steven Kells projected a total of 28 to 30 vigas in the set of rooms numbered 16 through 20 (Kells 1994). Access to the vigas is hindered by the original dirt roof, potentially significant historic wood ceilings, or recent ceilings in currently occupied rooms. All the vigas in Rooms 16-20 of the house are oriented north-south, with the ends resting on the east-west trending walls.

Samples 1, 2, and 3 were obtained from vigas in Room 20 (Table 2). This room had a fireplace or wood stove that had been removed and the ceiling opening had been covered with boards. This opening is located over Door 8. Samples 4, 5, and 6 were taken from vigas in Room 19. Samples 4 and 5 were collected through a cutout access in the wood ceiling. Sample 6 was taken from the end of the viga that was exposed through the south wall. Samples 7 and 8, from ends of exposed vigas adjacent to Sample 6, are in Rooms 17 and 18. Originally Rooms 17 and 18 were one large room but a recently built wall divides the room in half. Sample 9 was collected from a viga exposed in the attic over Room 16. Samples 10 and 11 are from adjacent vigas in Rooms 17 and 18. The samples were collected where the vigas are exposed in a modern hole in the original dirt roof that was made for the water heater vent flue. Sample 12 was collected from the viga in the breezeway of La Posta.

Three of the 12 tree-ring samples, Samples 1, 3, and 9, provided dates in the late 1850s (Table 2). The remaining samples were not variable enough to be dated. Sample locations were selected in areas that did not have visible debarking scars. During the collection of the samples, it was thought that the outside rings would remain, thus providing an exact cutting date. In the laboratory, microscopic analysis showed that the last few outside rings were missing. This probably occurred when the bark was removed before construction. Unfortunately, these three samples did not provide precise cutting dates. The dates do indicate that the three trees were alive in 1856 and 1857 and were cut shortly thereafter, possibly within five years. Samples 1, 3, and 9 are from rooms at opposite ends of the roomblock. The similarity in potential cutting dates of these three samples may indicate that the set of rooms was built in one construction period. It is very probable that the 28 to 30 trees were cut at the same time to be used as vigas. It is not known at this time if the trees were cut and stockpiled for seasoning before being used as vigas.

David T. Kirkpatrick

63
Table 2. Tree-ring Samples from Maxwell/Abreu House, LA 86000, Area 1.

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Room No.</th>
<th>Species</th>
<th>Date</th>
<th>Comments</th>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>Ponderosa pine</td>
<td>1824 to 1857</td>
<td>+v</td>
</tr>
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<td>2</td>
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<td>+v</td>
</tr>
<tr>
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<td>20</td>
<td>Ponderosa pine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>Douglas fir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td>19</td>
<td>Douglas fir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>17 &amp; 18</td>
<td>Douglas fir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>17 &amp; 18</td>
<td>Fir</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1807 to 1856</td>
<td>+v</td>
</tr>
<tr>
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<td>17 &amp; 18</td>
<td>Douglas fir</td>
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<td></td>
</tr>
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</tr>
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<td>1993</td>
<td></td>
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<td></td>
<td></td>
</tr>
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<td>+v</td>
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<td>20</td>
<td>Ponderosa pine</td>
<td>1793 to 1855</td>
<td>+v</td>
</tr>
</tbody>
</table>

Notes:

+ One or a few rings may be missing near the outside whose presence or absence cannot be determined because the series does not extend far enough to provide cross-dating.

++ A ring count is necessary because, beyond a certain point, the specimen could not be counted.

v A subjective judgement that, although there is no direct evidence of the true outside on the sample, the date is within a very few years of being a cutting date.

B Bark present
Three tree species were identified, ponderosa pine, Douglas fir, and white fir. The three vigas in Room 20 are all ponderosa pine, while the four samples from Rooms 17 and 18 are Douglas fir or white fir. The one sample from Room 16 is ponderosa pine. It is possible that the builders were selecting a particular species for each room, although the sample is too small to confirm this. If this is the case, the reason for such selection is unknown.

The 1993 dendrochronological study focused on coring piñon and ponderosa pine trees to develop a master chronology. In August 1993, Ron Towner took a number of tree-ring cores from lintels within the house, fruit and other trees around the buildings, and piñon and ponderosa pines in the area. The cores from the lintels were to provide construction dates associated with windows and closets in the walls. The trees around the buildings were cored to determine ages and obtain data on landscaping and the development of the orchards.

The results of the study were inconclusive regarding the lintel and beam samples (Dean 1996). The cores from the piñon and ponderosa pines did not provide the data necessary to develop a chronology. Additional cores are needed. Without these data, it was not possible to date the lintel and beam samples. The age of the fruit trees is difficult to determine, since the center of many of the trees are rotten and therefore lack growth rings. Many of the trees are over 50 years old. Based on historic data, it is assumed that Jesús Abreu planted the pear orchards. The orchard was important to him, as he branded his livestock with a pear brand.

Overall, the samples from the 1994 study were also inconclusive (Table 2). The clustering of the dates suggests a general period of construction after the mid-1850s. Some of the beams and lintels may have been recycled from previously built rooms, notably those with the early dates of 1839 vv and 1850 +B in Room 11 and 1846 +vv in Room 16. However, the study of the piñon pines was enlightening. The oldest tree dates back to A.D. 1399. Good rings allow reconstruction of a local master chronology spanning a 589-year interval from A.D. 1405 to 1993 (Dean 1996). Samples taken from Rooms 11 and 15 are from the same ponderosa pine slab, an unusual occurrence except that Room 15 was created from Room 11 during remodeling. The samples were from ceiling lintels in closets carved partway through the thick adobe walls in Room 11. The last recognizable ring on these samples dates to 1850, but outer rings are missing from the beam, so that an exact cutting date cannot be identified.

**INTERPRETATION**

The architectural and archaeological remains discovered and recovered during the 1992, 1993, and 1994 excavations provide a starting point for studying the Rayado Ranch. Many questions remain about the construction dates and details for the Maxwell-Abreu and North Houses. Archaeological excavations yielded important information on the building construction. The first is the absence of a foundation under at least two separate portions of the Maxwell-Abreu House. Second, stratified dirt or mud floors are present in at least one room and very possibly in several other rooms in the Maxwell-Abreu House. The analysis of the adobe bricks indicates that the material for the bricks was probably obtained on-site, possibly in and around the plaza. Further studies should be conducted on adobe bricks and the original dirt roofs of the two buildings. At the North House, excavations exposed the base course of a rock
foundation, indicating that there was once a room off Room 1.

The archaeological remains reflect aspects of the lifeways of the various Rayado inhabitants. The artifacts from the earliest occupation show the need for defense from the Indians. No definite subsurface architectural remains of the original Maxwell Plaza were located in the test excavations. It is possible that traces of the Maxwell Plaza could be located with more extensive excavations. The late-1800s artifacts are probably associated with the ranching activities of Jesús Abreu, who probably modified the buildings as new needs developed. The 1920s-1930s period is probably represented by many of the nondiagnostic artifacts. Yet this is the most difficult period to interpret because of the lack of temporal control. The most recent artifacts are associated with the occupation of the buildings by various Philmont employees and their families.

The buildings are representative of frontier architecture and reflect the changing styles through time. These buildings and others at Rayado are architectural artifacts that contain data about the history of Rayado. The evidence of the earliest occupations of the Maxwell Plaza will be the most difficult to locate because of later modification and/or destruction by the Abreu family. The cistern or well in the plaza is the most logical feature that will be preserved, because it would remain subsurface. The filling in of the cistern will have preserved this feature and artifacts associated with the fill. Trash dumps and privies should also contain artifacts relating to Maxwell’s early occupation and the later Abreu occupation. These types of features were located away from domestic buildings. In the early 1900s, the ranch was sold by Jesús Abreu’s heirs. They may have made the ranch headquarters more attractive by covering up trash deposits and leveling the general landscape around the buildings. Logically, other features associated with the founding of Rayado should be present in some form. The potential for locating these early features is unknown, since the limited excavations focused on excavating subsurface architectural features. The military button, the percussion cap, and the Jicarilla pottery sherds are positive indicators of Maxwell-period features and artifacts.

Similarly, the early period of the Jesús Abreu occupation is probably hidden by later building remodeling and landscaping activities. For example, historic photographs show barns and corrals west of the current barn in an area that is now pasture. The modern barn was remodeled after a fire at some unknown time. Photographs show a higher and steeper pitched roof (Figure 5). The Maxwell-Abreu House has been remodeled over the years. Recycled adobe bricks from an unknown source, possibly from room walls of the old Maxwell Plaza, were used to construct some of the gables of the Maxwell-Abreu House when the pitched roof was built over the level dirt roof. Once all the usable adobe bricks were recovered, the wall rubble was either removed or leveled over the plaza, removing this architectural feature from the aboveground record. The multiple dirt floors in the Maxwell-Abreu House may contain a good record of the early-to-late Abreu occupation that would be difficult to find in excavations around the building.

Archaeological sites with multiple periods of occupation contain complex records of architecture and material culture. Extensive research is often necessary to locate the remains of the early occupations, since these are often disturbed and buried by later activities. The later deposits can suffer the same fate, as the result of recent on-site...
activities. Such activities can include digging irrigation ditches, burying old debris from burn piles, leveling an area and planting grass, and installing buried utility lines and facilities. Through a well-planned excavation program that integrates historic photographs and other data sources, it should be possible to study the several historic periods of occupation at Rayado, which may overlie a record of prehistoric and protohistoric occupation by Native Americans.

ACKNOWLEDGMENTS

I am thankful to Stephen A. Zimmer, Director, Philmont Museums, and Steven Kells, Kells and Craig Architects, Inc., for the numerous “what if?” and “Or could it be?” brainstorming sessions. These creative discussions between a historian, an architect, and an archaeologist were educational to all. The result is a better understanding of Rayado Ranch and its various occupants. I am especially indebted to Renetta Frisen, HSR volunteer, who organized the laboratory and assisted in the cataloging of the artifacts for the three years, and to Leyla D. Kirkpatrick, for her volunteer assistant for the 1994 season.

— Human Systems Research, Inc., Las Cruces
REFERENCES CITED

Dean, Jeffrey S.

Kells, Steven

Kammer, David

Kirkpatrick, David T.

Kirkpatrick, David T., and Jeanie M. Hart

Monger, H. Curtis

Robinson, William J.

Scott, Glenn R.
IMPLICATIONS FOR MODELS OF ARROYO ENTRENCHMENT AND DISTRIBUTION OF ARCHAEOLOGICAL SITES IN THE MIDDLE RIO PUERCO

David W. Love

The Rio Puerco of the east in central New Mexico is among the first drainages in the western United States to be scientifically analyzed as to timing, processes, and causes for gully incision—influencing arguments of generations of geomorphologists, archaeologists, range managers, conservationists, and a host of other interested persons since the early 1900s over "the arroyo problem" (Cooke and Reeves 1976; Graf 1983). Kirk Bryan (1928), the historically well-known geomorphologist and geoarchaeologist, published a seminal paper on the Rio Puerco, influencing mainstream geologic thought concerning arroyos for nearly 70 years. Particularly important for geomorphologists was Bryan’s model of headward erosion to produce a continuous arroyo from mouth to headwaters. A second aspect of Bryan’s paper was his correlation of arroyo cutting with droughts and arroyo aggradation with periods of moisture (c.f. Calkins 1941; Cooke and Reeves 1976; D’Arrigo and Jacoby 1991; Graf 1983; Hereford 1993; Leopold et al. 1966; Schumm 1977; Tuan 1966). Numerous discussions concerning causes for arroyo incision have weighed the influences of human land use (grazing, roads, dams) with natural fluctuations in precipitation, vegetation, runoff, sedimentation, and other variables of stream behavior (Calkins 1941; Cooke and Reeves 1976; Hereford 1984, 1993; Leopold et al. 1966; Love 1983; Schumm 1977, 1985). A recent search for articles and other data concerning the Rio Puerco yielded more than 1,100 entries (Davis et al. 1993; Gorbach et al. 1996). Yet, for all the discussion of "the arroyo problem," the geomorphology of the Rio Puerco valley floor and the arroyo itself have received scant attention, except at specific locations where crosssections have been repeatedly measured or maps made for local features. The three-dimensional geomorphology of the valley is largely undescribed by those who continue to argue over processes and causes. Oddly, although Bryan (1928) quoted from original historic surveyor notes along the Rio Puerco, he only mentioned historic maps produced from the surveyor notes. Bryan did not reference other pertinent historic sources that could have influenced his model. Unfortunately for Bryan, aerial photographs covering the entire Rio Puerco watershed were flown in the mid-1930s, after his reports were completed. Modern 7.5-min. topographic quadrangle maps of the large watershed were produced from aerial photographs taken in the 1950s through 1970s and have given later workers a better base to evaluate the Rio Puerco. Kelley (1977) used aerial photographs to describe channel shifts west of Albuquerque but did not analyze historic records beyond Bryan’s summary.
The use of archaeological sites to analyze "the arroyo problem" began with observations by W. H. Jackson (1878) in Chaco Canyon in 1877 and continued along the Rio Puerco with discussions by Kirk Bryan (Bryan 1940; Bryan and Post 1927), Nials (1972, 1991), Love et al. (1982), and Warren (1984). Most of these discussions pointed out that prehistoric arroyos had cut and filled before major human impact and therefore must have climatic causes. Warren, on the other hand, related sites along the middle Rio Puerco to the geomorphology of the valley and arroyo. She observed that some sites along the Rio Puerco were within the arroyo and assumed that arroyo incision must have predated the sites.

This paper compares some of the historic maps and photographs, aerial photographs, and other historic descriptions to the geomorphology of the Rio Puerco from the Nuestra Senora de la Luz de las Lagunitas Grant north of Interstate 40 (latitude 35°20'N) to the Huning Ranch, south of Highway 6 (latitude 34° 45'N). Much of the historic documentation is related to the Atrisco Land Grant, an area in litigious contention and therefore repeatedly described for centuries (Metzgar 1977). Other reaches of the Rio Puerco, farther upstream and downstream, probably have related but somewhat different stream behavior and therefore different histories of geomorphic development. Those areas deserve separate detailed analyses. Because most of the historic descriptions use English units of measurement, these are quoted with metric equivalents. Metric units are given for detailed sediment descriptions. Locations are given latitude-longitude coordinates where appropriate.

**HISTORY**

Coronado crossed the Rio San José and Rio Puerco drainages on his way from Zuni to Tutahaco (Rio Grande valley) in 1540. In 1692, De Vargas crossed the Rio Puerco twice at Bareda de las Piedras, a sandstone ledge exposed in the Rio Puerco channel at 35°21'N, 107°2.5'W (Bryan and Post 1927). He called the stream "La Torriente de los Alamos" because of its water and cottonwood trees (Lopez 1980). The first time he crossed, the channel was dry. On the return trip to the Rio Grande valley, the Rio Puerco was rising, and his troops had to carry provisions on their shoulders and hurry to cross before the flood was too deep to ford (Lopez 1980).

Spanish settlement of the Rio Puerco valley was initiated in 1753 with the Nuestra Señora de la Luz de San Fernando y San Blas del Rio Puerco Grant (also known as the Bernabé M. Montaño Grant) downstream from the Bareda de las Piedras. Other grants followed, including the Nuestra Señora de la Luz de las Lagunitas (including the Bareda de las Piedras), the Bosque Grande (part of Atrisco), Lagunitas del Rio Puerco, Ignacio Chavez, Agua Salda, Cañada de los Alamos, and Ojo del Espíritu Santo (Widdison 1959). The settlement of Los Quelites was established in the Rio Puerco valley near the confluence of the Rio San José at 35°52.6'N, 107°02'W in 1765, apparently believing the San José provided "permanent running water" (Betancourt 1980). However, a gully developed and eroded agricultural fields near Los Quelites because Governor Capuchín issued an order to deal with the gully immediately. It is not known what the circumstances of this erosion were and what was done about it (Betancourt 1980). Upstream, on the Atrisco Grant in 1768, the occupants disputed with residents of San Fernando as to who owned the wood in the Bosque Grande along the Rio Puerco (Metzgar 1977). The settlements of the middle-to-late eighteenth century did not prosper or last, presumably because of raids by Navajo and
Apache. All Rio Puerco settlements were abandoned before 1800.

With the beginning of American expansion in 1846, Lieutenant J. W. Abert (1848) crossed the Rio Puerco valley on the Atrisco and Montaño Grants and described the land as follows:

The valley of the Puerco is wide and flat, overgrown with varieties of artemisias and coarse grass, fit only for sheep and goats. The banks of the river are of stiff loam; they are 10 or 12 feet high, and stand vertically.

Abert described banks 30 ft (9 m) high near some ruins ("Poblazon") on the B. M. Montaño Grant (Bryan and Post 1927; Dortignac 1962; Lopez 1980). Farther north, between Cabezon and La Ventana, Lieutenant J. H. Simpson (1850) crossed the Rio Puerco in 1849 and described the channel as being 100 ft (30 m) wide with vertical banks 20 to 30 ft (6 to 9 m) high. To the south in 1854, A. W. Whipple (1856) crossed the Rio Puerco near the confluence with the Rio San José and noted banks 18 ft (5.5 m) high. In 1855, J. W. Garretson surveyed New Mexico's principal meridian northward and intersected the Rio Puerco at several points. He recorded banks 20 ft (6 m) high and a channel 73 to 92 ft (22 to 28 m) wide at 34°29'N, 106°53'W. Bryan (1928:269) presented a table listing all the widths and depths known from later surveyors through 1927. At Los Cerros, a village 2 mi (3.2 km) south of the railroad (34°47'N, 106°58'W), Cunningham (Bryan and Post 1927) noted that residents were diverting water from the channel of the Rio Puerco using a rock and brush dam. He also noted a new channel for the Rio Puerco in the same township. Bryan and Post (1927) found remnants of the brush dam 22 ft (67 m) above the arroyo channel.

IRRIGATION HISTORY

Settlement along the Rio Puerco after the end of hostilities with nomadic Native Americans brought construction of irrigation dams and soon set a precedent for their episodic failure. Bryan and Post (1927) noted small irrigation dam failures near San Luis in 1875 and Cabezón in 1877. The failure of these stream diversions caused channel changes noted by surveyors (Bryan and Post 1927).

In 1888, the U.S. Geological Survey made a reconnaissance topographic map of the Albuquerque Sheet, encompassing 30 by 30-min. (SW corner at 107° and 35°) at 1:125,000 scale and 50-ft contour interval (Figure 1). The map shows the towns of San Francisco and San Ygnacio along the Rio Puerco as well as small dams, roads, and other topographic features. Of particular interest is a small dammed lake and a road on the southwest side of the lake shown along the Rio Puerco 2 mi (3.2 km) south of San Ygnacio. The map shows the Rio Puerco as a small meandering stream on the east side of the middle Rio Puerco valley from San Ygnacio to Mesita Negra (the small butte east of the Rio Puerco at 35°2.5').

Another dam pertinent to the evolution of the Rio Puerco, known as the English Dam, was constructed upstream across the Rio Puerco in 1896 at Bareda de las Piedras (Dortignac 1962; Lopez 1982; Yeo 1937). Although the footing of the dam was on sandstone bedrock and heavy sandstone blocks were cemented to the bedrock to form a spillway and irrigation headgate, the margins of the dam were in unconsolidated alluvium (Dortignac 1962), and the dam failed soon after it was built, draining a lake 1.5 mi (2.4 km) long. Dortignac (1962:20) said:
Figure 1. Southwest corner of the U.S.G.S. reconnaissance topographic map, 1888.
Information is either sparse, lacking, or concealed on events just prior or subsequent to the failure of the rock diversion dam. Old-timers claim the dam diverted water for a brief period before a flash flow washed around both ends of the dam.

Subsequent to Dortignac's brief article, photographs of the dam were donated to the Museum of New Mexico by the daughter of P. M. Harroun, an engineer/photographer from Santa Fe who visited the site (Olivas 1975). These photographs show the dam under construction, later while water was rushing over the spillway, and still later after the stream had entrenched below the dam. The pictures of the dam under construction show that the channel was already at least 20 ft (6 m) deep and that an abandoned floodplain with mature cottonwood trees formed an intermediate terrace between the valley floor and the deep arroyo. After the dam break, the channel downstream appeared to be approaching 30 ft (9 m) deep.

A map of the Atrisco Grant was produced in October of 1896 by G. H. Pradt (Metzgar 1977). He had also surveyed Townships 9 and 10 North, Range 1 West, south and north of the Grant. His maps show the Rio Puerco as a wide, meandering channel on the west side of the valley across the west edge of the Atrisco Grant, and the maps show the lower portion of the older channel where it joins the new channel along the southern edge of the grant.

TWENTIETH-CENTURY SURVEYS

The next survey of the middle Rio Puerco was undertaken in the middle 1920s by the Middle Rio Grande Conservancy District, and the results were presented by Bryan and Post (1927). They illustrated numerous longitudinal profiles and arroyo widths but not an overall map of the course of the Rio Puerco. Detailed maps of small areas showed historic channel changes and the courses of prehistoric, filled channels. Bryan and Post did not address the major channel shift west of the Atrisco Grant.

In the middle 1930s, the U.S. Department of Agriculture, Soil Conservation Service, produced aerial photographs (scale approximately 1:31,680) of the entire state of New Mexico and used them to make 15-min. mosaic “orthophoto” maps of the state (Figure 2). These photographs show the course of the entrenched Rio Puerco in adequate detail and show the valley floor. The aerial photographs show that the 1888 channel is recognizable on the east side of the valley floor and that individual meanders shown on the early map (Figure 1), particularly those near nineteenth-century roads, are identifiable on the photographs by their similar shapes and sizes. Kelley (1977) briefly described the courses of the new and old channels and speculated that the channel had evulsed near the Benevidez Ranch headquarters (located in the same area as the noted dam). The old channel on the aerial photographs has a width on the order of 30 to 100 ft (9 to 30 m), radii of meander curvature less than a few hundred ft, wavelengths of a few hundred ft, amplitudes of less than 500 ft (150 m), and a sinuosity of 1.36. The new channel is 100 ft (30 m) to several hundred ft wide, meanders with wavelengths of thousands of ft, radii of curvature of several hundred to thousands of ft, amplitudes of a few hundred to more than 1,000 ft (305 m), and sinuosity of 1.66. At least one older unintrenched meandering channel is seen adjacent and oblique to the 1888 channel on the aerial photographs from the 1930s. Old fields and sand dunes are prominent south of the former 1888 dam (Figure 2). The margins of the new channel show that the stream has already shifted.
Figure 2. Photomosaic of the Rio Puerco valley, ca. 1935: (1) remnant of 1888 dam, (2) course of 1888 Rio Puerco, (3) new channel of Rio Puerco, (4) nineteenth-century fields, (5) incised meander slip-off slopes.
meanders since its inception. The slopes on some of the point bars indicate that the river progressively entrenched as the stream migrated laterally. Both the new channel and old channel have some meander loops oriented both up and down valley, indicating that the gradient of the valley floor did not directly influence the course of the channel.

Since 1935, aerial photography has been repeated at numerous scales, with black-and-white, color, and false-color infrared films. These photographs through time show more and more eolian reworking of the valley floor, obliterating evidence of past nonarroyo channels. The photographs show a number of meander loops crosscutting each other through time. Within the arroyo itself since the 1930s, the channel has narrowed and developed an adjacent inner floodplain, commonly stabilized by tamarisk and willows (Elliot 1979; Heath 1983a, 1983b; Heath and Love 1986; Popp et al. 1983; Shepherd 1976). The inner channel continues to meander and locally to erode the high arroyo banks, widening the arroyo at the expense of the older valley floor. The inner channel of the Rio Puerco now (last measured in the 1980s; Popp et al. 1983) has widths from 50 to 100 ft (15 to 30 m), depths from 5 to 15 ft (1.5 to 4.5 m), meander wavelengths of thousands of feet, amplitudes of hundreds to thousands of feet, and sinuosities of 1.4-1.6.

Many important studies of the Rio Puerco have been carried out during the past 30 years (Davis et al. 1993) and are too numerous to summarize here. Notable discussions of the geomorphology and sedimentology of the Rio Puerco include Tuan (1966), Kelley (1977), Elliot (1979), Love et al. (1982), Wells et al. (1982), Love and Young (1983), Heath (1983a, 1983b), Popp et al. (1983), Condit (1984; Condit and Rose, n.d.), Love (1986), Shepherd (1987), Meyer (1989), and Gorbach et al. (1996).

Mud Balls

A final observation, seemingly of minor historical importance, the Rio Puerco’s common propensity to form and accumulate armored mud balls (Nordin and Curtis 1962) is pertinent to interpreting the geomorphic features and relationships suggested for archaeological sites within the Rio Puerco. Armored mud balls form as clay-rich clods from eroded stream banks are rolled downstream across local gravel bedload (most of the Rio Puerco is a sand-bedded stream). The gravel is impressed and sticks to the clay, armoring the balls and preventing further abrasion. Observations of nests of mud balls as well as excavation of a nest of artifact-bearing armored mud balls on the Huning Ranch indicate (1) mud ball diameters range from 2 to more than 50 cm; (2) clasts sticking to mud balls are mostly in the 1-10 mm range, but a few exceed 5 cm; (3) larger mud balls tend to transport larger clasts; (4) mud balls exhibit a range in clay colors, depending on the strata from which they were derived; (5) mud balls are commonly mixed in with other coarse sand and gravel in attached bars and point bars along the inner channel of the Rio Puerco; (6) nests of mud balls range to hundreds of mud balls over areas of tens of square meters; (7) clasts caught on mud balls tend to be flatter than adjacent gravel; (8) erosionally recycled artifacts such as flakes and pot sherds associated with mud balls tend to be flat; and (9) mud-ball nests exposed on abandoned point bars break down, leaving concentrations of gravel and flat artifacts in localized areas. These processes result in geologically produced archaeological sites having a range in artifact sizes, types, and concentrations in localized areas or even in individual mud-ball size areas. These
concentrations could be (and have been) interpreted as activity areas within sites. When darker mud balls break down, some even look like stone-lined hearths. If the mud balls pick up pot sherd, the sites could be interpreted to have a late Basketmaker to Pueblo component. If only lithics are picked up, nonceramic campsites could be interpreted.

**DISCUSSION**

All accounts of the Rio Puerco before 1900 describe at least a channel and valley floor, and where depth is noted, the channel is at least 10 ft (3 m) and commonly 20 ft (6 m) deep. None of the accounts describe the valley as having no channel or a discontinuous channel. Clearly, a channel was present when and where water was diverted for irrigation in the 1760s and late 1800s. The Rio Puerco apparently developed a riparian “Bosque Grande” before the 1760s, which was considered a desirable resource. The 1896 photographs around Bareda de las Piedras show that the Rio Puerco was entrenched and that entrenchment had proceeded in at least two stages, with an inset inner floodplain and mature cottonwood trees below the valley floor and above the more deeply entrenched arroyo. The timing of development of the inset inner floodplain and channel remain to be investigated.

The 1888 channel, at least partially entrenched, continued downstream onto the B. M. Montaño Grant to the vicinity of the dam and road shown on the 1888 map. Aerial photographs show that, below the former English Dam, the new channel follows the course of the old channel to the lower dam, then follows the orientation of the road to the southwest and cuts along the west side of the valley floor with larger widths and meander dimensions. While it is plausible that floods between 1888 and 1896 established the new course around the west edge of the lower dam, it seems more likely that the large discharge during the failure of the English Dam overwhelmed the capacity of the lower dam, leading to the southwestward course of the larger channel with larger meander dimensions at that time.

The nineteenth-century evidence for a continuous, at least partially entrenched Rio Puerco channel, the orientation of meanders up and down the valley, documentation of at least one large nonnatural flood, and the progressive entrenchment of the new channel along meander slip-off slopes all indicate that Bryan’s (1928) model of headward migration of the Rio Puerco arroyo up an unentrenched valley floor is not viable, at least in the Bernabé Montaño-Huning Ranch reaches. An alternate model was described by Leighly (1936), whereby a meandering channel merely scours its base at intervals along its course, particularly at meander bends, and lowers its course through time. Leighly presented evidence for such erosion along meandering streams in western New Mexico. The late twentieth-century Rio Puerco is known to scour its base during large floods and refill scours during smaller discharges (Love et al. 1991). Typical streams scour at meander bends (Dietrich et al. 1984), so the mechanism of meander entrenchment is not unusual.

Bryan (1928) and many subsequent workers (such as Elliot 1979; Gellis 1991; and Meyer 1989) used the headward-erosion model of arroyo development as the initial phase of an evolutionary cycle of arroyo morphology, wherein (1) the arroyo headwall migrates upstream; (2) the arroyo immediately below the headwall widens and deepens and becomes braided; (3) lateral erosion provides abundant sediment that is transported downstream; (4) as the headwall migrates farther upstream,
the lower reaches of the system become too wide, receiving too much sediment and not enough water, so that deposition takes place and vegetation colonizes the inactive parts of the arroyo bottom and an inner channel and floodplain develop; and (5) the channel and floodplain aggrade and either fill in the arroyo or the cycle is interrupted by renewed erosion.

This cycle undoubtedly occurs in many arroyos, and the Rio Puerco has undergone the described changes in morphology, but apparently not as part of an evolutionary development, but in direct response to changes in discharge and vegetation through time. Even today, where discharge and vegetation have not changed, the Rio Puerco remains a braided stream. Most of the channel, however, experienced a number of large discharge events from the early 1900s to the 1930s so that the channel remained wide and braided, as seen on the aerial photographs. A subsequent decrease in discharge during droughts in the 1940s and 1950s, coupled with the planting and spread of tamarisks along the channel, caused development of the inner channel and stabilization of the inner floodplain (c.f. Hereford 1984). Large flows are capable of increasing the width and depth of the channel (Love et al. 1991), but increasing thresholds enhance the stability of the inner channel and floodplain so that erosion and changes in channel morphology become more difficult (Heath and Love 1986). Therefore, each reach along the Rio Puerco is fairly well adjusted to discharge, sediment load, gradient, and vegetation conditions at that location.

Based on two archaeological sites discovered within the Rio Puerco arroyo between the Atrisco Grant and Los Cerros, Warren (1984) suggested that the arroyo had been there for at least 1,000-2,000 years and that the surrounding valley floor had aggraded with sediments derived from the adjacent valley-margin slopes rather than from overbank flooding by the Rio Puerco and Rio San José. She thought that the Rio Puerco channel had remained low and had episodically migrated within the high banks to maintain the rectangular crosssection of the arroyo.

Warren’s (1984) Site 3 is described as a stratified site within the arroyo with an Archaic (1500–2000 B.P.) component within a thick (1 m) clay overlain by a “thin scatter of gravel” and red clay containing Pueblo IV sherds. This component is overlain by eolian sand and nineteenth-century sherds. Warren’s crosssection suggests an alternative explanation wherein the Archaic component is within a general Holocene aggradation of the valley floor whereas the overlying gravel and red clay (a unit of gravel and armored mud balls?) appears to be at the erosional base of a laterally migrating and entrenching channel. The eolian sediments with the nineteenth-century sherds are consistent with eolian processes on abandoned or less active point bars (Shepherd 1987).

Warren’s second site (Site 10) found within the arroyo is interpreted to be a Socorro phase (A.D. 1050–1200) campsite on an intermediate inset terrace at the confluence of the Rio Puerco and Rio San José. This site is not as well exposed and appears to be draped across the terrace from the riser on the north, across the narrow terrace to the riser on the south, descending toward the inner floodplain. Eolian sand blankets the surface, although Warren also notes stream gravel. The geomorphology and gravel on the terrace suggest a similar eroded slip-off slope for this site, with armored mud balls carrying the sherds and lithic fragments. Excavation of the site would be necessary to determine the relationships
between the archaeological materials and the adjacent terrace.

Love et al. (1982) described a completely aggraded former Rio Puerco arroyo adjacent to Pottery Mound, a Pueblo IV site on the Huning Ranch. The dimensions of the buried arroyo are similar to the modern arroyo (slightly smaller) and include incised tributaries near Pottery Mound that received pueblo trash as the arroyos filled. Sherds in the deposits indicate that the arroyos filled during Pueblo IV time (A.D. 1325–1450). Unfortunately, the widening of the present arroyo has destroyed evidence of how the final, shallow channel behaved after the previous arroyo was filled.

CONCLUSIONS

Comparisons of historic descriptions, maps, and ground and aerial photographs strongly suggest that the Rio Puerco west of Albuquerque was already a continuous, somewhat entrenched channel during the nineteenth century and became more deeply incised between 1888 and 1896. The most likely time and cause for a channel evulsion and initiation of arroyo-cutting near Benevidez Ranch was the diversion of water around a small dam following increased discharge from summer precipitation and the failure of the English Dam upstream. The new channel has larger meander dimensions than the former (1888) channel and appears to have become incised by scouring its base as it migrated laterally down meander slip-off slopes.

The incision of meandering streams to form large arroyos follows Leighly (1936) and is an alternative to the popular model of headward erosion to form arroyos proposed by Bryan (1928). Subsequent stream adjustments to arroyo hydraulic geometry, primarily by increasing width and braiding low-flow sandy channels, are similar to those described by Elliot (1979) and other workers but are not part of an upstream-migrating evolutionary trend. Rather, these and subsequent adjustments to form an inner channel and floodplain are more related to water and sediment discharge conditions and vegetation changes within each reach through time (c.f. Hereford 1984, 1993). Feedback between water and sediment transport, floodplain development and storage dynamics, and vegetation affect discharge downstream so that less sediment is delivered to the Rio Grande through time (Gellis 1991).

Archaeological sites within the present arroyo "box" of the Rio Puerco appear to be both previously buried sites exposed by lateral erosion and sites formed by concentrations of gravel and armored mud balls deposited during lateral incision. These sites deserve a more detailed look to determine their geologic context. However, other valley-fill exposures on the Huning Ranch indicate that a previous arroyo filled to the current level of valley floor between A.D. 1325 and 1450—evidence that a semipermanent arroyo could not have existed for thousands of years in that stream reach.

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REFERENCES CITED

Abert, J. W.

Betancourt, Julio

Bryan, Kirk

Bryan, Kirk, and G. M. Post
1927 *Erosion and Control of Silt on the Rio Puerco, New Mexico*. Report to the Chief Engineer, Middle Rio Grande Conservancy District, Albuquerque, New Mexico.

Calkins, H. G.

Condit, Chris D.

Condit, C., and D. Rose
Cooke, R. U., and R. W. Reeves  

Davis, Ruth, A. Cross, and David W. Love  

D’Arrigo, R. D., and G. C. Jacoby  

Dietrich, W. E., J. D. Smith, and T. Dunne  

Dortignac, E. J.  

Elliot, J. G.  

Gellis, A.  

Gorbach, C., D. Love, S. Piper, R. Davis, and A. Cross  

Graf, W. L.  
Heath, D. L.


Heath, D. L., and D. W. Love

Hereford, R.


Jackson, W. H.

Kelley, V. C.

Leighly, J.

Leopold, L. B., W. W. Emmett, and R. W. Myrick

Lopez, L. S.

Love, D. W.


Love, D. W., J. W. Hawley, and J. D. Young

Love, D. W., R. P. Lozinsky, and E. M. Limburg

Love, D. W., and J. D. Young

Metzgar, J. V.

Meyer, D. F.

Nials, F.


Nordin, C. F., and W. F. Curtis

ASNM 23: Papers in Honor of Robert H. Weber
Olivas, A. (compiler)
1975 The Philip Etnbury Harroun Collection. Museum of New Mexico, Santa Fe.

Popp, C. J., J. W. Hawley, and D. W. Love

Schumm, S. A.


Shepherd, R. G.


Simpson, J. H.
1850 Journal of a Military Reconnaissance from Santa Fe, New Mexico to the Navajo Country, Made with the Troops Under the Command of Brevet Lieutenant Colonel John M. Washington, Chief of the Ninth Military Department, and Governor of New Mexico, in 1849. In Reports of the Secretary of War, 31st Congress, 1st Session, Senate Executive Document, No. 64, pp.79-81. Washington, D.C.

Tuan, Y.-F.

Warren, A. H.
1984 Arroyos and Archaeology in New Mexico. COAS, New Mexico, Archaeology and History 2(2):20-43.

Whipple, A. W.  
1856  
Report on Topographical Features and Character of the Country. In *Reports of Exploration and Surveys to Ascertain the Most Practical and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, Made under the Direction of the Secretary of War*. 33rd Congress, 2nd Session, Senate Executive Document No. 78(3). Washington, D.C.

Widdison, J. C.  
1959  
Historical Geography of the Middle Rio Puerco Valley. *New Mexico Historical Review* 34:248–284.

Yeo, H. W.  
1937  
The Casas Grandes culture occupied much of northwestern Chihuahua, southwestern New Mexico, and extreme west Texas from about A.D. 1200 to 1425. People such as the Concho, Chiso, Tarahumara, and Toboso apparently lived in the mountains and deserts around the Casas Grandes villages. After the passing of the Casas Grandes culture about 1425–1450, the entire region became occupied by hunting and gathering groups who apparently all spoke Uto-Aztecan languages. Some of them practiced a small amount of horticulture. As Griffen’s (1979, 1983) studies show, by the early Spanish Colonial period (1565–1660), these groups can be identified and located with considerable accuracy. In the southern part of the Casas Grandes world, the Concho and Tarahumara spread out from mountain areas they had occupied for centuries. In the middle of the former Casas Grandes world were the Suma who seemed to have moved into the region from the east. In the north, the Jocome and Jano occupied the northwestern corner of the old Casas Grandes world. They may have formerly lived in the Casas Grandes villages of that region and have developed a much-reduced lifestyle after the passing of Casas Grandes. In the Rio Grande valley, the Manso lived as hunters, fishers, and gatherers. They may have once lived in villages along the Rio Grande and been integrated into the Casas Grandes world. The Toboso in the deserts to the southeast appear to have been hunters and gatherers who retained an uninterrupted Archaic way of life from perhaps 7000 B.C. until the Spanish Contact period. After 1700, the Athapaskan-speaking Apache moved into the region from the Plains. Some of the earlier groups, such as the Jano, Jocome, and Suma, were evidently absorbed into Apache culture and became Apache by about 1750. Aside from the Tarahumara, who have maintained a dynamic culture in the mountains, the Indian people who did not become Apache were integrated into Mexican national culture and their descendants are still living in the modern villages.

INTRODUCTION

Given the new ending dates for the Casas Grandes culture of 1425 (Schaafsma 1995) or perhaps 1450 (Dean and Ravesloot 1993) (Table 1), it is no longer possible to discuss the ethnohistoric groups of northern Chihuahua, southern New Mexico, and west Texas without taking the Casas Grandes culture into account (Figures 1 and 2). We know that from about A.D. 1200 or perhaps even A.D. 1150 until circa 1425–1450, the large region depicted on Figure 1 was occupied by thousands of farming people living in hundreds of adobe villages with a
Figure 1. Casas Grandes interaction sphere, circa 1200–1425.
Figure 2. Ethnohistoric groups in the Casas Grandes interaction sphere region, circa 1500-1700.
Table 1. Chronology of Areas Related to Casas Grandes Culture.

<table>
<thead>
<tr>
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<th>Jornada Area</th>
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<td>1598</td>
<td>Suma, Concho, Tarahumara, Jano, and Jocome</td>
<td>Jano, Jocome, and Manso</td>
<td>Suma, Manso, Chinarra</td>
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Gray highlighted sections are periods with significant scholarly disagreement.
basic culture related to the site of Paquimé (or Casas Grandes) (Brand 1935, 1943; Di Peso 1974; Schaafsma 1979, 1995).

This extensive regional culture has been well known since Bandelier (1892) published his report. The core region of the Casas Grandes culture was accurately mapped by Brand (1935), who later described many of the sites (Brand 1943). The core region of the Casas Grandes culture has recently become the focus of current research (Minnis and Whalen 1993; Phillips 1989). It was extended to include the larger region shown on Figure 1 by researchers in 1979 and 1980 (LeBlanc 1980; Ravesloot 1979; Schaafsma 1979). Ravesloot (1979) was the first to use the term, “Casas Grandes interaction sphere” to refer to this extended regional culture. There appears little question that this extensive culture terminated about the same time as did the site of Paquimé and that the culture did not persist in this region after the demise of Paquimé. The notion of a post-Paquimé cultural presence in this region, or the Robles phase of the Tardio period, as Di Peso termed this hypothesized period (Di Peso 1974), has been laid to rest (Phillips 1990). In other words, Di Peso’s Robles phase is a chimera. When Paquimé was abandoned, the regional culture—exemplified by ball courts (Whalen and Minnis 1996), platform pyramids, Ramos Polychrome and related types, depictions of the horned serpent, extensive irrigation systems, and complex adobe villages—also terminated. The question for this discussion is, what happened after the collapse of the Casas Grandes interaction sphere about 1425–1450 and where did the various people present in the region at the time of initial Spanish exploration originate?

Starting with the information from the Ibarra expedition into northwestern Chihuahua in 1565 and documented by Obregón in 1584 (Hammond and Rey 1928), it is possible to speculate that, after the passing of the Casas Grandes world, the region became occupied by hunting and gathering groups who sometimes practiced a small amount of horticulture. As Griffen (1979, 1983) has shown, by the early Spanish Colonial period (1565–1660), these groups can be identified and located with considerable accuracy (Figure 2). Sauer (1934) and Kroeber (1934) researched these people and provided regional maps that show their approximate distributions in the mid-1600s. These maps are in substantial agreement with Griffen (1979, 1983). Griffen (1983:25) noted that his archival research supports Sauer’s (1934) general conclusions. Kroeber (1934:13–15) interpreted the meager linguistic data to indicate that these groups spoke Uto-Aztecan languages, probably of the Sonoran or Taracahitan branch. This interpretation is accepted by Beckett and Corbett (1992:32–37) and Griffen (1983:42–43). Sauer agreed that Suma-Jumano and Concho were Uto-Aztecan and probably the Sonoran branch (Sauer 1934:80–81), but he suggested that the Jano and Jocome spoke an Athapaskan language (1934:81). However, Beckett and Corbett (1992:34–37) have firmly eliminated this notion along with Forbes’ (1959, 1960) idea that all of these people spoke Athapaskan languages.

THE CASAS GRANDES AREA

The ethnic groups of the early historic era appear to be a mix of people who had once been neighbors of the Casas Grandes villagers; people who moved in from some distance; and people who may have formerly lived in villages of the Casas Grandes world and adopted a much-reduced lifestyle after 1425–1450. A proposed reconstruction of these changes is offered here.
The southern regions of the former Casas Grandes culture area in the upper drainages of the Rio Casas Grandes (San Miguel River), the Rio Santa Maria, and Rio del Carmen were occupied by the Concho and Tarahumara in the early 1600s (Griffen 1979:Map 1) (see Figure 2). My interpretation of this seventeenth-century distribution is that these two groups spread out from mountain areas they had occupied for centuries into areas formerly occupied by Casas Grandes people (Figures 1 and 2). This would imply they were once mountain neighbors of the Casas Grandes people. Ceramic evidence in these peripheral areas, such as the Sierra el Nido north of Ciudad Chihuahua, would suggest these people had very little to do with the people of the Casas Grandes culture. Future research in the Tarahumara and Concho areas may indeed indicate that there were distinct ethnic boundaries between these groups and the villages designated as part of the Casas Grandes interaction sphere about 1200–1425. My initial impression is these groups were fairly antagonistic toward each other, and there was very little interaction among them.

Certainly the Tarahumara speak a Uto-Aztecan language related to the Cahitan languages of the Yaqui and Mayo of Sonora (Hale and Harris 1979; Miller 1983). Little is known about the Concho language (Miller 1983:122), but it too was apparently Uto-Aztecan (Hale and Harris 1979:170). Sauer (1934:59) agreed with Kroeber’s (1934) determination that the linguistic affiliation of Concho was Uto-Aztecan with affinity to Cahita and Opata, that is, the Sonoran branch.

In the middle of the former Casas Grandes world were the Suma (Griffin 1979:Map 1) (Figure 2), who seemed to have moved into the region from the outside (Beckett 1994; Naylor 1969). It seems likely that the hunter-gatherers met by the Ibarra party at Paquimé in 1565 were Suma (Naylor 1969). However, Sauer (1934:62) suggested that the Concho were the inhabitants of the Casas Grandes area in prehispanic times, and they therefore would have been the group that met the Ibarra party. Griffen (1979:Map 1) has summarized the early Spanish documents regarding the Suma and provided a regional map showing where they were located during the seventeenth century. Not only were they present near Paquimé, but they were distributed in a broad east-west band from one side of the former Casas Grandes world to the other (Figure 2). Assuming the Suma met the Ibarra party in 1565, on the basis of their own statements, they were not descendants of the inhabitants of Paquimé and the other villages (Hammond and Rey 1928:207–208). There is essentially nothing archaeological or ethnographic that would conflict with their own testimony in this regard, and they therefore must be considered as outside hunter-gatherers who moved into the ruins of the Casas Grandes world from outside, perhaps from the east or southeast, as Beckett (1994) and Naylor (1981) have suggested.

The list of rebel Suma executed at Casas Grandes in 1685 suggests the Suma spoke a Uto-Aztecan language (Naylor 1981). Scholes indicated that the Suma probably spoke a Uto-Aztecan language and that “the language of the Jumanos had a close connection with that of the Sumas” (Scholes and Mera 1940:289). Hickerson (1988) has discussed the Jumano and shown there are many problems with this group. For this discussion, it is sufficient to maintain that these people once lived somewhere to the east of the former Casas Grandes culture and it is from that direction that the Suma came (Naylor 1969:9). There is currently nothing to substantiate Forbes’ (1960) notion that the Suma spoke Athapaskan. That idea should be disregarded (Naylor 1981).
To the north of the Suma, the Jocome and Jano occupied the northwestern corner of the old Casas Grandes world (Griffen 1979, 1983). It is clear in Obregón’s account that the Ibarra party met two distinct groups near Paquimé (Hammond and Rey 1928:198, 207). My reading of the Obregón account indicates that the Ibarra party crossed the Sierra Madre Occidental west of the Carretas Basin (Hammond and Rey 1928:197), probably over the same Carretas Pass that Bandelier (1892) used. If this is the case, the first of the two groups met by this party in 1565 would have been in the upper Carretas Basin, which is where the Jano and Jocome were living in the seventeenth century (Griffen 1979, 1983).

Obregón noted that the first Indian they met “was a comely young man, handsome and well attired” (Hammond and Rey 1928:198). The day after they met him, 300 of these people came to the camp (Hammond and Rey 1928:201). The Ibarra party could not “see what sort of habitations or houses they had because the army passed at a distance from their town” (Hammond and Rey 1928:203). They apparently ate “some corn” (Hammond and Rey 1928:203). While the Ibarra party called them “Querecho” (Hammond and Rey 1928:201), it is clear they were different from and enemies of the “Querecho” who lived among the buffalo (“cattle”) (Hammond and Rey 1928:203). The word “Querecho” seems to have been a generic term in those days, used for many different people.

These people may have formerly lived in the Casas Grandes villages of that region and have developed a much-reduced lifestyle after the passing of the Casas Grandes culture. The suggestion here, based mainly upon their ethnohistoric distribution, is that some of the people who once lived in the villages in the Carretas Basin west of Janos, Chihuahua, and in the southwestern corner of New Mexico (Figure 1) could have remained in the region after 1425–1450 and become the first group of people met by Ibarra’s party in 1565. They were later involved with the presidio and mission at Janos (Di Peso 1985; Griffen 1979, 1983; Kessell and Hendricks 1992). Indications are the Jano and Jocome spoke a Uto-aztecan language of the Sonoran branch (Beckett and Corbett 1992:48).

THE RIO GRANDE VALLEY

In the Rio Grande valley, the Manso lived as hunters, fishers, and gatherers at the time of the early Spanish expeditions (Hodge et al. 1945; Scholes and Mera 1940). Their ancestors may have once lived in El Paso phase villages along the Rio Grande (Beckett 1994; Beckett and Corbett 1992). These El Paso phase villages were integrated into the larger Casas Grandes interaction sphere (Schaafsma 1995). Like the Jano and Jocome, they apparently assumed a much-reduced lifestyle after 1425–1450. It is possible that they spoke a Taracahitan language in the Uto-Aztecan family closely related to Jano and Jocome (Beckett and Corbett 1992).

The linguistic affiliation of the farming groups living near Presidio, Texas, in the 1580s is controversial (Cloud et al. 1994; Hickerson 1988). Some of them may have been related to the Plains Jumano and moved into this area after 1550. At any rate, there is every reason to believe some of them were remnant people of the former Casas Grandes interaction sphere who, alone of all the people in the region, maintained a farming-village way of life after the demise of the Casas Grandes world. They apparently spoke a Uto-Aztecan language closely related to Suma (Naylor 1981; Scholes and Mera 1940).

The trend of the available evidence is that all of the groups occupying the region of the former Casas Grandes culture in the early
of historic period—such as the Concho, Tarahumara, Suma-Jumano, Jano, Jocome, and Manso—spoke Uto-Aztecan languages, possibly related to the Taracahitan languages of Sonora and Sinaloa. The Suma-Jumano remain the most problematical (Hickerson 1988). It is reasonable to suggest that three of these groups, the Manso, Jano, and Jocome, were remnant people who once were integrated into the Casas Grandes world (Beckett 1994; Beckett and Corbett 1992). The possibility that the Uto-Aztecan, possibly Taracahitan-speaking Manso, Jano, and Jocome, were descendants of the Casas Grandes world implies that some of the people, if not all who once were integrated into the Casas Grandes world, spoke Uto-Aztecan languages of the Taracahitan or Sonoran branch. This linguistic suggestion would agree with Turner’s (1993:45, Figure 12) finding that the teeth of the people at Paquimé (Casas Grandes) are very similar to the teeth of people in Sinaloa. Turner’s research is extremely significant and deserves far more investigation, for it obviously implies that the people of Paquimé (and the other villages, also) were related to or derived from people on the west coast of Mexico.

THE SONORAN REGION AND TO THE SOUTH

The Sonoran region in and immediately west of the Sierra Madre Occidental requires a great deal of attention concerning the ethnohistoric groups present during and after the time of the Casas Grandes culture. The “Serrana Province” and the people living there were extensively discussed by Riley (1987:39–96). Riley (1987:68) was ambivalent about the relationship of these western people to Casas Grandes, but was aware there was some kind of involvement with Casas Grandes that demands more research. Phillips (1989:389–390) has suggested that the Opata were derived from the Casas Grandes culture:

Piales and Doolittle argue that the Río Sonora culture continued into historic times, becoming the Opata. I would like to revive a hypothesis once put forward by Riley: that the Opata were descended—at least in part—from Casas Grandes. The Río Sonora hierarchy emerged at a time when the Casas Grandes network was expanding westward. The resulting demographic compression could explain the emergence of small but feisty local hierarchies. This same process may have intensified when the Casas Grandes area was abandoned, after A.D. 1400—its survivors shifting west into Sonora. Such events would explain historic language patterns in northern Sonora, in which Opata displaced Pima and Eudeve.

The complex situation in Sonora will not be explored further here, but the indications from this region also are that the people of the Casas Grandes culture may have spoken Uto-Aztecan languages, related to Taracahitan or the Sonoran branch of Uto-Aztecan.

In far southern Chihuahua were the Tepehuane (Griffen 1979:Map 1) (Figure 2), who may have been part of the Chalchihuites/Loma San Gabriel culture (Foster 1982). The Toboso in the deserts to the southeast (Griffen 1979:Map 1) (Figure 2) appear to have been hunters and gatherers who retained an uninterrupted Archaic way of life from perhaps 7000 B.C until the Spanish Contact period. The Chiso of the Big Bend country in Texas (Griffen 1979:Map 1) (Figure 2) were like the Toboso in being Archaic hunter-gatherers who persisted with little change for thousands of years until they were disrupted.
by the Spaniards during the 1600s (Griffen 1979, 1983). All of these peripheral groups, beyond the region of the Casas Grandes culture, seem to have spoken Uto-Aztecan languages. Apparently the Chiso were linguistically the same as the Concho (Griffen 1979).

THE APACHE TO THE NORTH

After about 1550, the Athapaskan-speaking Apache appeared in the far northeastern reaches of the former Casas Grandes interaction sphere in the vicinity of the Pecos River valley. At that time, apparently all southern Athapaskan or "Apachean" (Hoijer 1971) were High Plains buffalo hunters that the Coronado party described in 1540–1941 as "Querecho" (Gunnerson 1956; Gunnerson and Gunnerson 1971; Schaafsma 1981, 1996; Wilcox 1981, 1988; Winship 1896). The linguistic evidence summarized by Hoijer (1971) would agree with the statement made in 1630 by Fray Alonso de Benavides (Ayer 1916:130, 40) that all of the Apachean spoke a common language at that time. All indications are that they had arrived as hunters from the northern Plains (Eggan 1983:741; Wilcox 1981, 1988) into what is now eastern Colorado and eastern New Mexico about 1400 (Brunswig 1991; Schaafsma 1996). They were widespread in southern New Mexico by Benavides' time (1626–1629) (Hodge et al. 1945). It is only after about 1680 that the Apache moved into northern Chihuahua (Griffen 1979). Some of the earlier groups, such as the Jano, Jocome, and Suma, were apparently absorbed into the Apache culture after about 1680 and became Apache by about 1750 (Di Peso 1985; Griffen 1979:110; Naylor 1969). Surely their knowledge of living in the desert environment was incorporated into Apache culture during this process and readily accounts for the Apache success at desert life. Aside from the Tarahumara, who have maintained a dynamic culture in the mountains, the Indian people who did not become Apache were integrated into Mexican national culture and their descendants are still living in the modern villages (Naylor 1969; Griffen 1979).

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—Curator of Anthropology, Museum of New Mexico, Santa Fe

REFERENCES CITED

Ayer, Mrs. Edward E.
1916 The Memorial of Fray Alonso de Benavides, 1630. Privately printed, Chicago.
Bandelier, Adolph

Beckett, Patrick H.

Beckett, Patrick H. and Terry L. Corbett

Brand, Donald D.

Brunswig, R. H., Jr.

Cloud, William A., Robert J. Mallouf, Patricia A. Mercado-Allinger, Cathryn A. Hoyt, Nancy A. Kenmotsu, Joseph M. Sanchez, and Enrique R. Madrid

Dean, Jeffrey S., and John C. Ravesloot

Di Peso, Charles C.

94 ASNM 23: Papers in Honor of Robert H. Weber
Eggan, Fred

Forbes, Jack D.


Foster, Michael S.

Griffen, William B.
1979  *Indian Assimilation in the Franciscan Area of Nueva Vizcaya*. Anthropological Papers of the University of Arizona 33. The University of Arizona Press, Tucson.


Gunnerson, D. A.

Gunnerson, J. H., and D. A. Gunnerson

Hale, K., and D. Harris

Hammond, George P., and Agapito Rey
1928  *Obregon's History of 16th Century Exploration in Western America*. Wetzel Publishing, Los Angeles.

Hickerson, Nancy P.
Hodge, F. W., G. P. Hammond, and A. Rey
1945 Fray Alonso de Benavides' Memorial of 1634. University of New Mexico Press, Albuquerque.

Hoijer, H.

Kessell, John L., and Rick Hendricks (editors)

Kroeber, A. L.

LeBlanc, Steven A.

Miller, Wick R.

Minnis, Paul, and Michael Whalen

Naylor, Thomas H.


Phillips, David A., Jr.

96 ASNM 23: Papers in Honor of Robert H. Weber

Ravesloot, John C.

Riley, Carroll L.

Sauer, Carl
1934 The Distribution of Aboriginal Tribes and Languages of Northwestern Mexico. Ibero-Americana 5:1-94.

Schaafsma, Curtis F.


Scholes, France V., and H. P. Mera

Turner, Christy G., II
Whalen, Michael E., and Paul E. Minnis

Wilcox, D. R.


Winship, G. P.
Not long before her early death in 1978, my first wife remarked that the Zia sun symbol looked like a stylized total eclipse of the sun, with the inner corona enclosing the circular void of the moon and long coronal streamers reaching outward. It is entirely possible that the sun symbol has nothing to do with eclipses, but the resemblance is there, and others before her must have noticed it. Whatever the origin of the Zia sun symbol, an event so stunning and rare and unexpected as a total eclipse of the sun might well have been recorded in aboriginal rock art, or perhaps in some other durable medium. The purpose of the present article is to show that such records could be worth looking for.

A BRIEF TUTORIAL ON SOLAR ECLIPSES

An eclipse of the sun occurs when the moon comes between the observer and the solar disk, which can happen only at the time of new moon. Just what an observer sees, at a given instant, depends on the part of the moon's shadow he or she is in.

The shadow has a definite structure that governs the properties of an eclipse (Figure 1). It comprises two right circular cones centered on the line passing through the centers of the sun and the moon, the shadow axis. The outer (penumbral) cone surrounds the smaller, inner (umbral) cone.

Within the umbral cone, an observer sees the outlines of the sun and the moon as nonintersecting, almost concentric circles. Since the sun is intrinsically larger than the moon, the umbral cone gradually converges to a point on the shadow axis where the solar and lunar circles coincide. Beyond this point, it diverges. In the converging portion, the lunar circle is larger than the solar, and the observer sees a total eclipse. The sun is entirely hidden. In the diverging portion, the solar circle is larger, and the observer sees the eclipsed sun as a bright ring surrounding the dark moon. This is an annular eclipse.

Within the penumbral cone, the lunar and solar circles intersect. The moon overlaps only part of the sun, so an observer experiences a partial eclipse. The penumbral cone expands steadily with increasing distance from the moon. Outside the penumbral cone, the solar and lunar circles do not overlap, and there is no eclipse.

Because of the motion of the moon, the shadow system sweeps across the earth in a generally eastward direction. Its speed and direction depend on factors that differ from one eclipse to another. Since the earth also
Figure 1. Solar eclipse shadow geometry (not to scale). The expanding outer (penumbral) cone is where a partial eclipse occurs. The inner (umbral) cone has two parts: the converging segment within which the eclipse is total, and the diverging segment within which the eclipse is annular.

rotates toward the east, the net speed of the shadow with respect to the ground is somewhat reduced. The following numbers are typical: the earth takes about 5 hours to pass through the penumbral cone, the umbral cone sweeps across the earth in a little more than 3 hours, and the shadow axis moves over the ground at about 2,400 km (1,500 mi) per hour. An eclipse is never total for a stationary observer for more than 7.5 min., and usually the duration is much less. At any one place, total eclipses occur only rarely, at intervals of about 300 years on average.

While the shadow axis touches the earth, a relatively small, but swiftly moving, elliptical area on the ground lies within the umbral cone. The size of the area depends on its distance from the point of convergence noted above. As the dark patch moves over the ground, it sweeps out a band within which a total or annular eclipse is experienced at some time. The band is usually less than 322 km (200 mi) wide in temperate latitudes. Observers outside the band, but within about 3,220 km (2,000 mi) of it, see a partial eclipse. Even where a total eclipse occurs, the event begins and ends within an hour or so of a partial eclipse.

During a total eclipse (Figure 2), the moon hides the intensely bright solar surface (the photosphere), without covering the dim and tenuous outer atmosphere (the corona). The corona is visible only when the photosphere is entirely covered. The inner corona, which
Figure 2. Total solar eclipse of 1991 July 11, as photographed with the Newkirk coronal camera on Mauna Loa, Hawaii, through a radially graded filter that much reduces the intensity of the inner corona so that the outer corona and the red flame-like prominences stand out clearly. Apart from the suppression of the brilliant white inner corona that immediately surrounds the black lunar disk, this photograph closely depicts the typical appearance of a total eclipse to the human eye. (Rhodes College, Memphis, Tennessee, and to the High Altitude Observatory of the National Center for Atmospheric Research, Boulder, Colorado.)
extends some tens of thousands of kilometers above the photosphere, is bright enough to be seen through thin clouds. Brilliant red flame-like “prominences” of glowing hydrogen gas usually can be seen rising into the inner corona. The pale outer corona, with its rays and streamers reaching far into space, is much fainter and cannot be seen through even thin clouds. The sky is dark enough that the brighter stars and planets can easily be seen. (On one occasion, a previously unnoticed comet was discovered near the sun during a total eclipse!)

Only a total eclipse makes much of an impression. Most partial eclipses are not noticed by people who do not expect them. An annular eclipse might get some attention, especially if it occurs at sunrise or sunset, but it is not likely to be remembered for long, since the sun is not completely hidden. Annular and partial eclipses dim the light for awhile, but total eclipses “kill” the sun and reveal strange things that otherwise are never seen. No one who experiences a total eclipse can be oblivious to it.

VISUAL ASPECTS OF A TOTAL SOLAR ECLIPSE

A total eclipse of the sun is among the most awesome and visually powerful phenomena that nature offers. I have seen three, and even as an astronomer properly versed in such things, I have always found the event to be totally absorbing and emotionally compelling. I watch as a primitive, and my modern veneer of sophistication does not come between me and the things I see.

Imagine you are an aboriginal inhabitant in the path of a total eclipse. You have no idea that anything unusual is about to happen. Centuries have passed since your forebears last saw such a thing, and all memory of the earlier event has been lost, so you have no idea what is going on, or what to expect next.

The partial stage of the eclipse is well under way before you notice anything unusual. At some point, you sense that the sunlight seems a bit weak, especially if the day is clear, as is usual in the Southwest. It is a dimness like you see when the sun is dropping and about to set, except that the light is not getting redder. The color does not change, but the light steadily weakens, taking on a more and more “watery” appearance. If there are trees nearby, you notice that the familiar little circles of light on the ground, where the sun peeps through gaps in the leaves, have changed. They have “bites” taken out of one side. They look like fat crescents, and as the light fades, the crescents get thinner. Something clearly is not right, and you feel a little apprehensive.

Now things start to happen faster. As the little crescents under the trees turn into thin arcs, you see shimmering “shadow bands,” alternating bands of greater and lesser brightness, moving rapidly over the ground. If you look to the western horizon, you see that it is distinctly dark, and so is the sky above it. That is the shadow of the moon bearing down on you. There is still plenty of light, but only a fraction of what you are used to. Birds seek places to roost, and insects stop buzzing. It gets noticeably quieter.

Suddenly, you are in darkness. The sun is gone. There is an abrupt stillness. You feel a chill. Stars appear. A little light comes from the horizon and from the eerie haze around where the sun had been—where now you see a sharp black disk against a glowing white ring. Great red flames rise into the white ring. If the air is clear, you see the dim rays of the outer corona reaching far out from the sun. The sight is inexpressibly grand, and you have
never been more frightened in your life. You want to hide, but you cannot pull your eyes away. Time seems to have stopped. You wonder if the sun has gone forever and perhaps whether the black thing that took it is coming for you next.

Soon the moon moves enough to uncover a bit of the photosphere, and the total part of the eclipse ends abruptly. A tiny spot of brilliant light appears suddenly on the western side of the inner corona, and for a second or two you see what astronomers call “the diamond ring.” The outer corona and the stars disappear instantly, and in a few seconds more the inner corona is lost in the rapidly increasing light of the reappearing sun. From here on, the chain of events is the exact reverse of those that preceded totality. The sun comes back, and you feel immense relief, even a sense of anticlimax. And you earnestly hope the priests know how to ensure that such a terrible thing never happens again.

So much for the hypothetical aboriginal observer. I have tried to convey a sense of the impact a total eclipse has on those who witness it. The sight is gripping for persons who understand it, and it can be devastating to those who do not. My grandfather was a youngster at Hodgenville, Kentucky, when the total eclipse of August 7, 1869, took the community by surprise. Most Whites had enough education to realize what was happening, but many Blacks, only recently freed from slavery and totally without schooling, were helpless with terror. My grandfather remembered seeing grown men hiding in rain barrels, trying to avoid the stern wrath of the Lord, who had caught them unready for judgment. He must have picked up some of their stark fear, for he hated the memory of that eclipse for the rest of his long life.

A total eclipse is an unforgettable sight. Surely some ancient observers must have felt a need to record the unheard-of thing they saw. Consider the likely pictographic representation of the supernova of A.D. 1054 by the Anasazi at Peñasco Blanco in Chaco Canyon, showing an event far less shocking than a total eclipse of the sun. As we shall see, there were several total eclipses that would have been seen by the Anasazi. Do recognizable records survive?

METHOD

I sought eclipses during the millennium following A.D. 700 (roughly spanning the Pueblo I through Pueblo IV periods) that were total anywhere in the area bounded by the 34th and 38th parallels of latitude and the 105th and 111th meridians of longitude. The intent was to cover the Anasazi heartland and the Rio Grande pueblos, in an appropriate time range. The boundaries in time and space are arbitrary but reasonable.

The eclipses were found and calculated with computer programs that I wrote some years ago in preparation for eclipses I planned to observe. The main source of error in the computed eclipse paths is the irregularity of the long-term slowing of the earth’s rotation. The uncertainty in the calculated boundaries of totality is roughly 1.6 km (1 mi) north-south, 6.4 km (4 mi) east-west at A.D. 700, and 1.6 km (1 mi) east-west at A.D. 1700.

I ignored eclipses that took place near sunrise or sunset, because ancient observers probably would have regarded them as peculiarities of the particular sunrises or sunsets and because clouds are much more likely to interfere near the horizon. If the sun vanishes when it is high in the sky, you are bound to notice.
Twelve eclipses meet the search criteria (Figure 3). Eight are significant for this article. Those are discussed in the next section. The other four are so marginal that I will say nothing about them apart from these remarks:

711 October 16: Total only in the northeastern corner of the search area, north of a line running from near Monticello (Utah) to Taos (New Mexico).

957 July 29: Total only in the extreme northwestern corner of the search area. The southern limit of totality passed a few miles north of Hovenweep.

1076 March 7: Total only in the extreme southeastern corner of the search area. Total at Gran Quivira, but only partial at Abo and Quarai.

1318 August 26: Crossed the southwestern corner of the search area. Total for less than a minute. Path was only 32 km (20 mi) wide. Total at the future site of Springerville (Arizona) and would have been seen by the Mogollon people then occupying the nearby Casa Malpais pueblo.

The maps (Figures 4–11) show the bands for the totality of the eclipses judged to be the most noticeable and hence most likely to be recorded by the Anasazi or their Pueblo descendants. Here are approximate time of day, duration of totality at the center line of the path (duration goes to zero at the path edges), and rough direction to the sun, as experienced in the general search area, for these eclipses:

804 April 13: Early afternoon; duration 5.1 minutes; high in the west-southwest.

1097 July 11: Early afternoon; duration 4.7 minutes; high in the west-southwest.

1257 June 13: Midday; duration 6.3 minutes; very high in the south.

1259 October 17: Early afternoon; duration 3.5 minutes; fairly high in the southwest.

1372 September 27: Mid-morning; duration .5 minutes; fairly high in the southeast.

1379 May 16: Early to mid-morning; duration 4.0 minutes; fairly high in the east.

1397 May 26: Late afternoon; duration 3.1 minutes; low in the west-northwest.

1557 April 28: Mid to late afternoon; duration 4.2 minutes; fairly high in the west.

Five of the eight eclipses took place in the 140 years between A.D. 1257 and 1397. This is the result of random chance, not of some subtle property of eclipses.

The first three of these eclipses deserve further comment. The times given below for mid-totality are what a sundial would have said, had one been present (and if it could have been read with the sun hidden!). The solar directions at mid-eclipse are stated as altitude above the horizon and true azimuth (clockwise from north). These are relevant because an eclipse might be commemorated by architectural features or alignments. The durations of totality are expressed as “minutes:seconds.”

804 April 13: Total at Chaco Canyon and at Mesa Verde. At Chaco Canyon, mid-totality was at 2:43 PM, the altitude and azimuth of the sun were 45 and 246
Figure 3. Map of the Four Corners states, showing the center lines of the tracks for the 12 total solar eclipses between A.D. 700 and 1700 that satisfy the search criteria.
Figure 4. The shaded area shows where total eclipse occurred on 804 April 13. Outside the shaded area, the eclipse was partial.
Figure 5. The shaded area shows where total eclipse occurred on 1097 July 11. Outside the shaded area, the eclipse was partial.
Figure 6. The shaded area shows where total eclipse occurred on 1257 June 13. Outside the shaded area, the eclipse was partial.
Figure 7. The shaded area shows where total eclipse occurred on 1259 October 17. Outside the shaded area, the eclipse was partial.
Figure 8. The shaded area shows where total eclipse occurred on 1372 September 27. Outside the shaded area, the eclipse was partial.
Figure 9. The shaded area shows where total eclipse occurred on 1379 May 16. Outside the shaded area, the eclipse was partial.
Figure 10. The shaded area shows where total eclipse occurred on 1397 May 26. Outside the shaded area, the eclipse was partial.
Figure 11. The shaded area shows where total eclipse occurred on 1557 April 28. Outside the shaded area, the eclipse was partial.
degrees respectively, and the duration was 4:14. At Mesa Verde, the time was 2:40 PM, altitude and azimuth were 45 and 244 degrees, and duration was 4:04 minutes. It would have been a powerful event at either place.

1097 July 11: Total at Chaco Canyon and at Mesa Verde. At Chaco Canyon, mid-totality was at 2:11 PM, the altitude and azimuth of the sun were 58 and 252 degrees respectively, and the duration was 4:38. At Mesa Verde, the time was 2:06 PM, altitude and azimuth were 59 and 249 degrees, and duration was 4:31. Like the eclipse of 804, it would have been a stunning sight.

1257 June 13: Total at Mesa Verde, where mid-totality was at 12:10 PM, the altitude and azimuth of the sun were 76 and 190 degrees respectively, and the duration was 5:14. With the sun almost overhead, and lasting an unusually long time, this eclipse was likely the most impressive in the Anasazi country during the millennium that followed A.D. 700.

CONCLUDING REMARKS

We have seen that at least eight total eclipses were favorably observable in the Anasazi country and at the Rio Grande pueblos between A.D. 700 and 1700. These visually and emotionally commanding events could have impelled some who saw them to make a durable record, whether by rock art, by ceramic depiction, or by architectural alignment. Any artifact that could be tied to a specific eclipse would thereby be dated with extraordinary precision. I feel that a search for ancient records of eclipses might be very rewarding.

ACKNOWLEDGMENTS

The maps were prepared with the MapExpert 2.0 program from DeLorme Mapping, Inc., and they are used here with DeLorme’s permission. This program is a flexible and convenient tool for creating base maps on a wide range of scales and levels of detail. Of particular value for the present application was the ease and accuracy with which the slightly curved boundaries of the eclipse paths could be plotted.

The excellent photograph of the 1991 July 11 eclipse was provided by Oran R. White of the High Altitude Observatory, Boulder, Colorado. The camera system used to make it was developed by the late Gordon R. Newkirk, Jr.

I thank my late first wife, MaryJane, for her remark about the Zia sun symbol, and my present wife, Mary Ann, for her help in preparing the maps.

—National Radio Astronomy Observatory (retired), Socorro
GEOLOGY OF MOCKINGBIRD GAP SITE IN CENTRAL NEW MEXICO

Robert H. Weber

Geological and archaeological investigations at a major campsite of the Llano complex provide a basis for interpreting the stratigraphy, soils, geomorphology, and climate of the late Pleistocene and early Holocene. The Mockingbird Gap Site (LA 26748) is situated on the floor of an intermontane basin of interior drainage, the Jornada del Muerto, at an elevation of 1,513 m (4,960 ft). A lithic complex of Clovis points and associated stone implements enclosed in aeolian sands (now a reddish-brown pedocal) is assignable to the interval 12,000 to 11,000 B.P. on the basis of archaeological correlation with 14C-dated sites elsewhere in the Southwest. Formation of dunes during the Folsom occupation of sites in the surrounding region indicates a sharply increased drying trend during the interval 11,000 to 10,000 B.P. The Clovis horizon overlies a truncated late Pleistocene paleosol distinguished by a widespread basal zone of pedogenic gypsite, which in turn overlies slightly weathered gravels and sands. Conformable with a Pleistocene landscape of greater relief, the gypsite slopes beneath an adjacent drainage channel contain a sequence of clays, silts, and channel sands deposited in a small stream and associated pond or wet meadow, which may have been contemporaneous with the Clovis occupation. Migrating dune sands repeatedly deflected and blocked the stream channel, resulting in two additional stages of alluviation.

INTRODUCTION

Integrated archeological and geological investigations at the Mockingbird Gap site have aided in the interpretation of an interval of the late Pleistocene-early Holocene geologic history of a major intermontane basin and also have provided documentation of a human occupational sequence extending from Paleoindian to early historic Puebloan. Archeological work in the summers of 1967, 1968, and 1969 was greatly facilitated by the cooperation of Dr. George A. Agogino of the Paleoindian Institute, Eastern New Mexico University.

The area under discussion is located near the northern end of the Jornada del Muerto (“Journey of the Dead”) at an elevation of 1,513 m (4,960 ft). The Jornada is an elongate structural and topographic basin extending 240 km (150 mi) in a north-south direction and with a maximum width of 48 km (30 mi). The valley of the Rio Grande lies 30 km (18 mi) to the west beyond a low divide. A linear basin and range mountain border on the east consists of the Sierra Oscura and San Andres Mountains, separated by the pass of Mockingbird Gap, one of the principal routes of access for prehistoric travelers into the
Tularosa Valley to the east. Mockingbird Gap overlooks Trinity Site [National Historic Landmark], the scene of the first atomic bomb test in 1945 on the White Sands Missile Range.

The floor of the Jornada del Muerto now is a desert grassland of low relief that receives an annual precipitation of about 20 cm (8 in.), most of which stems from summer thunderstorms. Surface runoff to playa basins a few kilometers to the south of Mockingbird Gap site is limited to episodes of high-intensity storms that can overcome the absorptive capacity of widespread sand sheets, small deflation basins, and widely spaced stream channels clogged with dune hummocks and vegetation. As a consequence, channelways have been aggraded, and the type of deep arroyo dissection so prevalent in the Southwest, a boon to inquisitive geologists and pedologists but the bane of soil conservationists, is lacking here. There is no alternative, therefore, to digging or drilling if one seeks to decipher the Quaternary geology of the region. Fortunately, however, surface archaeological manifestations provide added incentive to dig in localities that superficially are not sufficiently attractive to induce a geologist to cast off his aversion to a dirt pick and shovel. The results commonly are of mutual benefit to archeologists and geologists.

The site is situated on and adjacent to a northeast-trending, low, narrow arcuate ridge ranging from about 140 to 200 m (450 to 650 ft) in width. Indications of significant Paleoindian occupation extend in a linear belt a little more than .8 km (.5 mi) in length along the ridge and across a maximum width of 275 m (900 ft). The course of Chupadera Arroyo, an inappropriate designation here, parallels the western foot of the ridge at a level of 5 m (15 ft) below the ridge crest. Opposite the southern section of the site, the channel is very narrow and clogged by dune hummocks and vegetation. To the north, however, it widens into a flat-floored drainageway up to 3 km (2 mi) in width. The Chupadera Arroyo drainage system heads in pinon-juniper woodland on Chupadera Mesa, 58 km (36 mi) to the north-northeast and terminates in a desert playa basin 13 km (8 mi) to the south. On the eastern border of the site is a flat, grassy meadow about .8 km (.5 mi) wide and 3 km (2 mi) long, a relict feature of a former tributary of Chupadera Arroyo that has been deflected southward and also an abandoned deflection channel of Chupadera Arroyo itself. The meadow is at a level about 2.5 m (8 ft) below that of the ridge crest.

Although the site was occupied intermittently by a succession of cultures extending from bearers of the Llano complex prior to 11,000 years ago, through the Desert Archaic, to a colony of Pueblo Indians in the seventeenth century, the focus of this study was on the earliest inhabitants. I shall not elaborate upon the archaeological features of the site except insofar as they bear upon geological interpretations. It may be appropriate to note, however, that whereas most recognized sites of the Llano complex, as indicated by the presence of distinctive fluted Clovis points, are kill and butchering sites, Mockingbird Gap Site illustrates an intermittently occupied campsite on which a wider range of domestic activities was pursued.

**STRATIGRAPHIC RECORD**

The physiographic isolation of the site from sources of sediment other than that transported by wind, humans, and animals has resulted in a skeletal stratigraphic record dominated by eolian deposition and deflation, erosion and redistribution by sheetwash, and soil-forming...
processes. As a result, much of the geologic record is assignable to disconformities and unrecognizable diastems. Exposure of a deeply buried section in the adjacent arroyo floor, however, aids materially in filling some of the gaps.

The basal stratigraphic unit on the ridge and adjacent flanks consists of gray and brown to reddish-brown fluviatile gravels and sands deposited by westward-flowing streams heading in the northern end of the Sierra Oscura and in hills still farther north (Figure 1). They consist predominately of slightly to moderately weathered Pennsylvanian and Permian limestones, dolomites, sandstones, and siltstones of subangular to rounded form, with clasts reaching a maximum diameter of about 40 cm (16 in.). Although in all probability assignable to depositional events in the late Pleistocene, no specific age-limiting criteria have been recognized.

The upper part of the gravel sequence has been severely eroded and subsequently was engulfed by a pedogenic gypsite more than 2 m (6 ft) thick [in places]. This constitutes the strongly developed gypsic or Ccs horizon of a paleosol. The gypsite commonly grades upward from a very pale yellowish-brown, friable aggregate of selenite crystals into an upper zone of very pale yellow to white, massive, microcrystalline gypsite of chalky coherency. The upper surface is armored by a very pale gray, platy, indurated crust showing polygonal jointing. Local zones of more coarsely crystalline, cellular gypsite abruptly transect the finer-grained phases; these may be products of recrystallization by vadose and groundwaters. Variable proportions of calcium carbonate are present, particularly in the upper part. Owing to its relative resistance to erosion by wind and sheetwash, the gypsite cap is widely exposed on the crests and slopes of the northern Jornada del Muerto, where it forms a mappable lithostratigraphic unit. Westward on the Jornada, it appears to grade into a chalky white calcite caliche. The draped configuration over topographic highs, dipping beneath stream channels and deflation depressions, indicates development on a Pleistocene landscape of deeper dissection than that of the present.

According to a recent survey by Page (personal communication 1971, 1972), gypsite caliches of similar to identical character are widely distributed in arid regions of the world. They are particularly extensive in southern Tunisia and adjacent parts of Algeria and Libya, where the annual rainfall ranges from 5 to 18 cm (2 to 7 in.). This relationship points to an interval of marked aridity during the late Pleistocene in central New Mexico.

The source of the gypsumiferous windblown dust from which the gypsic caliche developed during pedogenesis is likely to have been in the playa basins to the south in the Jornada del Muerto. More remotely, a possible source lies farther to the south in the adjacent Tularosa Valley, where wasted Pleistocene lakes were the source of the extensive White Sands gypsum dune field.

Overlying the gypsite caliche in irregular to smooth, sharply abrupt contact are mottled light reddish-brown sandy and clayey calcareous loams of truncated Bca-Cca horizons of a younger paleosol. Locally, this zone consists of more than 50 percent nodular calcite caliche, thus reaching the level of a K horizon, as defined by Gile et al. (1965). Although these carbonates (ca) horizons in part are superimposed upon the upper part of the basal gravels and sands, they also include later silty sands of apparent eolian origin deposited on the eroded surface of the gravels. Several steep-sided hummocks of the basal gravel, with well-developed carbonate
Figure 1. Stratigraphy of the Mockingbird Gap Site.
impregnations, projected through the gypsite on the crest of the ridge in the southern section of the site; these were overlain and abutted by the next younger unit. The similarity of these features to tree-thrown mounds in modern forests suggests a possible former extension of a forested vegetative zone onto the floor of the Jornada del Muerto during the late Pleistocene. Alternatively, however, they may have originated in a riparian gallery forest along the borders of a stream.

The calcic and gypsic paleosols were deeply eroded, prior to an during deposition of the next younger unit; sandy beds that contain artifacts and living floors of the Llano complex people. Although evidently of eolian origin, the sediments of this unit contain abundant evidence of redistribution by sheet wash and disturbance by humans, animals, insects, and plants (cicadas were particularly effective in churning and mixing the soils of this level and of the ca horizons of the underlying paleosol). Superimposed upon this sequence is a zonal soil profile, the upper part of which is a noncalcareous red to reddish-brown (2.5YR hue) Bt horizon of loamy sand, underlain by reddish-brown calcareous sandy loams of a Bca horizon. The physical characteristics of this soil permit assignment to the reddish-brown aridosols of semiarid to arid regions, and to haplargids in the 7th Approximation classification.

As a result of its low resistance to erosion, the “red sand” sequence has been stripped from large areas of the site and surrounding region, with preserved on-site thicknesses reaching a maximum of .8 to .9 m (2.5 to 3 ft). One of the thicker sections yielded projectile points of the Cody complex at a level above that containing Clovis points. At another site, 5.6 km (3.5 mi) to the northeast, a Clovis occupational horizon occurs in the lower part of this unit, whereas a nearby site contains artifacts of the Folsom complex in overlying red dune sands more than 2 m (6 ft) thick. Points of the Cody complex and early Archaic campsites occur in the upper part of these dunes.

These archeological correlations provide a basis for dating the “red sand” sequence and its soils. Although radiocarbon dates have not been obtained for the Mockingbird Gap Site, dates from other sites in the Great Plains and Southwest have been compiled and interpreted by Haynes (1967, 1968, 1970) in studies of the geochronology of late Quaternary alluvium. Clovis sites cluster in the interval between 11,000 and 11,500 radiocarbon years B.P. Folsom sites are largely bracketed by the period from 10,000 to 11,000 B.P. According to Wheat (1972), Cody dates fall generally in the range of 7,950 to 8,950 B.P. Applicable dates for local manifestations of the early Archaic are very meager, but a range between 5,500 and 7,000 B.P. may be a reasonable approximation.

It may be inferred from these lines of evidence that the widely recognized climatic shift toward increasing dryness in terminal Wisconsinan time was sharply accelerated to the point of active dune development during the Folsom occupation of the region. Similar conditions continued, or were repeated at intervals, into the early Archaic occupation during the Altithermal. The development of red to reddish-brown soils on this sequence evidently continued, at least intermittently, from late Wisconsinan time well into the Altithermal, and apparently continues in the present climatic regimen.

Succeeding geologic events on the site are poorly recorded in the fragmentary stratigraphy. Erosion appears to have predominated, probably accompanied by
episodes of eolian deposition. Most of the deposits overlying the "red sand" consist of sheetwashed pebbly sands filling depressions on the ridge and forming thin colluvial aprons on the slopes. Several Archaic complexes are represented within these deposits and in disturbed sections of earlier beds, but these have not been investigated in detail. Small dune clumps have been active during dry intervals of the last century; otherwise, erosion continues to be the predominant active process at the Mockingbird Gap site.

STRATIGRAPHY OF CHUPADERA ARROYO

A totally different stratigraphic sequence lies beneath the floor of the channelway of Chupadera Arroyo in the broader section of 100 m or so northwest of the site. A deep bulldozer trench dug there some years ago in a search for gravel for highway construction exposed an alluvial sequence that records depositional and erosional events in the channel. Although the floor of the trench has been deeply buried by mud from storm runoff, the spoil bank contains gravels nearly identical to the basal gravels on the site ridge. A total of about 7 m (23 ft) of stratigraphic section was sampled in the trench walls, pit, and auger hole.

On the basis of their lithologic similarity, the gravels are tentatively correlated with the basal gravels on the site, although those in the arroyo section could be younger. An unknown interval extends from the top of the gravels to the top of the limestone, which is a hard, gray, argillaceous, gypsiferous freshwater limestone containing carbonized plant fragments and rare diatoms. Overlying the limestone is a thin layer of light gray gypsiferous, calcareous clay containing abundant diatoms, ostracodes, charophyte oogonia, and carbonized plant fragments. The succeeding section of this unit consists largely of pale yellow, friable, granular calcareous gypsite that contains abundant calcified stems and oogonia of Chara, ostracodes, and sparse high-spired snail shells. Thin interbeds and small pellets of gray clay are interspersed in the gypsite. Clearly this 21 m (6 ft) section of clay and gypsite, plus an unknown thickness of limestone, was deposited in a clear, quiet body of fresh water—probably a small lake of Wisconsinan age. The gypsite of this sequence is quite different in character than the gypsic caliche on the site, and no correlation is inferred.

Overlying the gypsite on a deformed contact is a sequence of massive, coarsely mottled reddish-brown and gray, gypsiferous, clayey, sandy silts from 1.8 to 2.4 m (6 to 8 ft) thick. A zone of abundant prismatic selenite crystals up to 2.5 cm (1 in.) long distinguishes the central part of this unit, and the calcic horizon of a paleosol lies about 50 cm (20 in.) below the top. Root casts of calcite and gypsum are prevalent in the upper part. This unit may have originated in a mud flat and wet meadow environment on the lake floor following its desiccation.

Resting with sharp, undulating disconformity upon the massive silt are .9 to 1.2 m (3 to 4 ft) of thin-bedded to laminated reddish-brown to grayish-brown gypsiferous, calcareous clays with thin interbeds of brown fine sand and silt. Sugary gypsite nodules and root tube linings are prevalent. The bedding is deformed into undulating wave forms. No fossils were noted. The association of this unit with the overlying channel sands suggests a floodplain origin.

Channel sands and gravels, consisting of about .6 m (2 ft) of very pale brown laminated and cross-laminated fine to medium sand with gravel lenses, rest in abrupt
disconformity upon an undulating surface cut on the underlying clays. Pebbles and cobbles include noteworthy amounts of volcanic rock types. Iron and manganese oxide stains are conspicuous, and clay balls are common. Sparse snail shells, fragments of rib bone of a large mammal, and a small charcoal lens are among the minor features. No artifacts have been noted in this unit, nevertheless it is considered probable that this is the channel of a small perennial stream that was in existence after the Clovis occupation of the area. Flow may have continued at a greatly reduced, possibly intermittent, level during Folsom occupation.

The next higher unit is massive, light brown, clayey, sandy silt .6 to .8 m (2 to 3 ft) thick. Its similarity to modern sheetwash deposits on the channel floor suggests that deposition occurred under conditions approximating those of today during at least a part of the Altithermal.

Overlying the silts on an abrupt, undulating contact are .8 to .9 m (2.5 to 3 ft) of massive reddish-brown plastic clay, highly gypsiferous and calcareous, with pronounced subangular blocky structure. Modern plant roots are abundant, and caliche filaments are conspicuous. Physical characteristics indicate deposition under moister conditions than those of the present.

The present surface of the drainageway is thinly veneered with fine sand and silt similar to that below the upper clay. Narrow channel segments adjacent to and below the site are obstructed, thus episodes of very short-lived, shallow ponding are common during the summer rainy season.

CONCLUSION

Many of the geologic and climatic inferences made herein admittedly are but tenuously supported by the evidence reported. Hopefully, additional support and refinement of these preliminary findings will result from radiocarbon dating, pollen analysis, paleontological studies, and examination of additional alluvial sequences in the surrounding region.

ACKNOWLEDGMENTS


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REFERENCES CITED


Haynes, C. Vance Jr.

Robert H. Weber 121


Wheat, Joe Ben
The text of this paper, originally presented at the 33rd Annual Meeting of the Society for American Archaeology at Santa Fe, New Mexico, in 1968, has been reprinted herein, at the suggestion of the editors, in response to requests for information on the site that is not readily available in the published literature. Although clearly out of date in terms of subsequent investigations at the site, the data still fairly well represent the basic evidence for current interpretations of the site’s occupants and its function.

Since our preliminary report on the Mockingbird Gap Site (LA 26748), presented at the 31st Annual Meeting of the Society for American Archaeology at Reno, Nevada, in 1966, additional work has added to the artifact inventory, expanded the list of specifically identified cultural components, and clarified relationships between the physical stratigraphy and cultural elements. Excavations covering an area of about 87 m² (936 ft²) during the summer of 1967 were sponsored by the Paleoindian Institute of Eastern New Mexico University. This work demonstrated that parts of the site retain an intact sequence of sediments and superimposed soil profiles in which a succession of lithic complexes and a terminal late ceramic occupation can be traced.

The site is located at the northern end of the Jornada del Muerto, an intermontane basin extending for 240 km (150 mi) in a north-south direction, with a maximum width of 50 km (30 mi). Mockingbird Gap, a prominent pass between the adjacent Tularosa Valley and the Jornada, is visible on the skyline, 40 km (24 mi) to the southeast. Mockingbird Gap overlooks the Trinity Site [National Historic Landmark], where the first atomic bomb test occurred in 1945, marking the climax of nearly 12,000 years of weapons development in this area.

The site situation is a low, arcuate, sandy ridge and adjacent terrace that border a shallow arroyo. The maximum elevation is 1,515 m (4,970 ft), and the local relief is only about 4.6 m (15 ft). Clovis points and associated artifacts occur in 8 local clusters over an area of more than 14 ha (35 acres), with a linear extent of nearly .8 km (.5 mi), and a maximum width of about 274 m (900 ft). The site is separated into two major sections by a barren central area that has been stripped by erosion. Although parts of the site show sporadic use by late Paleoindian, Archaic, and Puebloan groups, the
predominant cultural assemblage pertains to the Llano complex, and it is upon this component that attention is focused.

There seems to be no doubt that this was a large campsite of probable recurrent occupation during the period of the Llano complex, as indicated by the character of the tool assemblage, the abundance of chipping waste of diversified lithology, and the predominance of basal sections of Clovis points, many of which are unfinished. Surface collections from the site over a period of 4.5 years include 100 Clovis points, an equal number of gravers, about half as many end scrapers, a smaller number of side scrapers, and a large quantity of utilized flakes anddebitage. The ratio of points to end scrapers, 2 to 1, is surprisingly high.

Clovis points from this site show considerable variation in both size and form that indicates the need for latitude in the definition of these characteristics (Figure 1). Small points, those under 50 mm (2.0 in.) in length, are particularly abundant. The small number of complete and restorable points precludes a meaningful analysis of length classes, but the impression is one of gradation. The character of fluting also ranges from rudimentary basal thinning to well-controlled true fluting. The various stages of point manufacture are quite clearly revealed in a series of 30 unfinished specimens. Leaf-shaped or ovate biface blanks were roughed out by percussion to the size and form of the finished point. This was followed by trimming and beveling of the base in preparation for fluting. A striking platform commonly was isolated in the center of the beveled base by the removal of small, lateral flakes, then the outer lip was ground and the flute was struck. The basal edge was then beveled in the opposite direction and the process repeated on the second face. Variations in procedure lead to multiple flutes on one or more faces and variable depths and shapes of basal concavities. Final retouch of the basal concavity, lateral edges, and tip was followed by grinding of the basal edges. Edge grinding also was used in some cases to prepare a platform for final retouch. The process was essentially that used to manufacture Folsom points, but the precise control achieved by the Folsom flintknappers was lacking. Some unfinished points that apparently were broken during manufacture reveal fine retouch of the lateral edge, suggesting that they were adapted for use as bifacial knives.

Gravers are probably more abundant than points, but underrepresented in our collection because of their small size and frequent destruction in use. Most are made on small, thin, amorphous flakes. Some occur in combination with other tools, such as the spurs on lateral edges of end scrapers. In one instance, the basal ear of a broken point was modified to serve as a graver. Both single and multiple tips are present. Most exhibit fine unifacial retouch; a few are bifacially retouched; and a large number show simple or multiple notches without retouch of intervening projections. The various types would serve for a number of functions, including scribing, incising, gouging, slitting, drilling, perforating, and scraping.

Scrapers are abundant, ranging from carefully trimmed, snub-nosed forms, some with lateral spurs as noted previously; through thin-flake end and side scrapers of pear-shaped outline; to numerous retouched or utilized random flakes. Pointed, or convergent, side scrapers constitute a minor class.

Knives are represented largely by thin, controlled and random flakes, with or without purposeful retouch, but showing chipping use. In some instances, projectile points and point
Figure 1. Clovis points and end scrapers from the Mockingbird Gap Site. Clovis point on the upper left is 44 mm long.
blanks appear to have been adapted for use as knives.

Cores that are definitely assignable to the Llano level are rare, except for irregular rejects from inferior local pebbles. Bifacial ovate cores are represented by few examples but are more abundantly indicated by the prevalence of distinctive expanding flakes with bifacial platforms that are commonly ground. Prismatic flakes and what appear to be exhausted nuclei of polyhedral cores are present but uncommon. These and other objects that show the use of bipolar techniques are comparable with the “pseudoblades,” “pseudocores,” and pièces esquillées described by MacDonald (1968) from the Debert Site, Nova Scotia. Clearly, some caution is needed in assigning these objects to specific artifact classes in which the intent of the maker is inferred.

Lithic raw materials include a wide variety of jasper, chert, chalcedony, flint, quartzite, and obsidian, most of which is from quarries and gathering grounds within a radius of 56 km (35 mi) of the site. A considerable amount is from pebbles available in gravels at the site, and small amounts are identifiable with sources as distant as the Alibates quarries of northwestern Texas and the Chuska Mountains of northwestern New Mexico.

Many similarities to other Folsom sites are noteworthy in this assemblage. The high frequency of small points, some of which are Folsomoid in outline and show refined edge retouch; occasional fluting approaching the broad, parallel Folsom style; and the similarities among some of the associated tools, such as gravers and snub-nosed scrapers with those from Folsom sites, lead to the speculative suggestion that the Mockingbird Gap fluted-point complex may contain elements that are transitional between Clovis and Folsom. The greater abundance of Folsom sites in this area may reflect a cultural efflorescence that followed the transition.

Representation of the Folsomoid Clovis or the Folsom complex proper at the site is limited to two channel flakes recovered as surface finds adjacent to the site. Folsom sites are far more abundant than any other Paleoindian manifestations in the surrounding region, hence it is rather surprising not to have found more specific evidence of a Folsom occupation here.

One point assignable to the Cody complex was recovered in situ in one of the trenches. Otherwise, only meager surface finds have indicated possible use of the site by Cody people, but do not eliminate the possibility that these are merely trophies brought here by later occupants.

Parts of the site show sporadic occupation by Archaic complexes that include early stemmed and shouldered points and later side-notched, corner-notched, and serrated points, milling stones, and cobble hearths.

The latest archaeological component consists of a pithouse, late Rio Grande Glaze-ware shards, hearths, pieces of charred maize, milling stones, late side- and corner-notched arrow points, and worked turquoise that apparently reflect an early historic occupation as an outlying seasonal farming site. Maize could have been raised on the adjacent alluvial flats that are still subject to summer sheet-flooding.

**POSTSCRIPT**

Further excavation, surface collection, and detailed mapping of the site have added significantly to the data base of information. The number of recovered artifacts has been
more than tripled, but the relative proportions remain approximately as indicated above. Projectile points still predominate among the formal tools, with snapped-off bases of numerous finished Clovis points and abundantdebitage reflecting retooling activities at a major base camp with a strong focus on hunting. Small prismatic flakes (microblades) driven from bipolar polyhedral cores are also clearly assignable to the Clovis assemblage.

Archaic projectile points that include Rio Grande ("J"), Bajada, San José, and most abundantly, late side- and corner-notched styles, are represented. Four more pithouses of late glaze-ware affiliation were located by soil augering, leading to speculation that these may represent a small, contact-period refugee site of Piro or Tompiro from the nearby Rio Grande or Salinas districts.

Geological investigations at the site (Weber 1973 and this volume) and in the Lake Trinity basin to the south (Kirkpatrick and Weber 1996) have revealed some of the salient features of late Pleistocene-Holocene stratigraphy and geomorphology of the northern Jornada del Muerto. In contrast to the skeletal stratigraphy of the site, the adjacent drainageway, the principal influence of Pleistocene Lake Trinity, contains a buried stratigraphic record of environmental changes that indicates the presence of a major perennial stream below, succeeded upward by a small lake extending northward, followed by pond and marsh, a minor perennial stream, and a sequence of sheet-flood deposits that characterize the Holocene alluviation of the earlier Pleistocene stream channels of the area. A radiocarbon age of 11,400 years from lacustrine deposits may bear some relevance to the probably later Clovis occupation of the Mockingbird Gap Site.

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REFERENCES CITED

Kirkpatrick, David T., and Robert H. Weber

MacDonald, George F.

Weber, Robert H.
It is highly important to every man passing through a country frequented by Indians to know some of their habits, customs, and propensities, (to) enable him....to take precautions against coming in collision with those who are hostile....Almost every tribe has its own way of constructing its lodges, encamping, making fires,....by some of which peculiarities the experienced frontiersman can generally distinguish them. [Marcy 1866:22-23]

It was surprising how readily and with what accuracy in detail our Delawares would designate the tribe, the number and disposition of the Indians, who had occupied the deserted camps we met with during our whole trip, and as we met with some of the same parties afterwards, their sagacity in this respect was fully established. [Parker 1856:152]

Behind their nineteenth-century phrasing, these writers were warning readers that what they did not know could kill them. At that time, there would have been thousands of people, virtually all of them Indians or Hispanics, who shared the esoteric knowledge to which the writers were referring. Now there is no one who has this, and only a few published accounts preserve any of the lore needed to distinguish the ephemeral campsites of tribes that once frequented the southern High Plains of the western United States.

INTRODUCTION

The hearths and the locations of tepees or other shelters that marked these campsites may not have disappeared entirely, and the specific observations that do survive might be useful to archaeologists for identifying such sites. Two Army officers, Randolph B. Marcy and Richard I. Dodge, are our principal sources. Dodge came to the frontier of Texas in 1849, and Marcy to Oklahoma the same year; and thereafter they spent a considerable part of their careers in contact with the plains Indians. Their interests were parallel: interpreting trail signs, Indian signaling methods, and the patterned behavior of various tribes as shown by their camp remains. All of these had obvious interest for the Army. These observations were confined to the mid-nineteenth century and to the southern High Plains of Oklahoma, Texas, and possibly eastern New Mexico.
survived Indian captivities were almost equally adept. Marcy relied upon Black Beaver, John Bushman, and John Connor, all renown Delaware guides, for his information (Marcy 1866:59–73; Parker 1856; Walker 1971). Dodge's primary informant seems to have been Pedro Espinosa, a Mexican who lived among the Comanche for 19 years, only to be shot by Texas Confederates in 1861 for carrying Union dispatches (Dodge 1877: 405–412, 1882:552–553). In recounting their own experiences, these guides and scouts were great storytellers, whereas on the trail they had to be coaxed into revealing tribal distinctions among trail signs and campsite remains.

Captain Marcy and Colonel Dodge's comments about the tribal differences exhibited at abandoned camps complement one another, without evidence of borrowing from one another. In their own writings, however, they did repeat themselves. The phraseology in the report on Marcy's 1854 expedition suggests that he may have written all or parts of the text, although W. B. Parker (1856) was the listed author. Parker had evidently been a Comanche captive for several years (Marcy 1866:34–35).

HOW GUIDES DISTINGUISHED INDIAN CAMPSITES

According to Colonel Dodge, the Apache (presumably meaning Lipan Apache), "fearing man only, sacrifices everything to that fear and locates his rancheria on the apparently inaccessible summit of some tall cliff," to which the women would bring water by paths known only to them (Dodge 1882:240). Dodge was inclined to distinguish between summer and winter camps, but for the Apache he did not say for which season the preference applied. One captivity narrative, by F. M. Buckelew, a teen-aged Texas boy the Lipan held for two years (1866–1868) in western Texas, neither contradicted nor confirmed Dodge's statement, but the source did note that his party once dried thin strips of beef over a frame they erected at "the top of brushy mountain" (Banta 1964:44–45).

Leaving the Apache, Dodge continued to note that, except in winter,...the situation of a camp indicates something in reference to its occupants. Thus a camp near water, but away from all timber, will probably contain Sioux, who have a mortal dread of ambuscade; a camp on open prairie, but near timber, would be Cheyennes or Arapahoes; a camp prettily situated among open timber, Kiowas or Comanches; while a smoke issuing from the cover of a dense thicket, would indicate the camp of Osages, Omahas, or Shawnees. [Dodge 1882:240]

He went on to describe the considerations in the situation of a winter camp, apparently without reference to a specific tribe, and then dealt in some detail with the layout of such a camp. His descriptions agreed well with those of Nelson Lee, who was held captive by the Comanche in western Texas for three years from April 1855 (Lee 1957:99–100), and with Lieutenant James Abert's account of a Kiowa village (Galvin 1970:39).

Captain Marcy had relatively little to say about the siting of campsites or villages, but between 1849 and 1866 he described at least four times how the encampments of different tribes could be distinguished by the remains of their lodges (Foreman 1939:387; Marcy 1859: 197–198, 1866:23; Parker 1856:212–213). His informant was Black Beaver. These identifications, as Marcy pointed out, depended heavily upon the circumstance that all these tribes left the framework of their lodges standing when...
they moved from camp to camp. There are two versions, his 1849 (Foreman 1939) and 1856 (Parker 1856) accounts being nearly identical, as are those from 1859 and 1866. These are closely paraphrased here.

The Comanche, according to Black Beaver, made their lodges by placing poles on the ground in a circle and tying the tops together, thus forming a framework of conical shape, which they covered with dressed buffalo hides. The Sioux, Arapaho, Cheyenne, Ute, Snake, Blackfoot, and Kiowa made use of the Comanche lodge. At another place, Marcy (1859:141-142) gave a more minute description of a Comanche lodge.

The Wichita made their lodges in the same manner, said Marcy of his 1849 account, but did not unite the poles at the top, leaving an opening at the top for the smoke to pass out. He also described a Wichita lodge in some detail (Foreman 1937:37, 125). In the later versions, Marcy (1859 and 1866) wrote that the Wichita, Waco, Tonkawa, and Tawakoni erected their hunting lodges of sticks, put up in the form of the frustum of a cone and covered with brush. The Osage made their lodges in the shape of a wagon-top, with bent rods or willows covered with skins, blankets, or the bark of trees.

The Kickapoo set the poles for their lodges in the ground in a circle like the Comanche or in an oval form, but instead of bringing them to a point at the top, they bent the poles from either side to unite them in an arch. The lodge, rounded on top, was covered with bark or cloth.

The Delaware and Shawnee carried tents. They planted two upright, forked poles in the ground, placed a stick across them, and stretched a canvas covering over it. The Cherokee had tents also, but made their fires differently from the Delaware:

They place the wood in the fire with the sticks parallel, and burn from one end, pushing it into the fire as it burns away; whereas the others place each stick pointing to the centre of the fire, like the spokes of a wheel. [Foreman 1939:387; Marcy 1866:23]

Marcy’s guide on his 1852 expedition told him that the only difference between a Kiowa and a Comanche camp was that the former made the holes for their fires about .6 m (2 ft) in diameter while the latter made them only about 40 cm (15 in.) across (Foreman 1937:57). In this connection, the report on an archaeological survey of the Fort Sill Military Reservation in Oklahoma included an unreferenced claim that both Plains tribes and the Wichita employed circular firepits in their dwellings, “the difference between the two being in size.” This was not explained further, but Site 63 from that survey yielded several stone hearths that were consistent in size, about .6 m (2 ft) in diameter (Shaeffer 1966:8-9). The dimensions suggest that these may have been historic Kiowa features.

In September of 1845, a party led by Lieutenant James Abert made its way eastward from Bent’s Fort through eastern New Mexico and the Texas panhandle via the Canadian River Valley (Galvin 1970). A hunter named John Hatcher, who accompanied the party, had the kinds of skills that Black Beaver and Pedro Espinosa would soon exhibit. On September 22 they camped at the head of a stream, near an old Comanche camp, where “the remains of wigwams still standing covered several acres of ground....On examining the old Indian camp we concluded that they had wintered there.” Abert did not say what led them to this conclusion, but they
had observed "circular holes and singular rings, which always mark the site of the medicine tent" (Galvin 1970:51). Two weeks earlier, farther up the Canadian, they had passed another old Indian camp and Abert remarked on its "peculiarities," which apparently included rude wigwams. Here, too, "the singular ring with stones heaped in the centre marked the site of the 'medicine lodge'; also, showed that it had been occupied by the Comanches." Hatcher even identified the specific band, the Buffalo Eaters (Galvin 1970:32). Ethnographic studies have reported that the favorite haunt of that band was the Canadian River Valley (Wallace and Hoebel 1952:26-27).

The presence of a "medicine lodge" (which now would be called a sweat lodge) within the campsite at both locations obviously was a factor in identifying these as Comanche camps. A few years later, Marcy described the appearance and use of Comanche medicine lodges, which were present at every village, and, in his terminology, were used as vapor-baths (Marcy 1866:40).

At one site in the eastern Texas panhandle, there was no question about its recent destruction, rather than a normal abandonment. In June of 1852, Marcy's exploring party was working its way south, still somewhere north of Palo Duro Canyon. One evening they pitched their tents on an old Indian encampment where the Delaware guide, John Bushman, discovered that a battle had been fought within the past two months:

The evidences of this are apparent from the fact that the remains of a large fire were found, upon which the victorious party had piled up and burned the lodges and effects of the vanquished. Pieces of the lodge-poles, and a quantity of fused glass beads, with small pieces of iron and other articles pertaining to their domestic economy, which had partially escaped the conflagration, were found scattered about the encampment. [Foreman 1937:72]

This had probably been a Kiowa camp, as Marcy's troop had encountered their old camping places and trails almost every day.

CONCLUSIONS

As intriguing as these various clues may be, we have probably been told of only a few out of a vast number of clues that the native guides, former captives, and mountain men and hunters must have depended upon to keep track of their friends and adversaries. Marcy emphasized that except for the changes incident to the introduction of the horse, the habits and manner of living for the southern Plains tribes had continued unchanged over centuries (Marcy 1866:3). This may be an overstatement, but in any event, the skills required for making identifications were not such that Army personnel could quickly acquire them. Marcy himself may have felt that the Army needed to gain such knowledge, but there never was a policy to do so. Civilian guides continued to be employed.

While the guides' criteria for tribal identifications of abandoned camps match ethnographic and ethnohistoric accounts quite well, Marcy and others may have had an incomplete understanding that could lead to errors. For example, the identification of campsites by tribes leaned heavily upon the nature of lodge remains at these camps, and in his 1866 work Marcy said that the Plains Indians left the frameworks of their lodges standing when they moved from camp to camp (Marcy 1866:23). Yet, in the same volume, he claimed that Indians moving with their families carried their lodges and could be
distinguished by the marks of their lodge-poles (i.e., travois), whereas a hunting or war party never transported lodges and their track would not show the marks of lodge-poles upon it (Marcy 1866:260; see also Marcy 1859: 173–174; Parker 1856:154). Marcy evidently missed this lapse in his own argument, and we are left to speculate whether a trail without the tracks of lodge-poles always indicated a war or hunting party.

I have found no more accounts of how guides distinguished the campsites of various tribes. The clues assembled here offer a starting point for archaeologists. The dependance upon lodge remains is a handicap, but if post-abandonment patterns can be recovered, then the nature of the structures might be inferred. It is unlikely that any aboveground remnants still exist in the High Plains settings, but in timbered environments they may yet be found. A series of tepee-like conical structures were discovered in aspen groves of northern Colorado in 1969; their affiliation is unknown (Johnson 1972). Navajo forked-stick hogans from the eighteenth century are well known, but because of their regional setting do not pose an identification problem. On the western plains, however, we have a place to start in determining affiliations of ephemeral campsites that nineteenth-century guides could have identified at a glance.

—Las Cruces

REFERENCES CITED

Banta, S. E.
1964 Buckelew The Indian Captive. J. Marvin Hunter, Kerrville, Texas.

Dodge, Richard Irving


Foreman, Grant

Foreman, Grant (editor)

Galvin, John (editor)

Johnson, C. Ralph

John P. Wilson
Lee, Nelson

Marcy, Randolph B.


Parker, W. B.

Shaeffer, James B.

Walker, Wayne T.

Wallace, Ernest, and E. Adamson Hoebel
A PRELIMINARY LOOK AT EVIDENCE FOR LATE PREHISTORIC CONFLICT IN SOUTHEASTERN NEW MEXICO

Regge N. Wiseman

Archaeologists in the Southwest and adjacent southern High Plains are currently rekindling an interest in prehistoric and historic conflict among Native Americans and between Native Americans and Euro-Americans (Haas and Creamer 1993, 1996; Owsley and Jantz 1994; Robarchek 1994). The term normally used in these studies is “warfare,” which today generally connotes large-scale hostilities involving thousands or millions of people. Even though some scholars define their use of the term to include small-scale hostilities, such as those among prehistoric villages and bands of hunter-gatherers, we prefer the term “conflict.” Either term, of course, encompasses both discreet actions and activities that occur intermittently over years, decades, or even centuries.

The origins and motivations for conflict among humans have been studied in depth over the past century. For discussions, including worldwide perspective, the reader is referred to the above sources and the citations therein. Suffice to say in this short paper, that the various authors generally conclude that some form of conflict, especially small-scale raiding among neighbors, both within ethnic groups (internecine) and between ethnic groups, was a part of life in the Plains and Southwest for many centuries, including an unknown but substantial period prior to the advent of Europeans to the New World. The archaeological evidence of conflict in the Southwest most often relies on data about site situation and changes in settlement pattern (Haas and Creamer 1996). Plains data are more encompassing in that data on village fortifications and evidence of trauma to human skeletons have been used (see various papers in Owsley and Jantz 1994).

The purpose of the present paper is to describe phenomena from three sites in southeastern New Mexico that are believed to have resulted from violent behavior. At present, we can only speculate about who the antagonists were and the reasons for the violence.

CULTURAL SEQUENCES OF THE JORNADA MOGOLLON

The late prehistoric remains in southeastern New Mexico and adjacent parts of west Texas are generally referred to as the Jornada Mogollon (Corley 1965; Lehmer 1948) (Figure 1). Over the years, a number of archaeological sequences have been devised for various localities within this vast region. In the paragraphs that follow, I suggest that each of four general regions may have also involved one (or even more) ethnic groups.
Figure 1. Locations of cultural areas in southeastern New Mexico.
The term "ethnic" is used in a general sense, with some reservation, as expressed in Webster's New Unabridged International Dictionary (2nd Edition, 1944): "2. Relating to community of physical and mental traits, or designating groups of races of mankind discriminated on the basis of common customs and characters." In my use of the term, I refer to people of the same race (all Native Americans) but recognize and emphasize the aspects of customs, lifeways, and sense of group inclusiveness that can and often do distinguish one group of people from another. In point of fact, two different ethnic groups can even be biologically and linguistically related. But in their eyes, they differ sufficiently from one another to permit aggression on the group level under some circumstances and allow social interaction and friendship when circumstances change. Obviously, this definition applies to various scales of human organization, with well-known examples at the tribal level (Sioux versus Pawnee, for example), the subtribal level (Chiricahua Apache versus Coyotero Apache), and the band-group level within subtribes (Chokonen Chiricahua versus Chihenne Chiricahua).

For the greater Sierra Blanca region (Sacramento/Sierra Blanca/Capitan/Jicarilla/Gallinas mountain chain) located between the modern towns of Corona and Alamogordo, J. Kelley (1984) has devised two geographically proximate, culturally similar sequences called the Glencoe phase (the southern sequence situated on the eastern slopes of the Sacramento and Sierra Blanca Mountains) and the Corona-Lincoln phases (northern sequence situated in the Capitan/Jicarilla/Gallinas Mountains). Sites of the two sequences neighbor one another along the Rio Bonito, which divides the Sierra Blanca from the Capitan Mountains.

Although the sites in these two sequences share a number of similarities, significant differences in architecture, pottery, and subsistence suggest that two ethnic groups may be involved. The Glencoe farmer-hunter-gatherers, who lived in pithouses and (late in the period) jacal-type structures, appear to be indigenous to the Sacramentoos and Sierra Blanca. The Corona-Lincoln farmer-hunters appear to have intruded into the region from the Chupadera Mesa (Gran Quivira) country of central New Mexico. We currently lack data as to how far north (if at all) the Glencoe peoples extended prior to the coming of the Corona-Lincoln peoples about A.D. 1100. Lincoln phase peoples appear to have extended eastward into the Roswell area where they inhabited at least one site, Bloom Mound.

The prehistoric remains along the Pecos River between Fort Sumner north and Roswell have been characterized as the Middle Pecos sequence by A. J. Jelinek (1967). That part of the sequence involving farmers, living first in pithouses and then in small jacal pueblos, dates from about A.D. 900 to about 1300, after which the villages were abandoned, perhaps to follow a bison-hunting lifestyle. Jelinek evidently believes the residents of his sites were indigenous to the area, and, I infer, potentially a third ethnic group. However, the houses and pottery assemblage of the Middle Pecos are so like those of Kelley's (1984) Corona phase and the "jacal sites" of the more populous Chupadera Mesa country (Caperton 1981) that this assumption is increasingly coming into question. Regardless of the similarities and relationships of the Middle Pecos remains to Kelley's Corona phase, the Middle Pecos remains are quite unlike her Lincoln phase sites.

Prehistoric sites within the area bounded by the Pecos River on the west, the west escarpment of the Llano Estacado (or southern
High Plains) on the east, U.S. Highway 70 (Roswell to Clovis/Portales) on the north, and extending slightly over the Texas state line in the vicinity of Hobbs, New Mexico, are included in the proposed eastern extension of the Jornada Mogollon culture (Corley 1965; Leslie 1979). Dating from about A.D. 900 to 1450, the sites evidence an architectural shift from pithouses to a combination of pithouses and small jacal pueblos. Subsistence involved hunting and gathering, but no evidence of farming has yet been found. Culturally speaking, the archaeological materials are similar in many respects to those of other Jornada Mogollon sequences. The question is, were the people who carried eastern-extension Jornada Mogollon culture Southwesterners or Southern Plains peoples? Thus, we have the potential for a fourth ethnic group in the Jornada Mogollon area.

As currently viewed, the prehistoric remains in southeastern New Mexico have been subdivided into four districts that are sufficiently dissimilar to permit our conceptualization of them as potentially different ethnic groups. The three most likely ones to be ethnically different are the Glencoe, Corona/Lincoln, and the “eastern extension” lying east of the Pecos River. The Middle Pecos may have originally derived from a Corona phase/jacal component in central New Mexico, but by the A.D. 1300s, diverged sufficiently to take on a separate identity. This would have been especially true if, as Jelinek (1967) suggests, they abandoned farming and became bison hunters.

**SITES YIELDING EVIDENCE OF CONFLICT**

Three instances of conflict have been recovered in excavations at as many sites. In the descriptions that follow, the evidence that I ascribe to conflict is unique in each case, but in every instance involves multiple individuals who did not receive the normal form of post-mortem treatment—formalized burial.

**Filingen Site, Lincoln County**

This prehistoric homestead, the Filingen Site (LA 16297), is situated on a small, upper tributary of the Rio Bonito north of Ruidoso, New Mexico (Farwell et al. 1992). The site is situated on a hill but cannot be termed defensive because the terrain in the area is mostly hills that bound small, narrow drainages.

The only structure at the site consisted of two or three shallow, contiguous pitrooms that shared walls and were arranged in a square with one quadrant left open. The structure probably had the external appearance of a single, unified dwelling. The only hearths were located outside to the east, indicating that this site, at an elevation of 2,135 m (7,000 ft) above sea level, was a warm-season habitation. The structure had burned with a large number of artifacts left on the floors. The pottery assemblage, including Three Rivers Red-on-terracotta but lacking Lincoln Black-on-red, suggests a middle Glencoe date, or sometime within the span A.D. 1200 to 1300.

The conflict or warfare at this site consists of four human skeletons found lying on the aboriginal ground surface within the fourth quadrant formed by the structure (Figure 2). The remains, belonging to three adult males, ages 35 to 45, 30 to 35, and 25 to 30, and a 4-year-old juvenile were sprawled on the ground rather than formally buried. Relative to one another and the structure, the youth was inside the L, one male was at the point, and the other two males were along each side of the unroofed quadrant formed by the structure. The crania of all four individuals
Figure 2. Filingen Site map (LA 16297).
were badly smashed. The 25 to 30 year old male was missing his right foot, which evidently happened at the time of death (Noble in Farwell et al. 1992). Except for the smashed crania, none of the skeletal material showed direct evidence of violence.

Three aspects of these skeletons suggest violent death: (1) three of the four are males (the fourth was too young to determine its gender); (2) the bodies were sprawled on the aboriginal ground surface, not buried; and (3) the position of the bodies relative to the structure indicates a defensive posture with the youth inside a protective square and the backs of the three defenders to the walls. The situation was certainly unusual enough to prompt the excavator (Oakes in Farwell et al. 1992) to ask whether the four skeletons were the result of “multiple violent deaths?”

**Smokey Bear Ruin, Lincoln County**

The second site is the Smokey Bear Ruin (Block Lookout Site) (LA 2112). Judging by the length of occupation, complexly stratified architectural remains, and the breadth of cultural remains (especially imported pottery) at this site, the Smokey Bear site was one of the more important southern Lincoln phase sites. The site is situated on a small, isolated, steep-sided hill that affords long views in all directions and a moderately defensive advantage.

This site was occupied more or less continuously by one or more groups living in a succession of small pueblos with their associated ceremonial chambers (Kelley 1984; Wiseman et al. 1976). Apparently the hilltop and slopes were built and rebuilt upon in a round-robin fashion; that is, as older dwellings fell into disrepair, the group would move over to a new spot, build, then move again when that became uninhabitable. Eventually, old buildings had to be leveled and built over, sometimes incorporating sturdy old wall remnants into the new constructions (Wiseman 1975). The occupations began in the middle to late A.D. 1200s and continued into the 1300s.

The evidence of conflict is in the form of numerous multiple deaths, the bodies having been cremated *en masse* and buried in an abandoned ceremonial structure (Wiseman 1996; Wiseman et al. 1976). It could not be determined precisely how or if the abandonment of the structure and the mass cremation were related events or merely events that occurred closely sequentially in time. The structure had been intentionally burned. A pile of sterile earth (mostly caliche) used to support the funeral pyre had been intentionally filled into the structure; the base of the pile rested on the floor (between Strata 8 and 9 in Figure 3). At least a dozen bodies, including two children, three adolescent females, one young adult female, three young and one fully adult males, and two unsexed adult individuals (El-Najjar and Bruder, in Wiseman et al. 1976) evidently had been stacked on the earthen pile and burned. The adjacent south wall was strongly oxidized in a broad, U-shaped pattern starting where the earthen pile abutted the wall and extending upward for 1 m or so. After the fire subsided, the burned remains were pushed eastward off the top of the earthen pile and came to rest where the lower slope of the pile contacted the east wall (Stratum 9). More sterile earth (Stratum 7) was brought in to cover the remains, and thereafter, the structure depression filled with up to 3 m of cultural trash and construction debris from subsequent occupations of the site (Strata 1 through 8).

The large number of individuals of all ages and both sexes who evidently died at approximately the same time and were
Figure 3. Feature 4 at the Smokey Bear Site (LA 2112).
cremated as a group indicates one of two things, either epidemic disease or mass killing. Epidemic disease can be ruled out since this evidently was an Old World phenomenon caused by early urban crowding; no evidence of epidemic disease has been documented in North America prior to the introduction of Old World diseases by European explorers (Linda Mick-O'Hara, personal communication 1997). This leaves mass killing as the most likely explanation for the cremated remains constituting Stratum 9 at Smokey Bear.

**Bloom Mound, Chaves County**

Bloom Mound (LA 2528) is a small adobe-walled pueblo that sits on a limestone outcrop in the middle of the Rio Hondo where that river enters the western edge of the broad Pecos Valley. The outcrop basically lacks defensive capability, and the setting is so low that good visibility is compromised in all directions.

The pueblo contained at least 9 and perhaps as many as 12 rooms paired in a linear room block and facing east on a large, subterranean ceremonial structure (Kelley 1984; Wiseman 1970, 1996). Several of the rooms had multiple floors. This site, provisionally assigned to the Lincoln phase by Kelley (1984), had burned and was found to contain large quantities of artifacts as well as stores of corn. Complete and nearly complete vessels of Rio Grande Glaze A Red, Ramos Polychrome, and Gila Polychrome indicate a firm fourteenth century date. The variety and quantities of ornaments, seven copper bells, and an unusually large component of El Paso Polychrome in the pottery assemblage led Kelley (1984) to suggest that this site lay on a trade route involving the El Paso region to the southwest, Pecos Pueblo to the north, and Plains groups to the east.

The evidence of conflict at Bloom Mound includes the burned structure, the large quantities of artifacts, and numerous burned human remains. Several skeletons were articulated but not formally buried, and others occurred as jumbles of elements in the lower fill of rooms (Kelley 1984). The positions of some of the articulated skeletons and their locations in room fill within roof fall on or just above floors suggest individuals who died while attempting to escape. Photographs and written descriptions indicate a hodge-podge of burned skeletal remains in Room C that is reminiscent of the Stratum 9 cremation remains at Smokey Bear (see above). Kelley (1984:487) summarizes:

> The skeletons that we excavated were not intentionally buried, and presumably the people perished in a collapsing building. The charred nature of most of the skeletal material suggests that the whole village burned, trapping several of the inhabitants.

The total number of individuals represented has been variously estimated from 15 to 30 (Kelley 1984; Wiseman 1970), based mainly on notes taken by members of the Roswell Archaeological Society, interviews with society members, and limited work by Texas Technological University (Kelley 1984). No data on age or gender are available. However, given the large number of individuals represented and the small size of the village, it is reasonable to infer that most, if not all, age-groups and probably both sexes were represented.

**DISCUSSION**

In the following discussion I attempt to present the most likely scenario for the observed patterns. This does not mean that other scenarios do not cover the observed
facts, it is only one possible scenario. As pointed out below, the Filingan Site does not conform to the pattern of the other two sites.

Interpretations of warfare (or conflict) in archaeological remains in the Southwest are primarily restricted to the Anasazi of the Four Corners region. These interpretations focus mainly on site situations and architecture (Haas and Creamer 1996). On the other hand, interpretations of conflict in the Southern Plains rely on both site characteristics and biological data from the Texas Panhandle and Oklahoma. In most instances, the biological data involve only one or two individuals at a given site. Evidence of death in these instances is often projectile points embedded in bones and, less frequently, head trauma from bludgeoning. Both young adult females (one of them pregnant) and adult males are represented (Brooks 1994; Collins 1968).

Not all evidence of violent death in the Southern Plains is the result of arrow and club wounds. At the Footprint Site in the Texas Panhandle, the burned, disarticulated, and intermixed remains of 19 individuals—including 11 adults, 4 subadults, and 4 infants—were recovered from the fill of bell-shaped pits and from house floor/fill contexts (Brooks 1994).

Evidence of conflict on the Southern Plains, then, takes two forms when biological materials are involved. Death by weapons such as the bow and arrow and clubs seems to involve only one or a very few individuals at a time. This death phenomenon is more reminiscent of a raiding pattern where an individual or two are surprised and killed in a brief encounter. This technique, very often in the form of an ambush, was a favorite of southwestern Apache in their struggle with the more sedentary groups such as Mexican and American farmers, ranchers, miners, and travelers (Sweeney 1991). The key aspect in this type of warfare involves surprising lone individuals or small groups in isolated situations and overwhelming them, hopefully before they can resist. These kinds of raids would probably most often be undertaken during daylight when people were moving about their daily routines. The bodies of such victims, as well as the occasional attacker who was mortally wounded or died as a result of the encounter, might be buried where they lay or be taken back to their home or nearest settlement for formal burial. Evidently, most of the murdered individuals summarized in Brooks (1994) and Collins (1968) were one side or the other of this form of conflict and subsequent disposition.

The second type of killing involved larger numbers of people assaulted in their villages or farmsteads, at known, established locations where they could be found, most predictably in the evenings, night time, or early mornings. Surprise, as in all warfare on any scale, would be important to success—the greater the surprise, the more people killed. One of the best ways to achieve that surprise would be to catch the people in the dark hours in their domiciles where they would be effectively penned up. In this situation, burning the structures would either drive them out to be killed by the attackers or else kill them through smoke inhalation and/or by burning. Either way, the same result is obtained. Survivors, if any, might then dispose of the dead through formal burial or perhaps by simply scooping up the remains and unceremoniously dumping them in a pit or abandoned structure. Otherwise, the bodies would be left where they fell, but only unusual circumstances might be expected to preserve the remains. This scenario seems to fit the example at the Footprint Site (Brooks 1994) and at all three Sierra Blanca/Roswell examples summarized here.
Age and gender characteristics of the murdered individuals are interesting. Again, in the Southern Plains cases examined by Brooks (1994) and Collins (1968) in which the people evidently had been killed when alone or in very small groups, six are adult males, three are adult females (two are "young," evidently of child-bearing age), and one individual is of unspecified gender. This pattern is consistent with opportunistic, ambush-type killing of individuals caught away from the support of family and friends. Apparently not all of the cited examples were away from the habitation or village at the time they were killed; a young woman recovered from the Heerwald Site in Oklahoma was pregnant and evidently accompanied by her older child when all three were killed.

At the Footprint Site (Brooks 1994), as at Smokey Bear Site and Bloom Mound in southeastern New Mexico, virtually all ages and both genders are represented among the dead, indicating that the killing was indiscriminate. This indicates that kidnapping of children to be raised by the captors and the taking of females for wives for enslavement were not objectives of the attack. The Filingen dead, being all male except perhaps for the child, is an exception to this mass-murder phenomenon. Since the burned house contained ample evidence for the presence of females through the presence of artifacts normally believed to be associated with female tasks (metates and manos for grinding corn), and since the dead were left where they fell, it seems probable that the females were taken into captivity following the assault. On the whole, all three southeastern New Mexico cases, as well as the Footprint example, point to attempts (in some cases successful) to exterminate entire villages. This is definitely more than harassment warfare, friction over boundaries, and trade disagreements.

In the case of the southeastern New Mexico examples, we are left with the question of who the attackers were. Brooks (1994) concluded that, since the Texas Panhandle and Oklahoma examples are from sites located near frontier areas, the warfare was the result of friction with neighbors over territory and/or perhaps trade considerations. One can make the case for the same being true for the southeastern New Mexico examples. The Filingen Site is located in the Rio Bonito drainage, the overlap zone of the Glencoe and Lincoln peoples. The Smokey Bear site is situated well north of the Capitan Mountains, where the inhabitants could have been vulnerable to Plains groups. However, some villagers survived the attack, cremated and buried the dead, and continued to occupy the site. The frontier argument also applies to Bloom Mound, where the occupants were even further from the mountains and friends; the relative isolation of this village in the Roswell area has been likened to a colony situation, perhaps extended eastward to take advantage of the abundant water, arable land, and trade potential of the locality.

And finally, Brooks (1994) concludes that Southern Plains warfare associated with frontier situations does not appear to have been particularly intense during prehistoric times, but that it clearly intensified during the early historic period. Judging by the few excavated sites in the Sierra Blanca and Roswell regions and the comparatively large number of examples of serious attacks involving attempted extermination, the intensity of warfare in southeastern New Mexico evidently was greater than elsewhere in the Southern Plains at a comparable time period.

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REFERENCES CITED

Brooks, Robert L.

Caperton, Thomas J.

Collins, Michael B.

Corley, John A.

Farwell, Robin E., Y. R. Oakes, and R. N. Wiseman
1992 *Investigations into the Prehistory and History of the Upper Rio Bonito, Lincoln County, New Mexico*. Laboratory of Anthropology Notes 297. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Haas, Jonathan, and Winifred Creamer

Haas, Jonathan, and Winifred Creamer (editors)

Jelinek, Arthur J.

Kelley, Jane Holden
Lehmer, Donald J.

Leslie, Robert H.

Owsley, Douglas W., and Richard L. Jantz (editors)

Robarchek, Clayton A.

Sweeney, Edwin R.

Wiseman, Regge N.


Wiseman, Regge N., M. Y. El-Najjar, J. S. Bruder, M. Heller, and R. I. Ford
1976  *Multi-Disciplinary Investigations at the Smokey Bear Ruin (LA 2112), Lincoln County, New Mexico.* COAS Publishing and Research Monograph 4, Las Cruces, New Mexico.
ERRATA

The following errors occurred in the article by Curtis F. Schaafsma, “The Chronology of Las Madres Pueblo (LA 25),” which appeared in the volume, Of Pots and Rocks: Articles in Honor of A. Helene Warren. For the record, we would like to make the following corrections available for the reader.

1. Table 1: The left column does not refer to level, as per the stratigraphic illustration, but to the period model (e.g., Period 1 Model). Also, the column labeled Wiyo B/w or Biscuit A should read Transitional Wiyo B/w / Biscuit A. The Glaze Red heading should read % Glaze Red Temper.

2. DATING THE PERIODS: The first sentence in this section should read “... six periods at Las Madres...” not “... San Marcos...”.