Archaeological Investigations at Chimney Rock Mesa: 1970-1972

by
Frank W. Eddy

Memoirs of The Colorado Archaeological Society Number 1

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ABSTRACT

Contract research conducted at Chimney Rock Mesa in southern Colorado during the summers of 1970, 1971, and 1972 is described. The identified cultural remains are all Anasazi of Pueblo II age, which are dated in the Chimney Rock area between A.D. 925 and 1125. Intensive survey revealed the presence of 65 sites containing 217 architectural structures as well as 27 transient camp/workshop locations. Three of the architectural sites were partially excavated to provide outdoor museum displays for the planned United States Forest Service interpretive development. A mound at one other site was excavated in order to salvage information prior to its destruction by the new access road to the top of the mesa. The recovered archaeological data are employed to define a new cultural unit—the Chimney Rock Phase. This local phase is a cultural pattern abstracted from the bulk of ruins distributed across the mesa. However, one significantly different site is the Chimney Rock Pueblo, interpreted as an intrusive Chacoan colony.

The unusual upland occupation close to the San Juan Mountain foothills is explained as an adaptive response in which the Anasazi farmers sought favorable agricultural conditions among which soil moisture and length of growing season were two of the most critical.

PREFACE AND ACKNOWLEDGEMENTS

This monograph is a direct result of the environmental concern shown the rich archaeological resources of the San Juan National Forest by officers of the United States Forest Service, Department of Argiculture. Because of the interest of this federal agency in developing the scientific and scenic potential of the Chimney Rock Mesa, three seasons of contract support were awarded to the University of Colorado Department of Anthropology. Without the financial, informational, and personal advice provided by the Forest Service personnel, this work could not have been accomplished. Although acknowledgement is due the entire Forest Service staff, particular thanks are offered to the successive Forest Supervisors, Rod Blacker and Peter Wingle.

For my own part, I wish to extend gratitude to two of my professional colleagues, Robert Lister and David A. Breternitz. Lister was first contacted by Rod Blacker in the matter of research and salvage of ruins to be developed or impacted by the construction of the Chimney Rock archaeological display. Lister responded to this overture by making a formal proposal for excavations and site survey resulting in the initial 1970 contract for which I was hired to supervise the research. After Lister's departure from the University of Colorado, Breternitz assumed direction of the Mesa Verde Research Center which continued its administrative and equipment support of the Chimney Rock Archaeological Project through the summers of 1970 through 1972.

Once a week during the summer field seasons, Al Lancaster consulted with me concerning the progress of the excavations. Of particular help was the training he provided in regard to the nuances of wall abutment and bondings as they bear on interpretations of building sequence.

Throughout the three summer seasons, many anthropology students of the Mesa Verde Research Center were rotated to Chimney Rock for tours of field duty including site survey, digging, laboratory analysis, clerical chores, and camp cooking. To all of these men and women I extend my appreciation. Of outstanding service however, were the following:

1970:
Paul Heberling, site survey crew chief
Fran Levine, laboratory technician

1971:
Burt Williams, field foreman
Susan Short, site survey crew chief
Marcia Truell, laboratory technician

1972:
Marcia Truell, field supervisor
Chuck Adams, field foreman
Susan Short, laboratory technician

A final group of people who deserve special acknowledgement are the various natural history specialists who contributed their unique expertise to investigations of both the modern and ancient environment at Chimney Rock. Foremost among these cooperating specialists is Arthur H. Harris of the Museum of Arid Land Biology at the University of Texas in El Paso (Appendix A). In 1971, working under a subcontract from the Chimney Rock Archaeological Project, he conducted a study of the modern ecology as a comparative baseline from which to measure the environmental changes that had taken place in the prehistoric past. This study focused on plant ecology with supplemental trapping of mammals and gastropod collecting. Concurrent with his study of the modern ecology, Harris identified and interpreted the prehistoric animal bone recovered through excavation of the archaeological sites.

A pollen study was conducted by David E. Buge and James Schoenwetter of the Arizona State University under subcontract issued for the 1970 and 1971 seasons (Appendix B). Their results cover work done on sites 5AA83, 86, and 92. A second pollen study was conducted on the 1972 research at site 5AA88 by Susan Short of the University of Colorado under the direction of Harvey Nichols (Appendix A in Truell 1975).

Further interpretation of the Pueblo II age plant ecology is based on identifications of macro-plant specimens recovered from the ruins excavations. Two special studies were performed: one at the Museum of Anthropology, University of Michigan (Appendix C); the second at the Laboratory of Tree-Ring Research, University of Arizona. The Michigan study was supervised by Richard I. Ford and deals with such plant parts as the charred twigs obtained from the burned and collapsed roof fall deposits as well as the cultigens including charred corn kernels and beans. The other macro-plant study was carried out under subcontract from the Chimney Rock Archaeological Project. It consists of wood identifications and dates on the dendro-specimens submitted to the Tree-Ring Laboratory. Both kinds of information were obtained through the investigations of J. S. Dean with interpretation of the evidence provided by W. J. Robinson. And finally, I wish to express my appreciation to the Memoir Series editor, Sarah M. Nelson, for her efforts in readying the Chimney Rock manuscript for publication.

To all of these people, I extended my special thanks for their services.

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University of Colorado
Boulder, Colorado
March 1974

I. Introduction

Three seasons of archaeological research were conducted on the Chimney Rock Mesa during 1970, 1971, and 1972 by the University of Colorado, Chimney Rock Archaeological Project, under contract from the United States Forest Service, San Juan National Forest. The project had four research goals specified by the cooperating agencies:

1. To excavate in four (5AA83, 84, 86, and 88) Pueblo II age (A.D. 925-1125) prehistoric Anasazi dwelling sites for Forest Service stabilization and restoration for display to the general public.
2. To salvage information from site 5AA92, which was partially destroyed in the spring of 1971 by construction of the access road leading to the new Forest Service recreation development at the upper end of Chimney Rock.
3. To conduct site survey of the research district in order to develop an inventory of the archaeological resources for the Forest Service.
4. To investigate research problems of two kinds:
   a. basic research on prehistoric settlement, population size, land use, subsistence adaptation, and cultural ecology (Eddy 1973).
   b. applied research through use of this information in developing an interpretive program for the Chimney Rock Archaeological Area.

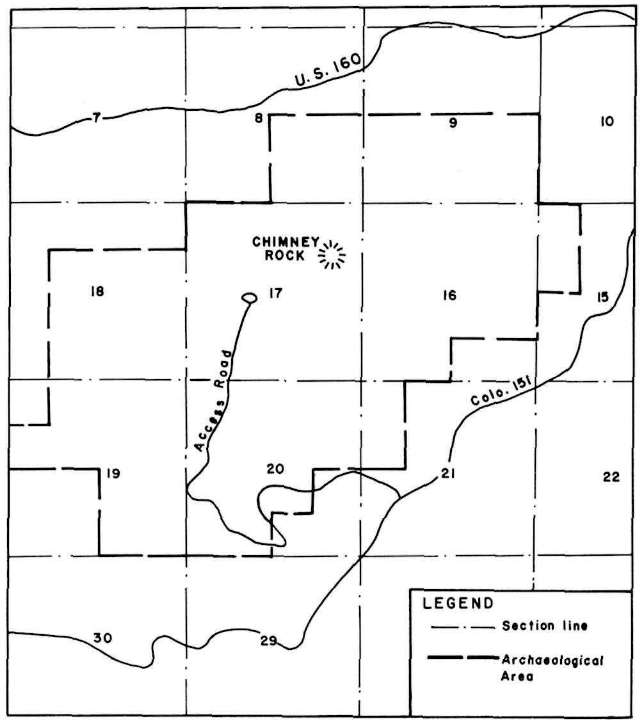


FIGURE 1. Map showing location of the Chimney Rock Archaeological Area as of 1957. San Juan National Forest, T34N, R4W, NMPM.

DEFINITION OF THE RESEARCH DISTRICT

The research district is an arbitrarily defined geographic unit of study consisting of 6.12 square miles of the San Juan National Forest which was withdrawn from commercial leasing and established as an archaeological preserve in successive steps beginning in 1957 (Fig. 1). This portion of the forest lies in the upper San Juan River Basin between the Piedra River and two of its tributaries—Stollsteimer and Devils Creeks.

Chimney Rock Mesa is a steeply dipping northeast-to-southwest trending cuesta which rises from about 6600 feet elevation to an altitude of 7,600 feet at its upper end. The mesa-like topography is divisible into two sectors: an upper and a lower mesa which are connected by a narrow causeway. The upper mesa is a small, triangular rock platform at 7,600 feet elevation and surmounted by a single prehistoric site—the well-known Chimney Rock Pueblo (see description below). The lower mesa contains the bulk of the upland area occupied by prehistoric people. It is bisected by a deeply eroded cut, named by us the Chimney Rock Ravine, which drains the mesa surface to a confluence with the Piedra River.

The Chimney Rock landform is a consequence of its bedrock geology. The inclined surface of the mesa is created by the resistant caprock, a thin bed of Pictured Cliff sandstone which forms short cliffs (Wood, Kelley, and MacAlpin 1948). Underlying are massive beds of less resistant Lewis shales and clays, forming long talus slopes which at times approach badlands topography. These deposits have been important to prehistoric peoples as sources of building stone and ceramic clays.

Two dramatic, freestanding pinnacles of rock—the Chimneys—are present as salients detached from the northeast end of the cuesta. The main pinnacle stands to an elevation of 7,903 feet while the Companion Chimney is lower. It is these features which attracted the place names Chimney Rock or "Piedra Parada" (standing rock) (Roberts 1930:14). (Fig. 2)

The study district is located in Archuleta County just off Colorado State Highway 160 which connects Pagosa Springs with Durango. The closest nearby modern community is the settlement of Piedra. Chimney Rock also lies some 20 miles north of the Navajo Reservoir and the junction of the Piedra River with the main drainage stem—the San Juan River.

The significance of the Chimney Rock Archaeological Area has been recognized by its designation on the National Register as a National Historical Site (Federal Register 1974).

LEGENDARY ACCOUNT OF CHIMNEY ROCK

The strikingly prominent Chimney Rock pinnacles have long served as a local landmark. According to a legendary account obtained from religious elders of the Taos Pueblo, northern New Mexico, this was also true in prehistoric times (Ellis 1969:171; Ellis and Brody 1964). This ethnographic account states that the mesa and its pinnacles are a chimney rock shrine used by a kiva group (the Day People) of Taos Indians who formerly dwelt in the area before moving to the Rio Grande Valley. Further information supplied by the ethnographer, Florence Hawley Ellis (personal communication) relates that the shrine was dedicated to the Twin War Gods who are well-known deities in Pueblo mythology. Ellis tells me that shrines to these two particular war gods are often natural stone pillars. Perhaps the two chimney pinnacles were also worshipped as a shrine in prehistoric times. Continuing this line of reasoning, the large Chimney Rock Pueblo (5AA83) may have been built on the highly inaccessible upper mesa not for practical considerations but for its superb elevated and commanding view of a sacred shrine.

FIGURE 2. Two oblique aerial views of the Chimney Rock Pueblo, 5AA83. *Upper,* facing north toward the site with the twin Chimney Rock pinnacles shown to the rear. *Lower,* facing southeast toward the site with the East and part of the West Kiva shown.

PREVIOUS INVESTIGATIONS

Archaeological research has been sporadically conducted in and around the Chimney Rock Mesa over the last half century. The initial pioneer investigations were carried out in 1921 as a combined expedition sponsored jointly by the State Historical and Natural History Society of Colorado (later changed to State Historical Society) in cooperation with the University of Denver. The 1921 field party was directed by J. A. Jeancon assisted by five university students, among whom were Frank H. H. Roberts, Jr., and Charles E. Mitton. Work was distributed over a number of projects including excavations at the Chimney Rock Pueblo (5AA83), the Guard House (5AA84), the Causeway Site or Location 1 (Rooms A and B of 5AA85), as well as at sites located on benches flanking the east side of the Piedra River near the Pargin and Harlan Ranches (Jeancon 1922).

In addition to these excavations, Mitton constructed a detailed topographic map of the Chimney Rock showing the location of the Chimney Rock Pueblo as well as 108 smaller mounds distributed over the causeway and lower mesa on either side of the Chimney Rock Ravine (Jeancon 1922: Plate 22). Thus in the first season of field work, Jeancon delineated the rich archaeological resources on the Forest Service holdings, amply justifying the establishment of the scientific and recreational preserve.

In 1922 the State Historical and Natural History Society of Colorado returned to Chimney Rock to conduct further excavations at the Main or Large Ruin (5AA83) under the direction of Frank H. H. Roberts (Jeancon and Roberts 1923, 1924). Roberts also mentions minor investigations carried out in small sites located on the lower benches of the Piedra River.

Lack of funds prevented further excavations by the State Historical and Natural History Society, so in 1923 Roberts was sent out in charge of a reconnaissance party. The resulting survey of sites showed that the Piedra Valley south of Highway 160 was thickly settled during the Pueblo I and early Pueblo II periods along its bordering benches and hills (Roberts 1925, 1930: Fig. 2:15-16). Of special interest was the discovery of some 30 villages, most of which were Pueblo I age, on Stollsteimer Mesa. Other survey findings included distributional recording of sites along the San Juan River from Trujillo to Arboles and again along the Pine River in the vicinity of La Boca.

The reconnaissance, which was continued during the summer of 1924 under Roberts' direction, covered country along the San Juan River as far south as Rosa, New Mexico. In addition, Roberts conducted three weeks of test excavations in one of the Stollsteimer Mesa sites (Roberts 1929). At the close of this season, he left the employment of the State Historical Society to do graduate work at Harvard (Stephenson 1967).

After Roberts' departure, Jeancon returned for one final season to conduct excavations on the Piedra River near the Harlan Ranch (Roberts 1930:17). Following cessation of work in the Piedra and Chimney Rock districts by the society, there was a two-year period (1926 and 1927) of research inactivity. Because of this lapse, Roberts, now in the employment of the Smithsonian Institution, determined to complete his excavations of Pueblo I and early Pueblo II age sites upon Stollsteimer Mesa in 1928. A preliminary note concerning this work was published in 1929 and the final report in 1930, a justly famous monograph entitled "Early Pueblo Ruins in the Piedra District, Southwestern, Colorado" (Roberts 1930). The Class A and B sites described by Roberts became the basis for a formulation of the Piedra Phase unit dated between A.D. 850 and 950 (Eddy 1966:492-499).

Between 1958 and 1963, the Museum of New Mexico carried out a sizable salvage program of site survey and excavations in the area along the San Juan River, now flooded by the Navajo Reservoir (Dittert, Hester, and Eddy

1961; Eddy 1972a). In addition to Pueblo I remains of the Piedra Phase, this research defined an early Pueblo II occupation (A.D. 950-1000) like that of the Class C ruins dug by Roberts (1930) on Stollsteimer Mesa. The cultural pattern reflected in these remains was termed the Arboles Phase (Eddy 1966:500-505). Still earlier manifestations of the Pueblo Tradition were termed the Los Pinos (A.D. 1-400), Sambrito (A.D. 400-700), and Rosa (A.D. 700-850) Phases (Eddy 1966:472-484). Together these five cultural units constitute an ongoing tradition reflecting a thousand years of Anasazi culture history (Fig. 3).

The excavations to be reported here, as well as the resurvey of the Chimney Rock District, were begun during the 1970 summer season and continued in the following summers of 1971 and 1972. This latter work has defined 91 sites equivalent to the 108 mounds described by Jeancon as well as new excavations in sites 5AA83, 5AA86, 5AA88, and 5AA92; all of these are dated between A.D. 925 and 1125. Thus this Pueblo II occupation overlaps the Arboles Phase as well as the very end of the Piedra Phase. However, because of its distinctive architecture, settlement pattern, and ceramic industry, the Chimney Rock occupation is employed to define a new archaeological culture, the Chimney Rock Phase (Fig. 3).

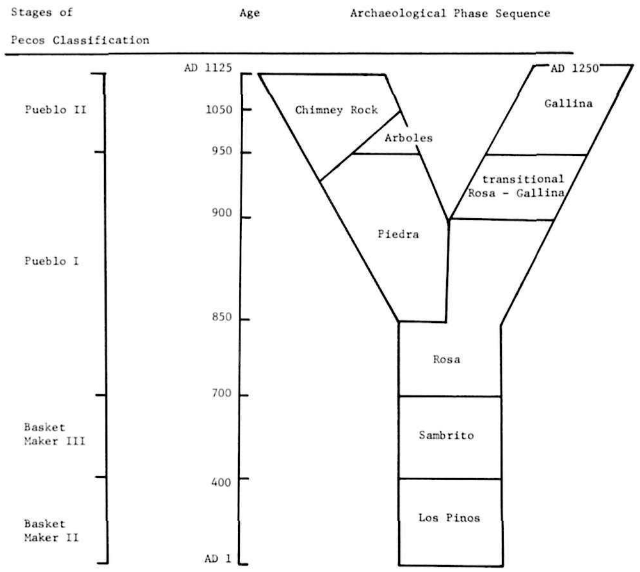


FIGURE 3. Diagram illustrating the diverging tradition of the Pueblo culture in the upper San Juan Basin. (Information adapted from Dittert, Hester, and Eddy 1961: Fig. 79.)

Following the close of the Navajo Reservoir study, the Mesa Verde Research Center conducted site survey on lands owned by the Southern Ute tribe lying immediately north of the San Juan River, Sandoval Section. This upland location is termed part of the Piedra District as designated by Roberts (1930). Analysis of the data covering three archaeological phases—Rosa, Piedra, and Arboles—allowed Adams (1975) to identify an upland settlement adaptation differing from either the slightly later Chimney Rock pattern or the contemporary canyon bottom arrangement (Dittert, Hester, and Eddy 1961).

II. The Site Survey

The following discussion presents a detailed account of the prehistoric settlements recorded by means of the site survey of the Chimney Rock District as well as the interpretation of these data in terms of the community social organization, human population size, and land use practices. It further offers a settlement context within which the more detailed site excavation studies can better be understood.

The site survey located 91 sites of prehistoric occupation. Twenty-seven of these were temporary campsites, while the remainder were sedentary homes marked by residential architecture totaling 217 structures. The average site density for the district as a whole is 14.9 sites per square mile, although considerable variation was found from one locality to another.

Although a few sites (17) were isolated, the bulk of the settlements were aggregated into seven named site groups. These clusters of sites are thought to have been largely self-sufficient, organized communities. Three of these (Pyramid Mountain, Southern Piedra, and Northern Piedra Groups) are distributed in a north-south line paralleling the Piedra River while three others (High Mesa, East Slope, and Stollsteimer) occupied the high terrain along the east side of the mesa. The seventh group, Ravine, forms an east-west link or bridge which ties the two together (Fig. 4). Taken as a whole, the 91 sites comprising this settlement distribution make up the bulk of the Chimney Rock Phase occupation in the upper San Juan Basin, and therefore we have delineated nearly the entire site population. For this reason, I believe we have isolated a social unit which can be thought of as a prehistoric tribe.

SURFACE EVIDENCE OF SETTLEMENTS

Site survey is a research activity which involves making an inventory of prehistoric remains based on their surface remains. From such an examination, one can make preliminary statements concerning the number, nature, and distribution of prehistoric settlements. But in order to make accurate predictions about what is underground based on what is on the surface, it is necessary to acquire enough understanding of the archaeological materials to accurately equate surface-exposed with underground phenomena. This understanding can be based on subsurface information gained through the illegal diggings of the looter, some extraordinary uneroded surface exposure, and/or preliminary planned excavation by the archaeologist himself. In the case of the Chimney Rock project, we have relied on all three sources of information. The following is a descriptive account of the kinds of surface manifestations and our present understanding of what these indicate in terms of their buried counterparts (Fig. 5).

Architectural Remains

At Chimney Rock we are fortunate in dealing with a prehistoric Pueblo people whose principal house form was constructed of irregularly coursed sandstone masonry, often with massive walls and sometimes with multiple stories sufficient to leave ample trace of their former presence. Further,

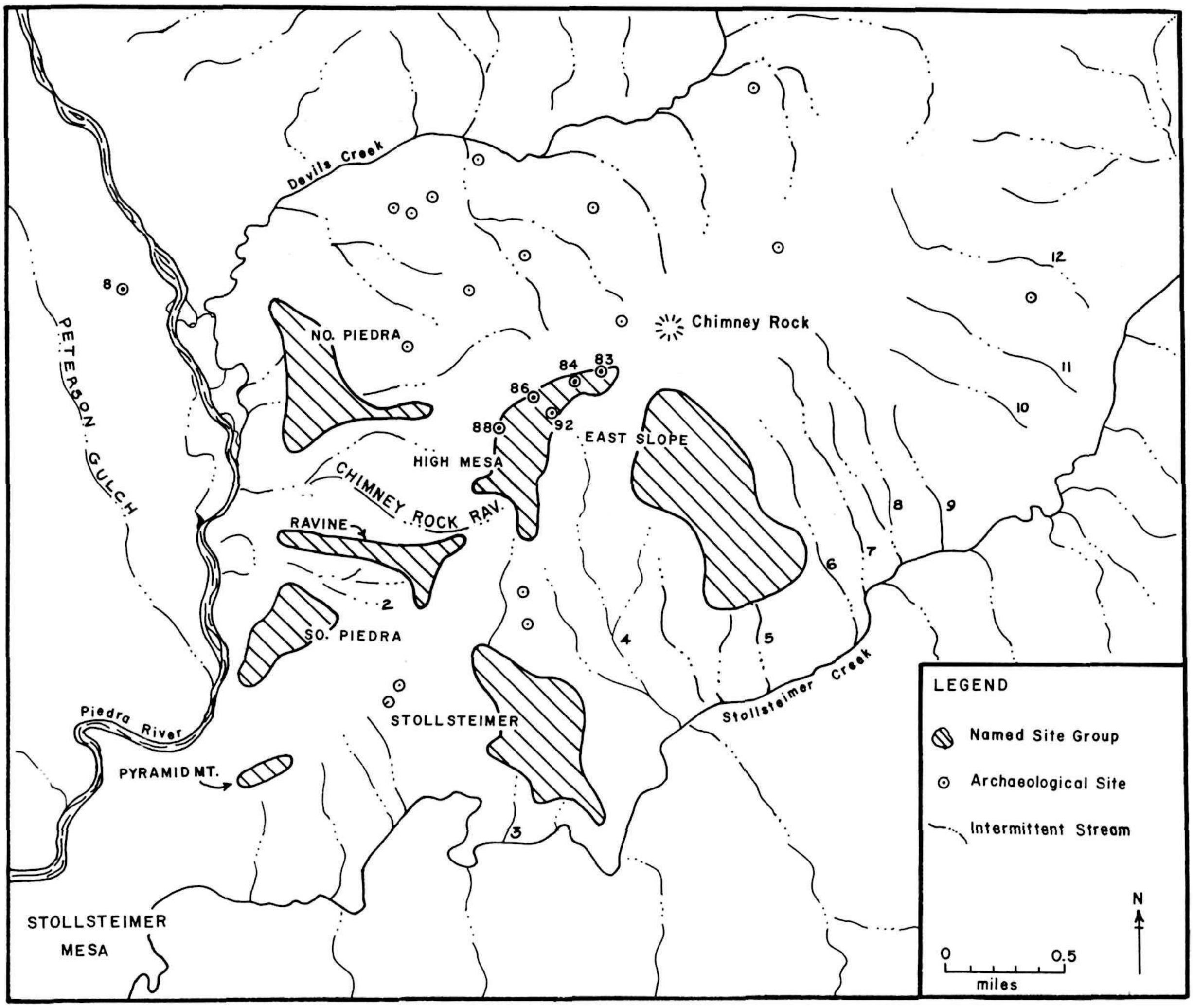


FIGURE 4. Map of the seven named site groups, Chimney Rock Archaeological Area. Ravines are numbered for purposes of identification.

we are blessed in the fact that the environment is dominated by a semiarid, water-deficient climate which supports spaced, open vegetation. The sparseness of the plant growth has materially aided the visibility of archaeological surface remains. With these factors working to our advantage, the following kinds of prehistoric surface manifestations have been defined: crater-shaped mounds, rubble dome-shaped and elongated-shaped mounds, surface depressions, jacal concentrations, and trash areas.

Crater-Shaped Mounds

The crater-shaped rubble mounds are the most characteristic archaeological remains along the east edge of the mesa. They are sparse on the east slope of the mesa and mixed with other architectural forms along the west flank of the study district. These mounds consist of sandstone rubble from just 1.5 feet high to impressive moundings up to 6.0 feet high. In plan, they are circular with a central depression 1.5 to 3.0 feet deep. As a rule the interior crater dimension is from 18.0 to 21.0 feet in diameter, but the survey crew encountered a few larger structures 30 to 40 feet in diameter.

Based on excavations in crater-shaped mounds at sites 5AA86, 5AA88, and 5AA92 of the High Mesa Group, it is assumed that these are the collapsed and eroded remains of circular thick-walled masonry domestic rooms. Further, these structures were outfitted with a central fireplace, a ventilator system (both tunnel and shaft) located in the southern wall of the room, and flat roofs made with logs and mud. That the equation between the crater-shaped mound surface manifestation and the circular domestic room is not unique is amply born out by pothunter exposures made in many other mounds, as well as the undisturbed exposure of the vertical ventilator shaft on a few undug mounds.

In one case (5AA93), a crater-shaped mound is known to contain a tall square masonry tower because of its partial exposure by pothunter diggings. Some crater mounds are also enclosed within rectangular masonry compound walls.

Unlike the common small domestic structures, the rare large crater-shaped mounds with interior diameters of 30 to 40 feet were thought to be the remains of collapsed Great Kivas principally on the basis of a size comparison with such ceremonial structures known from Chaco Canyon and Mesa Verde. The 1972 summer field season excavations at Mound 17, 5AA88, confirmed this hypothesis (see 5AA88).

Rubble Dome-Shaped Mounds

Dome-shaped mounds of sandstone slabs without an interior depression are the surface remains of either very small

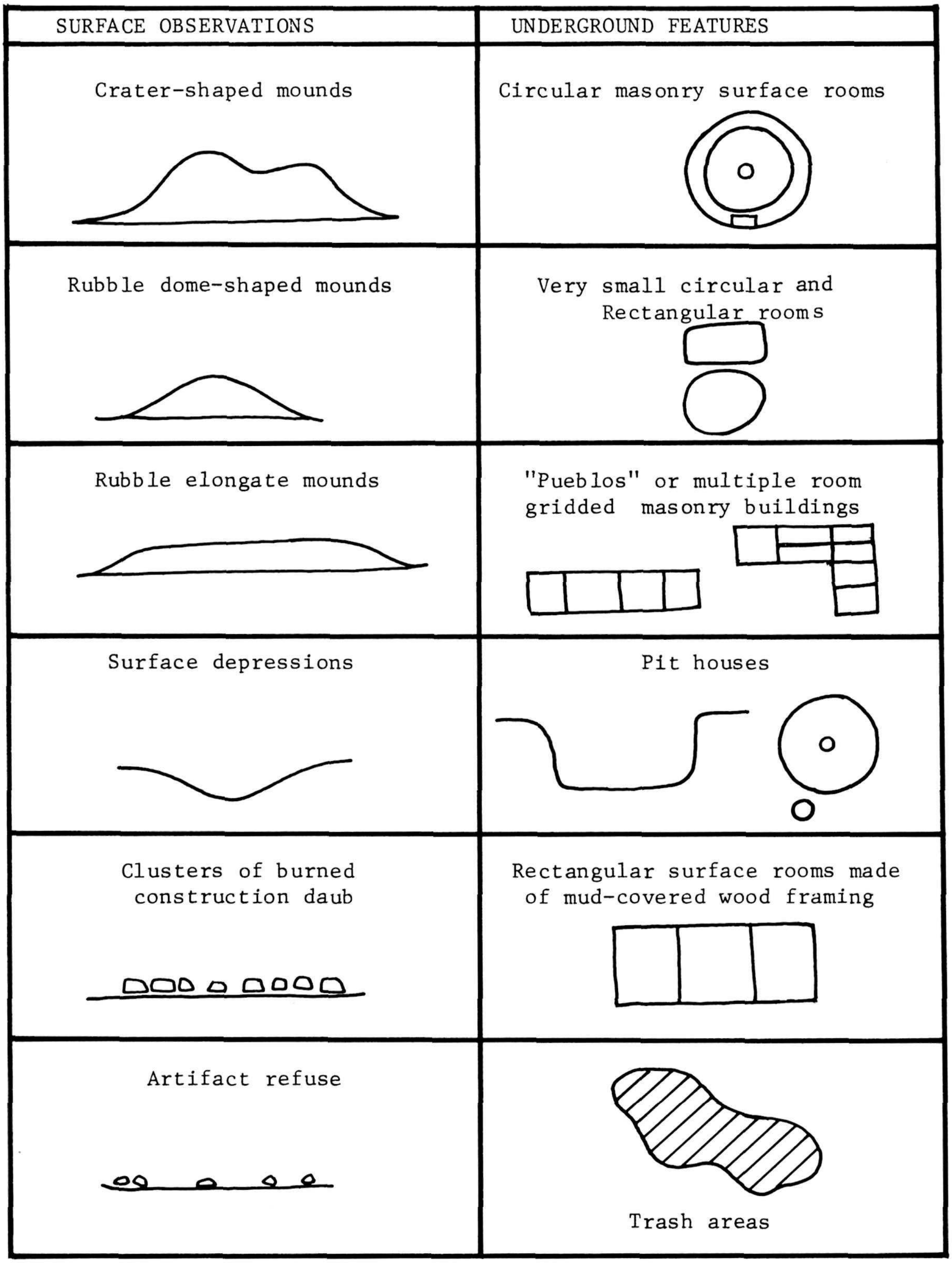


FIGURE 5. Correlation of surface manifestations with underground features.

circular rooms or more likely collapsed rectangular rooms. In some cases the rectangular nature of the buried walls can actually be followed on the ground surface, as was the case when we first inspected Rooms 1 and 6 at 5AA86, Mound 3. Unlike the massive (approximately 3.0 feet thick) walls of the circular rooms, the walls of the rectangular structures are generally one to two rocks across. Judging from the milling and slab cist features found in these rooms through excavations, it appears that they were constructed as food processing and storage rooms.

Rubble Elongate Mounds

These mounds are like the dome-shaped ones except that they are elongate in one or two (L-shaped) directions. Located principally in the two Piedra site groups, they are thought to be the surface manifestations of long, rectangular pueblos, or gridded buildings. This expectation is well substantiated by the excavations in elongate rubble mound, 5AA83, where a large gridded pueblo composed of 35 ground floor rooms has been partially cleared.

Surface Depressions

Depressions in the ground without any associated masonry rubble are comparatively rare features in the Chimney Rock District. However, from excavations in the Navajo Reservoir District, located some 20 road miles south of Chimney Rock, it is known that these are the remains of filled-in pit houses; a form of subsurface domestic dwelling (Dittert, Hester, and Eddy 1961:41-42). In the case of the Chimney Rock occupation, which is mostly a century or so younger than the Pueblo I (A.D. 700-950) occupation of the Reservoir District, a few of these surface depressions may indicate a now buried small kiva or ceremonial structure.

Jacal Concentrations

Concentrations of bright orange, brick-hard pieces of fired clay are recognized as the surface evidence of burned pole and mud structures ranging in size from one to several rooms. The baked clay pieces show impressions of the now destroyed pole frame of the house as well as finger marks left from the prehistoric application of the mud. No structures of this light frame type have yet been excavated in the Chimney Rock District but ample information was obtained from the salvage excavations in the Navajo Reservoir District to make this equation (Dittert, Hester, and Eddy 1961:42).

Trash Areas

Thin sheets of scattered trash are often found immediately outside many prehistoric residences. These deposits consist of discarded stone and pottery artifacts. Rarely is there much staining of the soil from charcoal or now-decayed organic waste. The thin, scattered nature of this material residue indicates that it is the remains of prehistoric garbage consisting of worn-out and discarded implements mixed with waste food and other materials disposed of by broadcast spreading next to the domestic dwelling. In no case was much thickness of deposit noted, leading to the conclusion that occupation of any one structure was always of a relatively short duration.

Other sheet deposits of trash, without associated architecture, have been interpreted as indicating temporary campsites, perhaps the leavings from hunters and seasonally dispersed farmers. It is thought that other cases, in which stone artifacts were found in the trash without much pottery, were workshops.

CLASSES OF ARCHITECTURAL SITES

Most architectural sites are internally organized in an irregular, dispersed pattern along a linear axis dictated by topography. This open, spaced kind of settlement distribution is termed rancheria in the American Southwest (Fig. 6). In contrast to the linear settlement organization are some compact sites located along the Piedra River where rectangular courtyard subunits of gridded masonry pueblos appear within large villages (Fig. 7).

Architectural sites are classified in three categories for this study: Single Unit, Multiple Unit, and Villages. The numbers and combinations of structures comprising these site types are described as follows.

Single Unit Sites

Sites exhibiting one architectural unit, sometimes with associated sheet trash, form a Single Unit site type. Common architectural units found on such sites are crater-shaped mounds, a pit house depression, or a jacal structure. Single Unit sites are inferred to be the permanent residence of a nuclear family.

Multiple Unit Sites

When a site contains between two and five architectural structures, it is termed a Multiple Unit type. Sites of this type may be composed of several crater-shaped mounds, pit houses, small pueblo buildings, or combinations of such structures. The units may be arranged in a dispersed line of separate houses, or some units may form contiguous sets. When structures are attached, they often include a row of rectangular storage rooms backing several conjoined circular rooms such as the internal layouts of Mound 3 at both 5AA86 and 92. Often several or all of such architectural structures will have thinly scattered sheets of trash nearby.

Multiple Unit sites are thought to have been the permanent residence of one or more extended families (or lineages) in which related kin are housed in nearby buildings.

Village Sites

When six or more separate buildings are found clustered together, they are termed a Village. Such sites commonly contain a large variety of architectural forms including multi-room masonry pueblos. In addition, whenever a site was found with a medium-to-large pueblo on it, it was termed a Village whether or not an accurate internal room count could be made. When oversized circular structures termed Great Kivas are found, they generally appear in Villages. For this reason, the Villages are thought to have been religious if not social and economic nuclei of the communities in which they are found. Probably all Villages, with or without a Great Kiva, housed a single lineage or extended family.

DESCRIPTION OF THE SITE GROUPS

Basic descriptions of the settlement data recorded on site survey are given below in terms of seven named groups of sites. The site groups are followed by a treatment of the few isolated sites which do not show spatial affinity with the occupational clusters. The following data is presented for

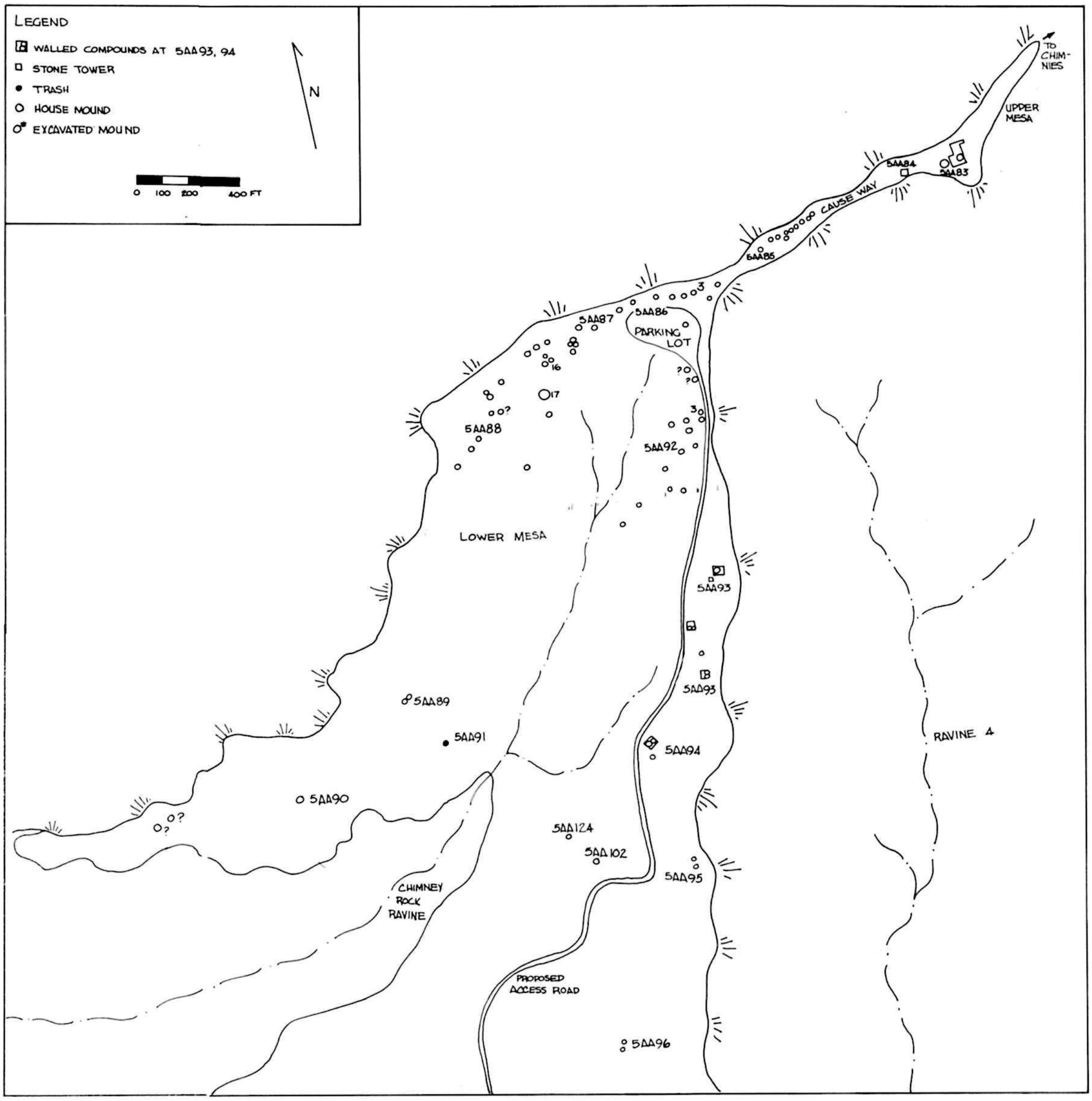


FIGURE 6. Map of the High Mesa Site Group showing the distribution of house mounds illustrating the typical loose, open site plan. Adapted from U.S. Forest Service topographic map, San Juan N.F., Colorado, Chimney Rock Archaeological Area, compiled by Division of Engineering Branch of Surveys and Maps, June 1969.

each site group interpreted as a prehistoric community: (1) site types, (2) site distributions, (3) site and structure density, (4) site situations, (5) arable land, (6) drainage and available water, and (7) vegetation. In sections to follow, these data will be interpreted in terms of the inferred prehistoric social organization and demography.

High Mesa Site Group

A dense cluster of 16 sites of prehistoric occupation was encountered to the south and west of the Chimney Rock pinnacles (Table 1). This set of rubble mounds, termed the High Mesa Site Group, is of paramount interest to this study since the ruins will be the first viewed by tourists. Prominent excavated members of the High Mesa Group are Chimney Rock Pueblo (5AA83), the Guard House (5AA84), the Parking Lot Site itself (5AA86), and 5AA88. Mound 3 of the Access Road Site (5AA92), which has been destroyed by road construction, was also a member of the site cluster.

From a cultural standpoint, the High Mesa Group is of interest because it reflects the highest altitude occupied by prehistoric members of the Chimney Rock Phase, with sites from 600 to 1000 feet above the surrounding valley floors. Also it was here that Chaco colonists living at the Chimney Rock Pueblo were in immediate, firsthand contact with the indigenous members of the Chimney Rock Phase.

Site Types

The High Mesa Group is comprised of 14 sites with residential architecture: three Single Units, four Multiple Units with 10 structures, and seven Villages with 97 structures and rooms. In most cases each site represents a distinctive cluster

TABLE 1

Settlement Data of the High Mesa Group

Site	Location	Age	Veg. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA83	T34N,R4W Sec. 17	PII	Pinyon Juniper	Multiple room masonry pueblo (34 × 68 m.): 36 ground floor rooms, 2 Chaco style kivas, southern plaza.	Uppermost platform of Chimney Rock Mesa	7600′	Excavated 1921, 1922 CR Pueblo
5AA84	T34N,R4W Sec. 17	PII	Pinyon Juniper	Single unit (6.1 × 7.0 m.): 1 circular masonry room enclosed by rectangular retaining walls.	Uppermost platform of CR MESA	7600′	Excavated Guard House
5AA85	T34N,R4W Sec. 17	PII	P-J	Village (12.0 × 35.4 m): 9 circular/ crater-shaped mounds, 1 shallow trash area.	Narrow causeway connecting upper and lower mesas	7520′	2 rooms excav.
5AA86	T34N,R4W Sec. 17	PII	P-J	Village (25 × 130 m.): 8 circular crater-shaped mounds; 1 thin trash area.	Edge of lower mesa	7440′	3 rooms excav. Parking Lot Site
5AA87	T34N,R4W Sec. 17	PII	P-J	Village (42.3 × 54.0 m.): 6 crater-shaped mounds; 2 (?) workshop areas: (?) cultivation area.	Edge of lower mesa	7400′	1 mound pothunt.
5AA88	T34N,R4W Sec. 17	PII	P-J	Village (138 × 138 m.): 16 crater-shaped mounds; 2(?) Great Kivas; 1 bedrock mortar.	Edge of lower mesa	7385′	3 mounds pothunt.
5AA89	T34N,R4W Sec. 17	PII	P-J	Multiple unit (7.8 × 3.6 m.): double crater-shaped mound (2 linked rooms).	Rocky knoll	7295′	Pothunt.
5AA90	T34N,R4W Sec. 17	PII	P-J	Single unit (2.5 × 2.0 m.): 1 crater-shaped mound; scattered trash around mound.	Rocky knoll	7285′	
5AA91	T34N,R4W Sec. 17	PII	P-J	Artifact refuse (3 × 3 m.): refuse of stone artifacts but few potsherds (workshop).	Rock bench	7210′	Below site 89
5AA92	T34N,R4W Sec. 17	PII	P-J	Village (83.4 × 133.2 m.): 13 crater-shaped mounds; 2 (?) crater-shaped mounds.	Edge of mesa	7350′	1 mound salvage excavat. 2 pot.
5AA93	T34N,R4W Sec. 17	PII	P-J	Village (50 × 133.2 m.): 3 compound units containing 5 crater-shaped mounds; 1 separate crater-shaped mound; 1 separate square masonry tower; 5 areas scattered trash, each associated with an architectural unit; (?) agricultural areas.	Edge of mesa	7300′	2 mounds pothunt.
5AA94	T34N,R4W Sec. 17	PII	P-J	Multiple unit (30 × 16 m.): 1 compound containing 2 crater-shaped mounds; 1 separate crater-shaped mound; 1 scattered trash area.	Rocky knoll near edge of mesa.	7315′	2 mound pothunt.
5AA95	T34N,R4W Sec. 17	PII	P-J Pond.	Multiple unit (16.7 × 16.7 m.): 2 crater-shaped mounds; 1 depression without mound (pit house); 1 scattered trash area.	Edge of mesa.	7270′	
5AA96	T34N,R4W Sec. 17	PII	P-J Pond.	Multiple unit (16.7 × 16.7 m.): 2 crater-shaped mounds.	Mild rocky knoll	7200′	
5AA102	T34N,R4W Sec. 17	PII	P-J Pond.	Single unit (15.8 × 15.8 m.): 1 crater-shaped mound.	Rocky rise mesa interior	7240′	Edge of strip of bedrock
5AA124	T34N,R4W Sec. 17	PII	P-J Pond.	Artifact refuse (14.9 × 14.9 m.): scattered stone artifacts (workshop).	Edge of ravine	7200′	Edge of strip of bedrock

of rooms or crater-shaped mound structures but in the case of three site designations, 5AA86, 87, and 88, the field recording was somewhat arbitrary. These three sites actually represent a more or less continuous scatter of rubble mounds extending from the southern terminus of the causeway southwestward around the head of the Chimney Rock Ravine and along the northwest margin of the mesa. This linear scatter of mounds comprises at least 32 masonry structures, of which 2 are oversized crater mounds thought to have been Great Kivas (5AA88).

Throughout the entire community, we observed 72 crater-shaped mounds and 2 other possible mounds. Seven of these structures are enclosed within rectangular masonry walls to form what are now suspected to be four compound structures (5AA93, 94). The Guard House (5AA84) consists of a single circular structure also enclosed by rectangular walls but, according to the field excavations of Jeancon (1922:13-14), these were retaining walls rather than freestanding compound walls. One other crater-shaped mound has been partially looted; this illegal digging has revealed the presence of a square tower in a mound estimated to stand some nine feet above the surrounding ground surface. Another rubble mound, the Chimney Rock Pueblo, contains an estimated 35 ground floor rooms and 2 kivas. Since the interior rooms of the mound are likely to have stood two stories high, there may have been as many as 50 rooms in this structure.

At 5AA95 was found a set of three structures, two of which are marked by the usual crater shape while the third is represented by a simple depression in the ground without sandstone masonry. Perhaps this depression is surface evidence of a small kiva, but only excavation can determine this.

In addition to the architectural sites enumerated above are two other sites (5AA91 and 124) consisting only of thin scatters of stone artifact refuse. Because of the paucity of ceramics collected from these two locations, the field investigator classified them as workshops for the manufacture of stone tools.

Site Distributions

The arrangement of sites on the upper end of the mesa is closely dictated by the availability of suitable level terrain. For this reason the sites form a large arc confined between the curving edge of the mesa and the north-south axis of the Chimney Rock Ravine. From here they continue across the causeway and up onto the rock platform of the upper mesa, separated from the pinnacles only by a deeply eroded saddle.

Site and Structure Density

The 16 sites of the High Mesa Group cover an area of approximately 0.16 square miles at a density of 100 per square mile. The close spacing of units is even more dramatically emphasized when the individual occupational structures are computed for density. Estimating 74 mound structures, and considering the Chimney Rock Pueblo as one unit rather than 35 ground floor rooms, the density of living units is 468.6 structures per square mile. These figures must be considered minimum calculations since surface observations always underrepresent the actual number. For example, Mound 3 of the Parking Lot Site was counted as one structure by the survey party, but excavations revealed four circular living rooms and two rectangular storage-food processing rooms. Again Mound 3 of the Access Road Site, when excavated, disclosed three circular residential rooms, three storage rooms, and one ramada. Thus our survey-derived density figures may be in error by a factor of three to five in underestimating the density of occupation of the High Mesa Group.

Site Situation

Examination of the kinds of topographic relief employed by the High Mesa Group for site situations dramatically points up the cultural attraction these people seem to have felt for elevation and view in their everyday living arrangements. In contrast, they seemed to express a strong disinterest in residence on the valley bottom. In order of preference they employed: edge of mesa, 7 sites; rocky knolls present in the mesa interior, 4 sites; a rocky bench of the mesa interior, 1 site; the edge of the Chimney Rock Ravine, 1 site; the causeway with sheer drop-off on both sides, 1 site; and a small rock platform (the upper mesa), 2 sites.

The sites range between 7,200 and 7,600 feet in elevation. The Chimney Rock Pueblo and the Guard House are most spectacularly placed at 7600 feet elevation. Just below, on the causeway, is 5AA85 at a height of 7520 feet, while the bulk of the sites lie somewhat lower, between 7,400 and 7,200 feet. One wonders why these pueblo farmers built and lived 600 to 1,000 feet above the surrounding valley floors, the most likely setting for agricultural activities.

Arable Land

The soils within the area of the High Mesa Group are shallow and rocky, and are poorly suited to prehistoric dry-land farming. Further, the talus slopes over the edge of the mesa are completely unsuitable for farming because of the very steep gradients. In addition, the mesa surface immediately south, between the High Mesa Group and either the Stollsteimer Group or the Ravine Group, is very shallow or else the bedrock is completely denuded of topsoil. For these reasons, it seems extremely unlikely that the upper end of the mesa provided the necessary farmland to support the demonstrated large population. It seems obvious, then, that the major farmlands must have been located somewhere other than the mesa top. The most likely spot is on the pediment colluvial soils at the base of the mesa on the east side within the Stollsteimer Valley. Judging from the low elevation campsites found on ridges just above the valley floor, farmers of the High Mesa Group spent all or part of each summer in temporary seasonal residence near their fields returning in the fall with their harvest, which was stored for winter use (see East Slope Group). That such harvests were destroyed by fire in the fall is well demonstrated by the finding of burned storage rooms full of shelled corn kernels and beans at sites 5AA88 and 5AA92.

Drainage and Available Water

In semiarid lands, the location, quantity, and potability of water become critical limiting factors for human occupation. This principle is nowhere better illustrated than in the prehistoric occupancy of the High Mesa Group. The present drainage cutting the Chimney Rock Ravine flows only after the short, intense but infrequent summer thundershowers, thereby providing little in the way of a dependable water supply. Neither did we find any clear-cut evidence that the ravine was dammed prehistorically to form catchment basins for water storage such as Jeancon (1922:11) claims to have observed some 50 years ago.

Springs, as such, are nonexistent, although a number of minor seeps are present in the Chimney Rock Ravine where dampness is found in the Lewis Shale just beneath the cap rock of the Pictured Cliff sandstone. However, this dampness barely supports moss and a few bees; it is insufficient for human needs at the present time.

From this negative evidence, it seems logical that the nearby perennially flowing valley streams must have been utilized for drinking water. This would have required journeys of 1.5 miles to the Stollsteimer Valley, 1.0 mile to use the Devils Creek (dry after mid-July), or 1.25 miles to the Piedra River. Assuming that some of the population remained on the mesa top year-round, maintaining the supply of water for cooking and drinking must have been a daily chore, with some members of each household always on summer assignment to haul potable water in large jars for household use.

During the winter the picture must have been quite different. Then mesa-top snowpack would have provided ample drinking water without arduous daily trips to the valley floors. Of particular benefit would have been the snow protected from melting on the shaded north and west facing talus slopes just under the cliff edge. It is likely that much of the masonry wall construction and clay plastering was undertaken in the late fall and early spring when this ample water supply was available, since the mud mortar to build so many houses would have required very large quantities of water.

Vegetation

Twelve of the 16 sites are found in the pinyon-juniper association which includes the upper mesa, causeway, and all of the area around the parking lot at the head of the Chimney Rock Ravine. Only four sites, 5AA95, 96, 102, and 124, lie within the ponderosa open woods or at the boundary between this vegetation association and the pinyon-juniper. That this trend also held for the prehistoric past is revealed by the analysis of prehistoric pollen obtained from excavated sites 5AA86 and 92, which shows cover ranging from sparse pinyon-juniper to a more dense growth of scrub oak (Appendix B). From this information obtained from the High Mesa Group, it would appear that the present vegetation distribution can be used as a rough guide to that of the prehistoric past, although internally the pollen record does indicate some minor changes in density and composition of the major vegetation associations through time.

East Slope Group

On the eroded, east slope of the Chimney Rock Mesa is found a dispersed set of 12 prehistoric sites: 5 architectural residence sites and 7 non-architectural sites thought to have been camps and/or workshops (Table 2). By and large the camps are situated on the middle and lower tips of ridges, where they command a view of the adjacent colluvial flats bordering Stollsteimer Creek. This position is inferred to mean that the camps were occupied during the summer by farmers of the High Mesa community who tilled maize and bean fields on the outwash flats of the debouching ravines. The permanent architectural sites, on the other hand, were probably occupied by a few isolated homesteaders on a year-round basis.

Site Types

The seven camps of the East Slope Group were identified as such because of the lack of any clear-cut architecture. They are characterized by scatterings of stone and pottery artifacts, which in a few cases were so sparse that little remained of the site after the survey party had made its surface collection. In the case of the artifact refuse found at 5AA257, only stone debris was found; therefore, the site was identified as a workshop rather than a camp.

The five architectural sites of the East Slope Group are three isolated structures of Single Unit and two Multiple Unit types. Two have been burned and 5AA254 has been seriously looted, exposing circular masonry walls. In most cases, thin concentrations of trash are to be found next to the rubble mound structures. In general, unlike the High Mesa Group, these sites lack architectural diversity or indications of long-term use.

Site Distribution

Sites of the East Slope Group are arranged around Ravine 5, which originates in the saddle between the Chimney Rock pinnacle and the Companion Chimney (Fig. 4). Three of the architectural sites form a minor cluster on the ridge separating Ravines 5 and 6, while the other two occupy much higher terrain to the north, about half a mile apart.

The non-architectural sites appear on the middle and lower tips of major ridges flanking Ravine 5. Exceptions to this distributional pattern are found only at 5AA251, lying high up at the head of the ravine and 5AA250 which lies out on the pediment flats beyond the mouth of Ravine 5.

Site and Structure Density

The East Slope Group covers an area of approximately 0.5 square miles at a density of 24 sites per square mile. Both the individual structures and the camps are thinly scattered in densities of 14 per square mile; an incidence which contrasts markedly with the high density of the High Mesa Group.

Site Situations

The preferred terrain for sites of the East Slope Group, whether permanent houses or temporary camps, was a saddle or low knoll along the crest of a ridge extending out from the east side of the Chimney Rock Mesa into the Stollsteimer Valley. Ten sites occupy ridge crests, one is situated on the tip of a pinnacle forming a salient from the main mass of the mesa (5AA254), and one is situated upon a low knoll which is actually part of the outwash plain of the Stollsteimer Valley perimeter (5AA250).

These sites have a vertical spread of over 600 feet, from a low at 6,640 feet to a high of 7,272 feet. Most of the camps (six out of seven) fall in the lower end of this distribution (between 6,640 and 6,840 feet) where they immediately overlook the colluvial outwash flats of Ravine 5. It is this proximity which has led to the summer farming interpretation for the camping activity.

Permanent residence sites are more irregularly correlated with elevation. One set of masonry house structures is found on ridges around 6,700 feet elevation while a second set is located around 7,200 feet. These site situations, although admittedly based on sparse data, show a pattern of avoidance of the lower elevations near the valley bottom and a positive attraction for the higher badland terrain with closer proximity to the main mass of the mesa itself.

Arable Land

Today the entire bottom of the Stollsteimer Valley is comprised of alluvial soils which are eminently suitable for tillage using simple, primitive farming implements such as the digging stick and stone hoe. Further, along the flanks of the valley, where lateral ravines and canyons debouch their

TABLE 2
Settlement Data of the East Slope Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA250	T34N, R4W Sec. 20, 21	P-II	P-J, sage	Artifact refuse (125 × 250 m.): thinly scattered artifacts.	Low knoll overlooking colluvial flats.	6640′	Campsite
5AA255	T34N, R4W Sec. 20	P-II	J-P, oak	Artifact refuse (109 × 109 m.): thinly scattered artifacts.	Ridge	6840′	Campsite
5AA252	T34N, R4W Sec. 21	P-II	P-J/ Pond.	Artifact refuse (19.5 × 21 m.): thinly scattered artifacts.	Ridge overlooking Ravine 5.	6800′	Campsite
5AA253	T34N, R4W Sec. 20	P-II	P-J/ oak	Artifact refuse (280 × 400 m.): dense concentration of trash; scattered sandstone masonry from structures.	Ridge below salient pinnacle.	6750′	Campsite, overlook Ravine 5
5AA254	T34N, R4W Sec. 17	P-II	Scrub oak	Multiple unit (32 × 50 m.): 2 crater-shaped mounds (contiguous).	Salient pinnacle between Ravines 4 and 5	7272′	Burned adobe
5AA251	T34N, R4W Sec. 17	P-II	Juniper, oak	Artifact refuse (21 × 24 m.): artifact concentration.	Ridge overlooking Ravine 5.	7200′	Campsite
5AA256	T34N, R4W Sec. 16	P-II	Jun., oak, sage	Single unit (280 × 400 m.): 1 rubble mound; scattered trash.	Ridge overlooking Ravine 5.	7120′	Burned sandstone masonry
5AA257	T34N, R4W Sec. 21	?	P-J, sage	Artifact refuse (20 × 20 m.): thinly scattered stone artifacts.	Ridge overlooking Ravine 5.	6800′	Stone workshop
5AA259	T34N, R4W Sec. 21	P-II	P-J, oak	Multiple unit (8 × 18 m.): 1 rubble mound; 2 areas thinly scattered trash.	Saddle on ridge between Ravines 5 and 6.	6760′	
5AA260	T34N, R4W Sec. 21	P-II	P-J/ oak	Artifact refuse (10 × 10 m.): thinly scattered artifacts.	Tip of ridge overlooking Ravine 6	6680′	Campsite
5AA258	T34N, R4W Sec. 21	P-II (?)	P-J	Single unit (?) (4.5 × 7.5 m.): 1 rubble mound (?); thinly scattered trash.	Small knoll on ridge.	6680′	Overlooks Ravine 5 flats
5AA261	T34N, R4W Sec. 21	P-II	P-J	Single unit (1 × 1 m.): 1 rubble mound, scattered trash.	Small knoll at tip of a long ridge.	6680′	Overlooks flats of Ravines 5 and 6

sediments, there are rich colluvial soils suitable for the floodwater farming called akchin (Hack 1942:26-28). Judging from the distribution and situation of campsites along the ridge crest bordering Ravine 5, just such akchin farming was practiced by the Chimney Rock agriculturalists. Even though there are no sites located around the mouth of other ravines flowing out of the Chimney Rock uplands, the presence of individual artifacts on the flats at the mouth of Ravines 4, 7, 8, 9, and 11 also points to an agricultural use of these outwash plains. This generalization is drawn, of course, entirely from surface observations and remains hypothetical until excavations in the outwash colluvium produce prehistoric artifacts in association with prehistoric maize pollen at the site of the ancient fields.

Drainage and Available Water

The most obvious source of potable water to serve the needs of the East Slope Group is the perennially flowing Stollsteimer Creek. The ridge tip campers would have had to fetch potable creek water no more than 0.4 mile, whereas the higher domestic house sites are up to 1.3 miles from the stream. Further, the camps and house sites flanking Ravine 5 could count on temporary water flow during the summer following thunderstorms even though the swift runoff is heavy with mud. For those higher elevation sites back against the main mesa, there are at least five seeps discharging from the Lewis Shale. However, these yield very little water today. The seepage is highly charged with carbonate salts to judge by the white limy staining of the surrounding clay soil, a feature which makes the water unpotable. Further, no sherds of broken clay water jars have even been found at these seeps and this negative evidence would seem to argue against utilization for human consumption in prehistoric times. From this review, it is quite plain that the water stress experienced by the High Mesa community was not as severe as that experienced by the East Slope residents.

Vegetation

The vegetation of the east slope is far more xeric than elsewhere in the district because of the steep slope and southeasterly exposure. Here the vegetation associations which segregate neatly elsewhere are often completely broken down, so that ponderosa pine, pinyon, juniper, sage, oak, and other vegetation types are frequently mixed. Despite this mixing, most of the sites (9 out of 12) are found in a sparse pinyon-juniper cover, although understories of oak and sage as well as other shrubs are common. Two other sites are found at the breaks between pinyon-juniper cover with nearby ponderosa pine, and one site is entirely in a shrub cover of oak (5AA254). The preponderance of shrub cover on the east slope as well as the general vegetation diversity supports ample wildlife, particularly deer, whose trails, bedding areas, and droppings were seen in great numbers by our survey party. More rarely a small elk herd was sighted at the mouth of ravines north of Ravine 12. These observations suggest that the farming camps of Ravine 5 may have also served as points of departure for fall hunters.

Stollsteimer Group

On the southeastern tip of the Chimney Rock Mesa fronting on the Stollsteimer Valley is a cluster of 15 prehistoric sites: 9 are permanent residences, while the 6 others are non-architectural sites identified as camps and/or workshops (Table 3). Most of the permanent occupations consist of single masonry circular structures which give the impression of a newly formed community which had not experienced the growth exhibited by the High Mesa Group located to the north. Further, the campsites suggest that outside members came to stay seasonally for short periods. Perhaps they were farmers from the High Mesa Group who appeared during the summer to camp and practice floodwater farming on the alluvial bottomland along Stollsteimer Creek. Other activities which could have been conducted at these non-architectural sites are fall hunting and stone knapping.

TABLE 3
Settlement Data of the Stollsteimer Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA100	T34N, R4W Sec. 20	P-II (?)	P-J/ Pond.	Artifact refuse (5 × 5 m.): 1 trash area; 1 (?) structure.	Flats, mesa interior.	6930′	Ravine 3, camp (?)
5AA101	T34N, R4W Sec. 20	P-II	P-J	Single unit (15.8 × 15.8 m.): 1 dome-shaped mound without depression; 1 trash area.	Eroded slope, mesa interior.	6900′	Burned
5AA109	T34N, R4W Sec. 20	P-II	P-J	Single unit (21 × 21 m.): 1 crater-shaped mound; 1 trash area.	Slope, mesa interior.	6890′	Large boulder mortar, Ravine 3
5AA110	T34N, R4W Sec. 20	P-II	P-J	Single unit (7.0 × 7.0 m.): 1 depression (pit house?) without masonry mound; 1 trash area.	Flats, mesa interior.	6930′	Ravine 3
5AA111	T34N, R4W Sec. 19	P-II	P-J/ riparian	Single unit (10 × 10 m.): 1 crater-shaped mound; 1 trash area.	High knoll, mesa edge.	6685′	Overlooks Stoll-steimer Creek
5AA112	T34N, R4W Sec. 20	P-II	P-J/ Pond.	Multiple unit (7 × 7 m.): 1 dome-shaped mound; 1(?) crater-shaped mound.	Rocky ledge, edge ravine.	6840′	
5AA113	T34N, R4W Sec. 20	P-II	P-J/ Pond.	Artifact refuse (7 × 7 m.): 1(?) structure; 2 trash areas.	Rocky ledge, edge ravine.	6915′	Camp (?)
5AA114	T34N, R4W Sec. 20	P-II	P-J	Single unit (15 × 15 m.): 1 crater-shaped mound.	Rocky knoll, ravine edge.	6805′	Structure burned
5AA117	T34N, R4W Sec. 20	P-II	P-J	Single unit (15 × 15 m.): 1 crater-shaped mound.	Knoll	6760′	
5AA118	T34N, R4W Sec. 20	P-II	P-J	Single unit (7 × 7 m.): 1 crater-shaped mound.	Ridge crest	6885′	Ravine 3
5AA119	T34N, R4W Sec. 29	P-II	P-J/ riparian	Artifact refuse (7 × 7 m.): 2 trash areas.	Small knoll, mesa edge.	6700′	Overlooks Stoll-steimer Creek; camp
5AA120	T34N, R4W Sec. 29	P-II	P-J	Artifact refuse (12.9 × 12.9 m.): scattered artifacts.	Ridge, mesa edge.	6740′	Camp
5AA121	T34N, R4W Sec. 20	(?)	P-J	Artifact refuse (not recorded): scattered stone artifacts.	Slope above Ravine 3.	6900′	Workshop
5AA122	T34N, R4W Sec. 20	(?)	P-J	Artifact refuse (11.5 × 11.5 m.): scattered artifacts (no pottery).	Ridge above Ravine 3.	6940′	Workshop
5AA125	T34N, R4W Sec. 29	P-II	P-J/ riparian	Single unit (5 × 5 m.): 1 crater-shaped mound; 1 refuse area.	Knoll, mesa edge.	6700′	Overlooks Stoll-steimer Creek

Site Types

The six camps and/or workshops were identified from the presence of thin scatterings of artifactual debris. Two other sites were interpreted as workshops from the almost exclusive presence of stone artifacts without the associated appearance of pottery. Two of the camps have questionable structures because the sandstone bedrock outcrops so near the mesa surface; they may well not be of human construction.

The nine sites with definite architecture consist of eight Single Unit types (one structure each) and one possible Multiple Unit site consisting of a possible structure and a definite structure. The nine definite structures consist of six crater-shaped mounds (surface evidence of circular masonry rooms), two dome-shaped rubble mounds (lacking interior depression), and one surface depression without any fallen masonry. This last structure, found at 5AA110, is most likely a pit house of Pueblo II age such as the contemporary Type C ruins (Arboles Phase) reported by Roberts (1930) from the Stollsteimer Mesa just to the southwest of the Chimney Rock Mesa. All of these buildings are likely to have been occupied on a year-round basis in contrast to the more ephemeral campsite settlements.

Site Distribution

These sites are distributed along the flanks of two major canyon-like ravines which bisect the mesa tip with drainage flowing south to a confluence with the Stollsteimer Creek. The most prominent intermittent drainage, designated by us as Ravine 3, is flanked by 8 of the 15 sites, while 5 other sites are aligned along the axis of a minor ravine lying to the east of Ravine 3 (Fig. 4). Two other sites, 5AA119 and 125, occupy a ridge-like spur of the mesa which juts southward from the main mesa like a finger into the Stollsteimer Valley. This distribution does not seem to be accidental. The prehistoric peoples took up residence here for proximity to Stollsteimer Creek, the rich arable soils, and for the special plant-animal resources to be found within the two ravine canyons along which the sites were aligned. No pattern of segregation is discernible; the camps are randomly interspersed among the house structures.

To the south, the nearly vertical cliff hindered further spread of occupation sites. Similarly, there is an absence of sites to the north between the Stollsteimer Group and either the Chimney Rock Ravine Group or the High Mesa Group because of shallow soils and a large area of exposed bedrock from which the soils have been stripped by erosion. However, some meager use of this area is recorded by the scattered distribution of artifacts over the area of stripped bedrock. It is not known why the Stollsteimer community did not expand westward in the direction of isolated sites 5AA115 and 116, which seems to be favorable terrain for prehistoric occupation.

Site and Structure Density

The Stollsteimer Group of sites covers an area of approximately 0.13 square mile at a density of 115.3 sites per square mile. The definite architectural structures have a density of 69.2 per square mile, while the camps/workshops have a density of 46.1 per square mile. By comparison, the Stollsteimer site and structure densities are much higher than the thin dispersion of the East Slope Group, but in no way approach the very high structure density of the High Mesa Group.

Site Situations

A variety of mesa-top situations were occupied by sites of the Stollsteimer Group: knolls, 5; ridges, 3; mild slopes, 3; flats, 2; and rocky ledges (benches), 2. Six of these sites lie in the interior of the mesa, five others appear along the immediate edge of the two ravines, and four sites are on the edge of the mesa itself, overlooking the Stollsteimer Valley.

In elevation, the sites are distributed between 6,685 and 6,940 feet. There is no obvious correlation between elevation and site type; camps and residences are found evenly spaced throughout.

Arable Land

As previously discussed for the High Mesa Group, the shallow and rocky mesa top soils are not thought to have been extensively employed for dryland farming. Instead, it is likely that farmers, both local residents and seasonal farmers, used the alluvial lands for floodwater farming along Stollsteimer Creek. This resource, in fact, is probably a compelling reason for establishment of the community here.

Drainage and Available Water

As with other communities of the Chimney Rock, scarcity of water was certainly of paramount concern. The survey party did not report any springs or seeps within either Ravine 3 or its companion, but these two intermittent water courses were certainly used for water during the rare times of surface water flow. Of more permanent utility, however, is the proximity of Stollsteimer Creek from which water could have been hauled over a straightline distance between 0.1 and 0.6 miles. The short distance to haul water is likely to have been another important determinant in the founding of this community.

Vegetation

The vegetational diversity of the Stollsteimer Group area is considerable, and major associations of plants are closely juxtaposed to provide unusual opportunities for plant and animal exploitation. On the mesa top proper is a pinyon-juniper cover within which many of the sites are located (8 out of 15). Within the canyon ravines and to the northeast in the vicinity of 5AA110 are found growths of ponderosa pine and associates. Four other sites lie within the pinyon-juniper cover but near the ponderosa boundary so that resources of both vegetational types are immediately available. Three other sites also occur in the pinyon-juniper zone but so close are they to the southern edge of the mesa that the riparian plant associations found along Stollsteimer Creek were within close reach of their occupants.

Chimney Rock Ravine Group

Along the southern rim of the Chimney Rock Ravine is a group of eight sites termed the Ravine Group (Table 4). Five of these are architectural sites occupied by year-round residents; the three others are non-architectural temporary campsites. The Chimney Rock Ravine Group forms a linear distribution of sites running east-west, linking the High Mesa Site Group with the two Piedra River Groups. This distribution suggests that they may outline a communication route for upland to lowland commerce and social intercourse.

TABLE 4
Settlement Data of the Chimney Rock Ravine Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA97	T34N, R4W Sec. 19	P-II	P-J	Artifact refuse (not recorded): 1 refuse area.	Ridge, edge Chimney Rock Ravine.	7140′	Camp
5AA126	T34N, R4W Sec. 19	P-II	P-J/ Pond.	Multiple unit (20 × 20 m.): 2 crater-shaped mounds (1 probable Great Kiva with 11 m. interior diameter).	Ridge, edge Chimney Rock Ravine.	7100′	
5AA107	T34N, R4W Sec. 19	P-II	P-J	Multiple unit (18.3 × 68 m.): 5 crater-shaped mounds (3 mounds enclosed by rectangular masonry walled compound); 4 refuse areas.	Ridge, edge Chimney Rock Ravine.	7020′	Evidence of springs in ravines
5AA106	T34N, R4W Sec. 19	P-II	P-J/ Pond.	Single unit (8.8 × 8.8 m.): 1 crater-shaped mound; 1 refuse area.	Ridge, edge Ravine 2.	7020′	Evidence of springs in ravines
5AA123	T34N, R4W Sec. 19	P-II	Pond.	Artifact refuse (10.8 × 10.8 m.): scattered artifacts.	Base of hill.	6960′	Camp
5AA108	T34N, R4W Sec. 19	P-II	Pond.	Village (33.0 × 66.0 m.): 6 crater-shaped mounds (3 small plus one 11 m. diameter Great Kiva enclosed by rectangular compound; 2 other single structures); 1 workshop; 5 refuse areas.	Knoll on high terrace, edge of Ravine 2.	6920′	
5AA266	T34N, R4W Sec. 19	P-II	Pond.	Single unit (10 × 40 m.): 1 multiple room jacal structure; sparse artifacts scattered near structure.	High terrace.	6640′	Structure burned
5AA265	T34N, R4W Sec. 19	P-II early (?)	Pond.	Artifact refuse (35 × 40 m.): scattered artifacts.	High terrace.	6560′	Campsite, period identity not certain

Site Types

The three campsites consist of sparse concentrations of artifacts without any obvious architectural remains. The five architectural sites consist of two Single Units, two Multiple Units, and one Village site. These contain 14 crater-shaped mounds which indicate circular masonry rooms. Two of these have interior diameters of 30 feet or more and are therefore judged to be evidence of Great Kivas; one is located at 5AA108, the other at 5AA126. One of the Single Unit sites has a burned, jacal structure containing an unknown number of contiguous rooms. At two sites (5AA107, 108) are rectangular compound walls enclosing sets of house or kiva mounds. All of the architectural sites have one or more thin sheets of trash associated with rooms, and one site (5AA108) has a trash sheet comprised almost entirely of stone tools, identifying it entirely as a workshop.

Site Distributions

The Ravine Group forms the crossbar of an H whose verticals are comprised of sites distributed in two north-south parallel zones: one formed by those sites flanking the Piedra River and the second by those along the east rim of the mesa. The Ravine Group is bounded on the north by the main Chimney Rock Ravine and on the south by a lesser canyon ravine numbered 2 (Fig. 4). Both drainages head in the area of the High Mesa Group and flow intermittently to the west forming confluences with the Piedra River.

Within this distribution, sites of the Ravine Group are aligned linearly as dictated by the topography. Within the linear distribution, it can be seen that the camps lie around the periphery and the permanent domestic sites take up the central portion of the alignment. Large sites 5AA108 (Village) and 5AA126 (Multiple Unit), each of which contains an oversized crater mound thought to be a Great Kiva, probably served as the functional nucleus of the site community based on the thesis that the ceremonies held in these religious structures would have served a wider public than simply the resident members of that particular home site. In this sense, then, the Great Kivas served as social mechanisms for integrating the entire community (Beardsley et al 1956).

Site and Structure Density

Sites of the Ravine Group cover an area of about 0.1 square mile at a density of 80 per square mile. The 15 architectural structures have a density of 150 per square mile and the 3 campsites 30 per square mile. These figures are comparable to the other site communities characterized principally by permanent residences but contrast with the low site and structure densities of the East Slope Group.

Site Situations

Topography utilized for site situations includes the crest of ridges (four sites), the base of a hill (one site) and high Pleistocene terraces (three sites). One of these three, 5AA108, is located on a very high knoll carved from a Pleistocene terrace remnant. Four of the eight sites also lie immediately adjacent to one of the two ravines which flank the site group.

The elevational range of the Ravine Group extends from 6,560 feet to 7,120 feet. The lowest three sites occur on gravel-capped Pleistocene terraces which lie respectively 160 (third terrace level), 240 (fifth terrace level), and 520 (higher than fifth terrace level) feet above the Piedra River located to the west. The situation of sites on Pleistocene terraces has the advantage of a commanding view over the river floodplain, as well as providing a ready source of stone knapping material within the terrace gravels.

Arable Land

As already discussed, the thin, rocky soils of the mesa are little suited to primitive farming. In contrast, the deeper Pleistocene terrace soils around sites 5AA266 and 265 would have been very suitable for dryland agriculture. Further, the floodplain of the Piedra River would also have been a major farmland resource; perhaps these two field resources formed major factors in the decision to locate this community.

Drainage and Available Water

Both ravines had springs in areas immediately below 5AA106 and 107. Further, intermittent summer flash flood runoff in the ravines was probably used for water resources. The sites located near the Piedra River must have relied on this year-round water supply for domestic needs.

Vegetation

The four sites located at lower elevations are situated within stands of ponderosa pine. But particularly the terrace-located sites also have a significant understory of sage. Two other sites lie within pinyon-juniper cover but near the ponderosa zone while two others lie entirely within pinyon-juniper with no nearby pine forest. These distributions show a greater favoring of ponderosa tree cover than has been noted in the eastern site groups of the mesa. However, only pollen analysis of the subsurface archaeological deposits could positively determine if these same relationships also obtained during the prehistoric past.

Pyramid Mountain Group

On the extreme southwestern corner of the Chimney Rock Mesa is a high erosion remnant which towers some 250 feet above the sloping mesa surface (Table 5). This pinnacle-like feature was named Pyramid Mountain by the survey crew. Upon the peak of the pinnacle is a Village site, 5AA129, while farther down the spiny crest along the south side of the hill is a second, a Multiple Unit site, 5AA130. Together these two sites are described as a separate settlement unit since they are spatially segregated both from the terrace communities located to the north along the Piedra River and from the Pueblo II age sites described by Roberts (1930: Fig. 3) on Stollsteimer Mesa immediately to the south of Pyramid Mountain. The large size of these sites, numbering some 12 structures, seems ample justification for considering them a separate and distinct prehistoric community rather than isolated sites.

Site Types

The Village, 5AA129, is made up of seven crater-shaped mounds of which five are separate structures and two are oversized mounds (30-foot diameter) which appear to be enclosed within a large (36 × 63 feet) rectangular walled compound. Since there are four oversized mound structures on this site, it is thought to be a major ceremonial center for the surrounding communities. Six sheet trash areas adjoin the structures and continue down the slope of Pyramid Mountain.

Multiple Unit site 5AA130 consists of four depressions, which are probably pit houses, and a single rubble-strewn crater consisting of a depression within a mound. The interior dimensions of all five structures appear to be about 18 to 21 feet. The houses are arranged longitudinally along a relatively flat portion of the rocky ridge in two subsets: two pit houses and the crater-shaped mound in one group and two other pit houses in a second group about 213 feet away. Trash abuts three of these structures, forming sheets of artifactual debris which extend down the slopes of the ridge.

Site Distribution

The positions of the two sites are dictated by the limited level space upon which buildings could be constructed. Village 5AA129 is arranged on a northwest-southeast axis on the peak just behind a steep eroded face of Pyramid Mountain while 0.06 mile to the south is Multiple Unit 5AA130 on the spiny ridge crest which extends southward from the peak down to the general split-level surface of Stollsteimer Mesa.

Site and Structure Density

The two architectural sites comprising the Pyramid Mountain Group occupy a small area calculated at 0.005 square

TABLE 5
Settlement Data of the Pyramid Mountain Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA129	T34N, R4W Sec. 30	P-II	P-J	Village (20 × 103 m.): 7 crater-shaped mounds (5 separate units of which are two Great Kivas, and two are Great Kivas enclosed within a large masonry compound wall); 6 refuse areas.	Peak of erosion remnant 400 ft. above Piedra River.	7052′	
5AA130	T34N, R4W Sec. 30	P-II	P-J	Multiple unit (6 × 157 m.): 5 structures (4 pit house depressions, 1 crater-shaped mound); 5 refuse areas.	Ridge spine.	6890′	Just North of Stollsteimer Mesa

mile at a density of 400 per square mile. The extremely high density of this occupation is even more vividly portrayed by computing the density of the architectural structures: 2,400 units per square mile. Clearly these occupational units are the densest of any community on the Mesa, even the High Mesa Group.

Site Situations

Village site 5AA129 is situated at an elevation 7,052 feet. At this location the site towers impressively 690 feet above Stollsteimer Creek. One hundred sixty feet lower is Multiple Unit 5AA130, which still lies some 530 feet above the valley floor.

Arable Land

There is no land suitable for farming immediately around the sites since all of the terrain slopes steeply toward the valley floor. However, a short distance to the southeast is a large Pleistocene terrace just above the Piedra River, and this fertile land form could have been employed in dry farming. Or the inhabitants could have farmed the rich alluvial soils of either the Piedra River floodplain or the Stollsteimer Creek floodplain, but both of these would have required a considerable descent to reach the fields.

Drainage and Available Water

No springs or other suitable water sources were observed by the survey party and it is assumed that the Pyramid Mountain occupants must have had to send water carriers down to either the Piedra River or Stollsteimer Creek on a daily basis during the summer. Of course during the winter when snow was available, the situation would have been alleviated by the use of meltwater.

Vegetation

The mountain peak around 5AA129 is grass-covered with several pinyons, desert rose, mountain mahogany, and sage. The 45-degree mountain slope is densely clothed in Gambel's oak. The ridge spine running off to the southwest is covered with juniper, with occasional pinyon, Gambel's oak, spruce, and ponderosa pine. Thus plant and animal resources of both the pinyon-juniper and the scrub oak associations were immediately available for the prehistoric inhabitants, while riparian plants, including willows and grasses, were present along the perennial streams in the valley below.

Southern Piedra Group

Six architectural sites are present on Pleistocene terraces located along the Piedra River on the southwestern margin of the Chimney Rock Mesa (Table 6). One other site, a workshop, was found nearby on a slope above a ravine on the mesa surface proper. This set of sites is termed the Southern Piedra Group. It is distinctive for the presence of small masonry Pueblos and a large number of oversized depressions and crater-shaped mounds, some of which are thought to be Great Kivas. Occupation of the high terraces was apparently determined by (1) the presence of terrace cobbles suitable for stone knapping, (2) the commanding view of the river floodplain where floodwater farming may have been conducted, and (3) the possibility of dry farming on the terraces.

TABLE 6
Settlement Data of the Southern Piedra Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA127	T34N,R4W Sec. 19	?	Pond.	Artifact refuse (size unknown): pocket of scattered stone artifacts.	Slope, interior mesa.	6780′	Camp, workshop, edge of ravine.
5AA128	T34N,R4W Sec. 19	P-II	P-J/ Pond.	Multiple unit (50 × 100 m.): small pueblo (?) 6 × 13 m.; 2 depressions of 15 m. diameter (Great Kiva); 1 (?) mound structure; 1 refuse area of scattered artifacts.	2nd Pleist. terrace.	6645′	Overlook Site 131, Piedra Riv.
5AA131	T34N,R4W Sec. 19	P-II	P-J/ Pond.	Village (20 × 200 m.): 1 L-shaped pueblo (7 × 35 m.); 1 depression (10 m. diameter); 2 crater-shaped mounds (12 m. diam.); 1 circular structure (4 m. diam.); 2 refuse areas; 1 juvenile burial with two pottery vessels removed.	Pleistocene terrace.	6520′	Overlooks Piedra Riv.
5AA132	T34N,R4W Sec. 19	P-II	P-J/ Pond., sage	Village (30 × 100 m.): 1 single tier pueblo (four rooms 8 × 20 m.); 1 small (5 m. diam.) crater-shaped mound; 1 large (11 m. diam.) crater-shaped mound (Great Kiva).	Pleistocene terrace.	6530′	Overlooks Piedra Riv.
5AA235	T34N,R4W Sec. 19	P-II	P-J/ Pond., sage	Single unit (7 × 7 m.): 1 surface depression-pit house (6 m. diameter).	Pleistocene terrace.	6690′	Overlooks Piedra Riv., ravine.
5AA134	T34N,R4W Sec. 19	P-II	P-J/ Pond., sage	Multiple unit (9.3 × 9.3 m.): 2 crater-shaped mounds (11 and 15 m. diam.); 1 trash area.	Pleistocene terrace.	6650′	Overlooks Piedra Riv.
5AA133	T34N,R4W Sec. 19	P-II	P-J/ Pond., sage	Single unit (5 × 5 m.): 1 surface depression (pit house, 4 m. diam.); 1 trash area.	Pleistocene terrace.	6650′	Overlooks Piedra Riv., Ravine 2.

Site Types

The Southern Piedra Group contains six sites of permanent residence: 2 Single Unit, 2 Multiple Unit, and 2 Villages. The Single Unit sites are each marked by a surface depression without evidence of associated masonry mounds, presumably indicating domestic pit houses. One of the Multiple Unit sites, 5AA128, consists of a small pueblo with two nearby surface depressions with 45-foot diameters. The latter are thought to be evidence of Great Kivas. The other Multiple Unit site, 5AA134, has two oversized crater-shaped mounds, suggesting additional Great Kivas. Both Villages are marked by outcropping masonry walls, indicating single row pueblos. One of the structures constains an estimated four rooms while the other, measuring 21 × 105 feet, is composed of an unknown number of rooms arranged in an L-shaped pattern.

Since three of the depressions and five of the crater-shaped mounds have oversized interior diameters, these structures are interpreted as Great Kivas in line with the interpretation of the large buildings throughout the study district. However, eight Great Kivas within one prehistoric community, a figure which is half of the total number of structures, seems unreasonable. Probably a number of these buildings are actually domestic structures; an inference which leaves us in doubt as to the true ratio between ceremonial and domestic structures for this community.

Site 5AA131 produced a juvenile burial with two pottery vessels. This feature was located in a sheet trash deposit off to the southwest of the L-shaped pueblo building. It represents a member of that particular settlement since the pottery vessel offerings are of the same ceramic styles as the other sherd fragments found in the site. The vessels, a Mancos corrugated bowl and a white-slipped necked jar with twisted coil handle, were removed by the survey party for study in the laboratory but the skeleton was left in place.

Site Distributions

The six residential sites of the Southern Piedra Group are aligned in a north-south zone on two terrace levels paralleling the Piedra River. On the north they are separated from the Ravine Group sites by the very deep canyon called Ravine 2 (Fig. 4). To the east is the largely unoccupied upland topography of the Chimney Rock Mesa while Pyramid Mountain rises to the south.

Site and Structure Density

Sites of the Southern Piedra Group cover an area calculated to be 0.04 square mile in extent. Because of the limited amount of available level terrain suitable for building and farming purposes, the sites have a density of 175 per square mile. The 15 structures found on these sites appear in a density of 375 per square mile, a figure approaching the density of occupational units at the High Mesa Group but still distinctly lower than the extremely close packing of structures on Pyramid Mountain.

Site Situation

All of the residential sites are located on high Pleistocene terrace remnants at elevations ranging between 6,540 and 6,690 feet. The two villages appear on a third terrace between 120 and 130 feet above the modern river while the Single and Multiple Unit sites are situated on the fifth terrace bench approximately 100 feet higher. The fourth terrace defined along Devils Creek does not occur along the Piedra River.

The highest site is the workshop, 5AA127, located on a slope just above a small ravine of the mesa interior at an elevation of 6,780 feet.

Arable Land

The Southern Piedra Group is advantageously located for use of both the floodplain of the nearby Piedra River and the fertile terrace soils. Since the heaviest concentration of structures occurs at the village sites located on the third terrace, probably most of the dryland farming took place on the higher fifth terrace lying just south of Ravine 2.

Drainage and Available Water

Presumably water for drinking, cooking, and construction was never much of a problem for this community since a plentiful year-round supply was available in the river.

Vegetation

Six sites are found today in the pinyon-juniper association but always with some nearby ponderosa pine. One other site lies entirely within the ponderosa zone. In addition, the terrace sites have considerable shrub cover, particularly sage, Gambel Oak, and mountaim mahogany. Furthermore, along the river there is a riparian vegetation of cottonwood, willow, and rank grass.

Northern Piedra Group

The Northern Piedra Group is a cluster of 14 prehistoric sites containing 70 buildings forming a settlement comparable in size to the High Mesa Group, the two being the largest communities in the study district (Table 7). It is difficult to compare the two settlements since 21 buildings of the Northern Piedra Group are pueblos for which we have inadequate room counts, but I estimate that it actually housed more people than the High Mesa Group.

The reasons for the size, structural diversity, and location of the Northern Piedra Group obviously have to do with the plentiful farmland. The community was positioned on the high Pleistocene terraces immediately overlooking the Piedra River at a point fronting upon the confluence of the river and Devils Creek. This junction forms a large, broad alluvial flat which today is planted in alfalfa as well as being used as pasture. In the prehistoric past it would have been superb for primitive agriculture using floodwater techniques. This reach of the Piedra River and the mouth of Devils Creek are choked with sediment today, as expressed by the braided nature of the two water courses and it is this high water table which would have favored primitive floodwater farming.

Another farm resource is the land directly upon the fourth and fifth terraces which are very broad in the area of the Northern Piedra Group. Although we cannot directly demonstrate that dryland farming was practiced among the prehistoric houses, still it seems very reasonable to postulate that this available land was used agriculturally. By way of comparison, the Southern Piedra Group, which occupies an identical site situation, has many times fewer sites and buildings. In order to account for this difference, it seems reasonable to assume that the much greater farming potential supported many more people in the Northern Piedra community.

This group is also of interest because it is probably the

TABLE 7
Settlement Data of the Northern Piedra Group

Site	Location	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA236	T34N,R4W Sec. 18	P-II	Pond., P-J	Single unit (5× 5 m.): 1 surface depression (pit house).	Knoll on ridge.	6920′	
5AA237	T34N,R4W Sec. 18	P-II	Pond.	Artifact refuse (5 × 5 m.): scattered trash deposit.	Ridge edge of ravine.	6850′	Camp
5AA238	T34N,R4W Sec. 18	P-II	Pond., P-J	Artifact refuse (5 × 5 m.): scattered trash deposit.	Knoll on ridge.	6760′	Camp
5AA239	T34N,R4W Sec. 18	P-II	Pond., P-J	Single unit (5 × 5 m.): 1 crater-shaped mound.	Ridge on Pleistocene terrace.	6720′	Cobble construction.
5AA249	T34N,R4W Sec. 18	P-II	P-J/ Pond.	Multiple unit (15 × 170 m.); 3 over-size crater-shaped mounds (12, 12 and 15 m., Great Kivas); 1 crater-shaped mound.	Front edge of high Pleistocene terrace.	6680′	
5AA248	T34N,R4W Sec. 18	P-II	P-J/ Pond.	Village (18 × 18 m.): 1 rectangular pueblo (5 rooms, 4 × 26 m.); 1 small surface depression (kiva); 1 over-size surface depression (Great Kiva, 11 m.).	Front edge of Pleistocene terrace.	6620′	Cobble construction, overlooks CR Ravine.
5AA247	T34N,R4W Sec. 18	P-II	P-J/ Pond.	Village (66 × 66 m.): 1 large L-shaped pueblo (double tier, 10 × 50 m.); 1 masonry tower (5 m. diam.) attached to pueblo; 3 small rectangular pueblo rooms (5 x 10 m.); 1 large surface depression (15 m. diam.) enclosed by compound walls.	Front edge of Pleistocene terrace.	6620′	Cobble construction.
5AA240	T34N,R4W Sec. 18	P-II	Pond.	Single unit (5 × 5 m.): 1 crater-shaped mound.	High Pleist. terrace.	6840′	Cobble construct.
5AA241	T34N,R4W Sec. 18	P-II	Pond.	Village (51 × 126 m.): 2 small surface depressions (8 m. diam., pit houses); 2 over-size surface depressions (10, 13 m. diam., Great Kivas); 1 small crater-shaped mound (4 m. diam.); 1 over-size crater-shaped mound (11 m. diam., Great Kiva); 2 trash areas.	Edge of Pleistocene terrace.	6660′	1 trash area is 70 cm. deep; burned adobe.
5AA246	T34N,R4W Sec. 18	P-II	Pond., sage	Village (333 × 1000 m.): 7 pueblo units (3 L-shaped and 4 rectangular, 1 has 9 rooms); 11 depressions and mounds (2 are over-size, 11 and 23 m., Great Kivas); 2 trash areas.	Pleistocene terrace.	6620′	Extensive burning.
5AA243	T34N,R4W Sec. 18	P-II	Pond., sage	Village (23 × 40 m.): 1 L-shaped pueblo (15 × 23 m.); 1 small surface depression (pit house or kiva); 1 over-size depression (12 m. diam., enclosed within pueblo).	Edge of Pleistocene terrace.	6680′	
5AA244	T34N,R4W Sec. 18	P-II	Pond.	Multiple unit (15 × 15 m.): 1 small crater-shaped mound; 1 over-size crater shaped mound (10 m. diam., Great Kiva).	Pleistocene terrace.	6720′	
5AA242	T34N,R4W Sec. 18	P-II	P-J, sage	Village (20 × 71 m.): 1 large pueblo (4 × 20 m.); 1 surface depression (kiva, 8 m. diam.); 2 crater-shaped mounds; 2 trash areas.	Edge of Pleist. terrace.	6620′	Burned adobe.
5AA245	T34N,R4W Sec. 18	P-II	Pond., sage	Village (33 × 880 m.): 1 large L-shaped pueblo (contains 4 circular structures); 1 large rectangular pueblo: 5 small rectangular pueblos (1 contains a single circular structure); 16 circular rubble mounds and depressions (1 small mound, 8 small circular, 7 large circular with diameters between 10 and 15 m.); 1 trash area.	Front edge of Pleist. terrace.	6600′	Burned adobe, cobble construct. overlook juncture Devil Creek and Piedra River.

locale of some early excavations conducted by Jeancon (1922). These will be briefly summarized in the section to follow.

Site Types

Sites of the Northern Piedra Group consist of the following: 2 camps, 3 Single Unit sites, 2 Multiple Unit sites and 7

Villages. This distribution differs from that of most other communities in favoring village aggregates. These large sites are outstanding for their structural variability and the presence of sub-clusters of structures organized around the multi-room pueblo buildings. Twenty-one masonry buildings are identified as pueblos, 15 of which are rectangular (one and two rows of gridded rooms) and 6 of which are L-shaped. Many of the latter probably encompass plaza areas (to judge from contemporary Pueblo Indian society) where work, ceremonial, and play activities were conducted. Some of the pueblo buildings incorporate circular depressions thought to be kivas, and one structure, at 5AA247, contains a tower revealed by exposed walls.

In addition to the pueblo structures, there are a great number of circular buildings, either pit structures or surface masonry rooms. The presence of 13 surface depressions suggests that there are 6 small pit houses (or small kivas) and 7 Great Kivas. Ten other buildings are indicated by the presence of rubble-strewn crater-shaped mounds: seven are small structures thought to be domestic rooms and three are oversized. Another 26 single-room circular buildings are identified in the field notes only as depressions and mounds. Seventeen of these are small domestic rooms and nine are large rooms interpreted as Great Kivas. These figures give us 19 Great Kivas, or about one-third of all of the circular rooms (whether pit house depressions or crater-shaped masonry surface rooms). As with the Southern Piedra Group, this ratio of ceremonial to domestic architecture seems much too high and probably only a fraction of the 19 oversized structures actually served ceremonial needs. Without excavation to identify interior kiva features, however, our interpretations cannot be carried further.

Site Distributions

The Northern Piedra sites form a north-south zone of occupation which parallels the Piedra River along the left bank. It runs from the deeply cut Chimney Rock Ravine northward to an unnamed tributary canyon which bisects the terrace to join Devils Creek. At right angles to this distribution is a second alignment of sites (5AA247 to 5AA236) which extends up a ridge into the mesa interior. This secondary band of sites lies along the north flank of the Chimney Rock Ravine and appears to be organized for exploitation of both upland and canyon bottom resources.

Site and Structure Density

The area of the Northern Piedra Group covers 0.17 square mile. The 14 sites occur in a density of 82.3 per square mile, a spacing which is less dense but generally comparable to some of the other major residential settlements of the study district. The density of structures, however, which reaches a figure of 411.8 per square mile, is surpassed only by the structure density at Pyramid Mountain and in the High Mesa Group.

Site Situation

All but one of the residential sites are located on gravel-capped terrace remnants. Five of the largest sites, all Villages, are found on a fourth-level terrace situated between 200 and 220 feet above the river floodplain. Two other Villages and a Multiple Unit site occupy the next higher terrace at elevations of 260 and 280 feet above the river. A Single Unit site, a Multiple Unit site, and a camp lie on gravel bench remnants located higher than the fifth terrace level,

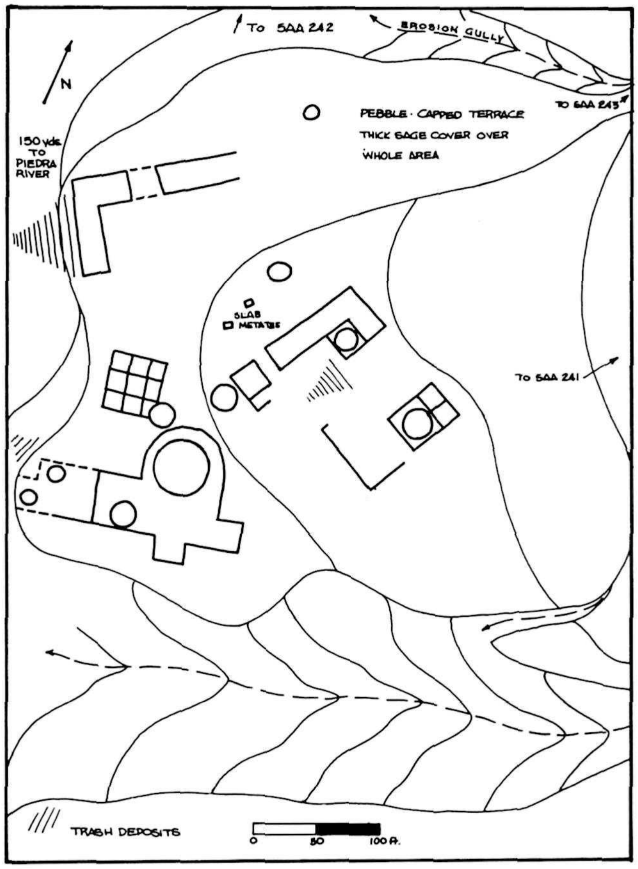


FIGURE 7. Sketch map (not to scale) of 5AA246 (Northern Piedra Group) illustrating an atypical incipient courtyard site plan.

around 6,720 and 6,760 feet elevation. In the interior of the mesa lie three final sites: two camps and a Single Unit pit house site. These site situations, ranging from 6,600 feet to 6,920 feet, provide an instructive transect showing the manner in which Village sites favor the broad, level terrain immediately overlooking the river while small camps and single residences are found in the higher, more rugged mesa interior. This topographic distribution provides a most convincing argument that the terrace terrain was favored for the control it provided in overseeing the floodplain agriculture. A second determinant for this gravel bench occupation lies in the use of the cobbles for manufacturing stone tools and for building stone, the use of cobbles in masonry architecture replacing construction by flat sandstone slabs which is prevalent in the upland site groupings.

Arable Land

The Piedra River occupies a deep narrow canyon with high but sloping sides. The land masses lying both to the east (the Chimney Rock Mesa) and west (ridge by Peterson Gulch) effectively block both the morning and afternoon sunlight. For this reason the effective daylight for corn agriculture is much less than on the broad and open Stollsteimer Valley. Further, the narrow, confining nature of the Piedra Valley leads to cold air drainage at night and in the early morning; a temperature factor which would retard the growth of crops throughout the spring and through the month of June. In contrast, the broad and open Stollsteimer Valley, although experiencing some cold air drainage from the highlands, does not hold its cool temperature because of the less confining nature of the terrain and the warming effect of the early morning sun.

For these reasons, the Piedra Valley offers the prehistoric farmer a reduced growing season but ample soil moisture for his summer crops. During a dry climatic interval, an agricultural population could be expected to exploit the Piedra Valley agricultural potential. On the other hand, the Stollsteimer Valley offers the advantages of an extended growing season (planting potential in early spring rather than late summer) but minimal soil moisture. To offset the naturally drier character of the east slope terrain, the prehistoric site locations suggest that farmers planted on outwash fans at the mouths of side ravines to capitalize on the early spring runoff from snow-derived meltwater. The Stollsteimer akchin farming would be most profitable during a cool climatic interval when the length of the growing season was the critical controlling determinant to a successful maize-bean crop.

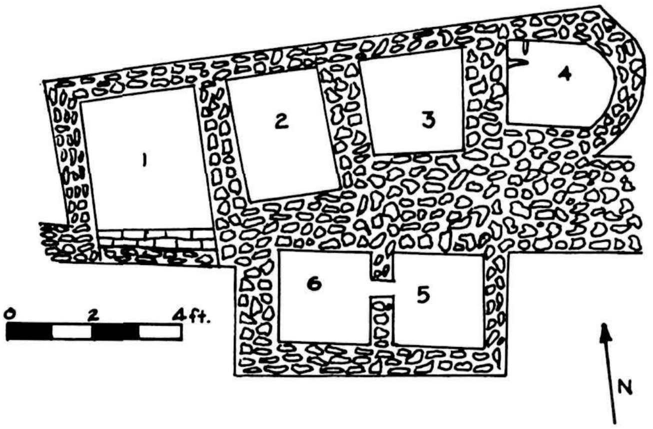


FIGURE 8. Ground plan of Site A or the Harlan Ranch pit house (5AA242). Reproduced from Jeancon (1922: Plate VI, lower).

Vegetation

The 14 sites of the Northern Piedra Group are distributed in the following vegetation associations: ponderosa pine (10 sites), pinyon-juniper at boundary of ponderosa pine (4 sites), and in pinyon-juniper alone (1 site). As a rule the tree cover is broken by understory shrubbery such as oak, mountain mahogany, and sage. Other plant resources are conveniently nearby, such as cottonwood and willow, which favor the wet floodplain along the river.

Early Excavations

During the summer field season of 1921, when not occupied with the excavation of the Chimney Rock Pueblo and other structures in the High Mesa Group, J. A. Jeancon directed some small excavations in several sites located on Pleistocene benches along the Piedra River (Jeancon 1922; Jeancon and Roberts 1923, 1924). Judging from a sketch map of their locations, these structures are part of the Northern Piedra Group (Jeancon and Roberts 1923: figure 2). Both appear to be representative of the Chimney Rock Phase and are of Pueblo II age. Site A or the Harlan Ranch pit house may well be part of 5AA242 while Site B, the Pargin Ranch Tower, looks like it is part of 5AA245. A brief summary is given below as a supplement to our site survey data.

The Harlan Ranch pit house or Site A is no pit house at all but a masonry pueblo containing six or more rectangular rooms (Jeancon 1922: bottom Plate VI). The rooms, aligned in two east-west rows, are constructed of cobblestones with some horizontally laid sandstone slabs all set in quantities of mud mortar (Fig. 8). This wall construction is erected upon a ground-level adobe foundation pad 10 to 12 inches thick. The walls were plastered with mud several inches thick, which at the time of excavation had been burnt thoroughly. No exterior doorways were found although one interior opening was present connecting Rooms 5 and 6. This doorway had an adobe lintel raised 10 inches above the floor surface. The entire structure was floored with sandstone mortared with adobe plaster. In addition, the southern rooms once had a second paved floor level as evidenced by a small remnant of flagstone. Room 1 had a burial with five smashed pottery bowls. This individual was a female, aged 35 to 40 years, found flexed in the southwest corner of the room. The vessels with the body had been smashed when the roof collapsed. Based on an examination of illustrations of the decorated vessels (Jeancon 1922: Plate XXII), the burial and, by association, the structure, are of Pueblo II age. Room 4 has a D-shaped outline with some sort of bin or interior construction in the northwest corner. Jeancon's (1922) text states that this is the only room in the structure containing a fireplace. Room 5 has two ladder holes in the floor, one of which contained a burned post. The holes were placed near the doorway to Room 6 and adjacent to the thick central wall. Room 6 contained "a lot of small pots and vessels of clay, more or less mingling with a large mass of charred corn" (Jeancon 1922:10).

The Pargin Ranch Tower, or Site B, is described as a circular structure built of adobe and cobblestone masonry. The structure has a 15-foot diameter and 3-foot thick walls which once stood an estimated 10 feet high (Jeancon 1922:8, 1923). The foundation of the building consisted of adobe mud, and the roof of cedar slabs, poles, and mud construction. This description sounds very much like the circular masonry structures excavated at 5AA86, 88, and 92 in the High Mesa Group. Because of the presence of an interior fireplace and various domestic artifacts, Jeancon concluded that it was not a kiva but a domicile. Outside of the structure, in what appears to be a trash area, Jeancon found many adult burials, most of which had been burned (1922:9).

ISOLATED SITES

Areas between the high density site groups occasionally yield evidence of campsites or small units of more permanent residential architecture (Table 8). These isolated sites occur in very low density relative to the total area surveyed and effectively point out how dense the community clusters are. Isolated sites are either temporary camps where members of the permanent communities seasonally stopped off to exploit some locally rich natural resource or they are the remains of more permanent, sedentary occupation by a single family. These latter are of interest in that they are homesteaders who were incipient founders of new communities. They were not obviously affiliated with any established community site group and maintained themselves in relative isolation.

Two of these sites, 5AA4 and 5AA8, were located by a 1969 site survey party working under contract from the Southern Ute tribe; the remainder were recovered through the U.S. Forest Service contracts of 1970 and 1971. Site 5AA8 lies completely outside the study district near the sharp rim of a hogback between Peterson Gulch and the Piedra River (Fig.

TABLE 8
Settlement Data of Isolated Sites

Site	Location	Community Proximity	Age	Veget. Assoc.	Site Type, Size and Features	Situation	Ele.	Remarks
5AA115	T34N, R4W Sec.19	Isolated between Stollsteimer Gp. and So. Piedra Gp.	P-I	P-J	Single unit (5 x 5 m.): 1 pit house depression (?); scattered trash.	Flats, mesa interior.	6930′	
5AA116	T34N, R4W Sec.19	Isolated between Stollsteimer Gp. and So. Piedra Gp.	P-II	Pond.	Single unit (5 x 5 m.): 1 crater-shaped mound.	Small knoll mesa interior.	6945′	
5AA98	T34N, R4W Sec.20	Isolated between High Mesa Gp. and Stollst. Gp.	P-II	P-J/ Pond.	Multiple unit (10 x 40 m.): 3 crater-shaped mounds; 1 large depression (Great Kiva?); 4 areas scattered trash; 2 possible (?) structures.	High rocky knoll.	7160′	
5AA99	T34N, R4W Sec.20	Isolated between High Mesa Gp. and Stoll. Gp.	P-II	P-J/ Pond.	Artifact refuse (10 x 10 m.): 2 ? structures; 4 trash areas.	Low knoll of mesa interior.	7050′	
5AA8	T34N, R4W Sec. 13	Hogback above right bank of Piedra R.	P-II	Pond.	Village (17 x 66 m.): 1 masonry pueblo; 1 surface depression (kiva), 1 surface depression (rock-lined); 2 surface depressions (pit houses).	Hogback just below rim.	6980′	Out of study district; 1969 survey
5AA240	T34N, R4W Sec. 18	Above No. Piedra Gp.	P-II (?)	Pond., P-J	Single unit (5 x 5 m.): 1 crater-shaped mound.	Ridge on edge of ravine, Pleist. ter.	6840′	Cobble construct; no pottery age uncertain.
5AA264	T34N, R4W Sec.17	Above No. Piedra Gp.	P-II	Pond., oak	Multiple unit (2 locations each 15 m. diam.): 1 surface depression (pit house); 1 crater-shaped mound; 2 trash areas, one with each structure.	Knoll on high Pleist. terrace.	6988′	Mound burned.
5AA4	T34N, R4W Sec.18	Above No. Piedra Gp.	P-I	Pond.	Multiple unit (10 x 10 m.): 1 low rubble mound; 1 surface depression.	Ridge	6860′	Burned sandstone; 1969 site survey.
5AA267	T34N, R4W Sec.17	Overlooks Devil Cr.	P-II	Pond., oak	Artifact refuse (3 x 3 m.): scattered stone and pottery artifacts.	Ridge on edge ravine.	6760′	Campsite
5AA103	T34N, R4W Sec.7	Overlooks Devil Cr.	P-II	Pond., oak	Artifact refuse (7 x 7 m.): scattered stone and pottery artifacts.	Pleist. terrace.	6720′	Campsite assoc. with 104 and 105.
5AA104	T34N, R4W Sec.7	Overlooks Devil Cr.	P-II	Pond., oak	Artifact refuse (15 x 15 m.): scattered stone and pottery artifacts.	Front edge of Pleist. terrace.	6720′	Camp
5AA271	T34N, R4W Sec.8	Overlooks Devil Cr.	P-II	Pond., Meadows	Single unit (25 x 30 m.): 1 surface depression (pit house); 1 ? sandstone surface structure; 1 trash area.	Pleist. terrace.	6580′	
5AA268	T34N, R4W Sec.8	Overlooks Devil Cr.	P-II (?)	Shrub/ oak	Artifact refuse (10 x 17 m.): scattered artifacts.	Knoll on ridge.	6980′	Camp
5AA269	T34N, R4W Sec.17	Directly under Companion Chimney, NW side.	P-II	Oak, shrub	Single unit (8 x 9 m.): 1 crater-shaped mound; 1 trash area.	Saddle on narrow ridge.	7330′	Located NE of 5AA83.
5AA262	T34N, R4W Sec.9	NE of CR overlooks Devil Cr. and Stoll. Val.	P-II	Shrub, oak	Single unit(?) (4 x 4 m.): 1 ? crater-shaped mound; 1 trash area.	Knoll on ridge.	7280′	Burned sandstone.
5AA270	T34N, R4W Sec.9	Overlooks Devil Cr.	P-II (?)	Pond., oak	Single unit (2 x 2 m.): 1 concentration of burned adobe (jacal structure); 1 trash area.	Ridge.	6800′	Burned clay daub.
5AA263	T34N, R4W Sec.15	Overlooks Stoll. Val. between Rav. 11 and 12	P-II (?)	Shrub oak, Pond.	Single unit (2 x 5 m.): 1 burned adobe concentration (jacal struc.); 1 trash area.	Knoll on ridge.	6880′	Burned clay daub.

4). This site has not been included when calculating density figures for the isolated sites within the study district.

Site Types

Eighteen sites are isolated from the main site clusters. Six of these are campsites, while the other 12 are remains of permanent residents: Single Unit, 8 sites; Multiple Unit, 3; and Village, 1. These architectural sites have surface manifestations including depressions (11 structures), burned jacal (2 structures), crater-shaped mounds (5 structures), and masonry pueblo (1 structure with walls exposed). The surface depressions are principally pit houses (9 examples) although the survey party interpreted one depression as a small kiva (5AA8) and another as a Great Kiva. This Great Kiva structure is on a Multiple Unit site (5AA98) located between the High Mesa and Stollsteimer Groups near the east rim of the Chimney Rock Mesa. It may well be that this site was not isolated in the same sense as the other sites of this category, but instead served to integrate the members of the High Mesa Group (who had only two Great Kivas at 5AA88) with the residents of the Stollsteimer Group who lacked any Great Kiva organization.

Site Distribution

Isolated sites are found principally in the high, rugged country above the Northern Piedra Group, and above Devils Creek (Fig. 4). Most of this irregular distribution can be accounted for by the broken nature of the terrain which offers few level building sites and minimal land suitable for agriculture.

Site and Structure Density

The total area surveyed within the Chimney Rock District comprises an estimated 6.12 square miles of which 1.11 square miles are taken up by high density site clusters. The relatively unoccupied intervening area of 5.01 square miles is the land occupied by the scattered sites here termed isolated. Seventeen of these sites (excluding Village 5AA8 located on the Peterson hogback) occur in a density of 3.4 per square mile, a very low density indeed compared to the formal site groups. Again, the 14 definite structures found on isolated sites within the study district yield a density of 2.8 per square mile; a figure which is about one percent of the site group densities. Despite the high proportion of campsites relative to the architectural sites, their density is still extremely low at only 1.2 per square mile; a figure which is around 10 percent of the density of non-architectural sites found in formally organized communities.

Site Situations

Almost half (8 out of 18) of the isolated sites are found on ridges in the interior of the mesa; often on very narrow spines overlooking ravines on either side. A similar situation is the position of 5AA8 which is located on the sloping side of a hogback just below the rim. Other isolated sites are found on knolls of the mesa interior (3 sites), on flats (1 site), and on high terraces (5 sites). These range in elevation from a Single Unit pit house site on a terrace along Devils Creek at 6,580 feet to a crater-shaped mound at 7,330 feet located on a ridge just under Companion Chimney.

Arable Land

Since many of the camps and small Single Unit homesteads are located on terraces and ridges flanking the left bank of Devils Creek, it seems reasonable to suppose that these people were farming the small floodplain area of that tributary valley. However, unlike the perennial Piedra River, Devils Creek is mostly dry after early July except during the occasional cloudburst storms. For this reason it would not be as dependable for floodwater farming as the Piedra River; a factor which undoubtedly helps account for the scarcity and small sizes of sites. Again, Devils Creek is sufficiently narrow to trap cold air drainage and its northern exposure would further limit the growing season for maize and bean agriculture.

Those isolated sites that are situated at higher elevations on ridges well back from the creek do not have any obvious farmland. For this reason, it is thought that the occupants of such upland isolated sites must have depended a great deal on wild plants and animal foods or else that they regularly moved to camps along the main floodplains during the summer months.

Drainage and Available Water

Low elevation sites near Devils Creek could have been supplied with potable water for most months of the year; in fact, even in the dry months of July and August there are usually some stagnant pools along the creek. But the occupants of upland sites well back from the creek would have the same water-hauling problem that members of the High Mesa Group did, arduous treks to the creek during the summer.

Vegetation

Many of the isolated sites (11 of 18) are found in ponderosa pine cover which is often broken as parkland with oak understory. Three sites were found in predominantly oak shrub cover and one site in non-oak shrubbery. Two sites occur in pinyon-juniper plant cover with nearby ponderosa while one other is in pure pinyon-juniper. This distribution represents the highest proportion of ponderosa and the only occurrences of pure scrub oak cover. Particularly the presence of oak on the northwest talus slopes of the Chimney Rock Mesa would have yielded a large crop of edible acorns and offered a large deer and elk population for hunters who occupied lands without a high agricultural potential.

Summary of Settlement Data

The preceding discussion has reviewed the settlement data of the Chimney Rock District in terms of seven named aggregates or clusters of prehistoric sites which form significant localities of prehistoric occupation. Due to the close spacing of the sites and architectural structures, it is thought that these site groupings are the settlement reflection of eleventh-century communities. Each site group community, then, is distinctive in its architectural composition and location on the landscape although all members did practice a basically similar cultural pattern termed the Chimney Rock Phase. Taken together, the seven named site groups account for 74 sites of prehistoric occupation or about 81.3 percent of the total recorded. In addition, there were 18 sites in isolated positions with no obvious spatial affiliation with any community cluster; 17 of these appear within the study district and one, 5AA8, was recorded on the right bank of the Piedra

River high upon a hogback ridge. Such permanent isolated sites are thought to reflect homesteaders who were actively colonizing new terrain. Other isolated sites show no surface evidence of architectural remains and are therefore interpreted as temporary campsites probably occupied by farmers and/or hunters who seasonally dispersed from the formal communities to exploit special natural resources such as floodplain soils for agriculture, wild game, or plants.

Camp and/or Workshops

Twenty-seven non-architectural sites are here classified as camps and/or stone workshops. Seven of these appear on the east slope of the Chimney Rock Mesa talus where they occupy ridges flanking an intermittent drainage ravine (Ravine 5). This location close to the floodplains of both the ravine and the outwash margin of Stollsteimer Valley is thought to indicate that the camps were occupied during the summer by transient farmers of the High Mesa Group for agricultural purposes.

Other camps which seem to be located for seasonal farming are a group of six mixed among the permanent Single Unit sites of the Stollsteimer Group as well as six isolated campsites, most of which appear along the rugged pine-covered terrain flanking the left bank of Devils Creek.

Architectural Sites

Sixty-five prehistoric sites reveal evidence of stone masonry and permanent structures, domestic architecture as well as ceremonial buildings (Table 9). The largest number of sites per site group is found in the High Mesa Group with 14 sites. The distribution of architectural site types, which include 75 individual buildings, is skewed toward larger sites, with 4 Multiple Units and 7 Villages (Table 9). Other communities have small site types.

In terms of structural types, the three communities located along the eastern rim of Chimney Rock Mesa show a preponderance of circular masonry surface structures while the Piedra River communities are outstanding for the number of rectangular and L-shaped multi-room pueblos as well as the relatively high proportion of oversize circular structures interpreted as Great Kivas. Of the 217 permanent buildings recorded within the study district, the bulk are located in the High Mesa Group (75 structures) and in the Northern Piedra Group (70 structures). These largest structural aggregates, one being the highest and the other near the bottomland, represent the most complexly organized communities with the largest populations of the district.

TABLE 9
Numbers of Architectural Site Types by Site Group

Site Group	Single Unit	Multiple Unit	Village	Total
High Mesa	3	4	7	14
East Slope	3	2	-	5
Stollsteimer	8	1	-	9
Ravine	2	2	1	5
Pyramid Mtn.	-	1	1	2
Southern Piedra	2	2	2	6
Northern Piedra	3	2	7	12
Isolated	8	3	1	12
TOTALS	29	17	19	65
AVERAGE	3.6	2.1	2.4	

Site and Structure Density

As a means of quantitatively describing the settlement spacing, density computations were calculated for the seven communities, the isolated sites, and the study district as a whole (Table 10). The site survey covered intensively 6.12 square miles, most of which were within the portion of the San Juan National Forest designated as the Chimney Rock Archaeological Area (district). Along the National Forest boundaries, however, the survey party sometimes moved into non-National-Forest land to complete some natural unit such as a ridge or valley. Of this surveyed area, about 1.11 square miles had been intensively occupied in prehistoric times in the named site groups. Here, sites were found in densities of tens and hundreds of units per square mile. However, the terrain between the seven named communities comprising 5.01 square miles was suprisingly sparsely occupied: a few isolated sites in densities of only 3.4 per square mile. As a comparative baseline to appreciate the extremely uneven nature of the site density over the landscape, the average density of sites for the entire study district was computed at 14.9 per square mile. From this figure it can be seen that the density of sites between communities is far under average while the packing of community sites is very dense, reaching a peak of 400 per square mile on Pyramid Mountain.

The figures for the architectural structures are even more dramatic. Using the district-wide average of 35.6 structures per square mile, the Site Groups reached a density peak of 2,400 per square mile (again on Pyramid Mountain) compared with a low among the isolated sites of 2.8 per square mile. As might be expected, the camp/workshop sites showed much less variability. From an average density of 4.4 for the whole district, the isolated sites dropped to 1.2 per square mile, while camps associated with formal Site Groups rose only as high as 46.2 per square mile (Table 10).

Site Situation

The nature of the terrain has a direct influence on the location of sites and the number that can be clustered together. The largest communities were built on the most extensive areas of level ground: the High Mesa Group and the two Piedra groups. The former occupies a gently sloping section of the mesa interior while the latter communities are on high Pleistocene terraces flanking the left bank of the Piedra River.

Small sites appear, in contrast, in the more rugged and broken terrain, especially on long, narrow ridges. Other isolated sites or single structures within larger communities are perched on knolls and other eminences for the drainage and view that they afford. As a rule, the more broken the terrain, the lower the site and structure density; the more level and broad the ground, the more dense and larger the sites.

Figure 9 shows the vertical distribution of sites and structures by elevation above mean sea level. Basically there are two patterns evident in these data, upland versus lowland occupation. The High Mesa Group, ranging in altitude from 7,200 to 7,600 feet, rises some 600 to 1,000 feet above the bottomland. In contrast, the other six Site Groups largely overlap in their elevational spread, lying at lower elevations between 6,520 and 7,200 feet. Even so, the lowest sites are on high terraces 100 or more feet above the floodplain. Isolated sites span the entire range of the six lower site groups but just overlap the lower end of the High Mesa distribution.

TABLE 10
Site and Structure Data for the Chimney Rock Survey

Site Group	Area*	No. Sites	Site Density	No. Structures	Structure Density	No. Camps/ Workshops	Camp/Workshop Density
High Mesa	0.16	16	100.0	75	468.8	2	12.5
East Slope	0.50	12	24.0	7	14.0	7	14.0
Stollsteimer	0.13	15	115.4	9	69.2	6	46.2
Ravine	0.10	8	80.0	15	150.0	3	30.0
Pyramid Mtn.	0.005	2	400.0	12	2400.0	0	0.0
So. Piedra	0.04	7	175.0	15	375.0	1	25.0
No. Piedra	0.17	14	82.4	70	411.8	2	11.8
Isolated Sites	5.01	17 (+1)	3.4	14(+5)	2.8	6	1.2
TOTAL SITES (ave. density)	6.12	91(+1)	14.9	217	35.6	27	4.4

(+) = records of 5AA8 which are not included in the density calculations.
* all area computed in square miles.

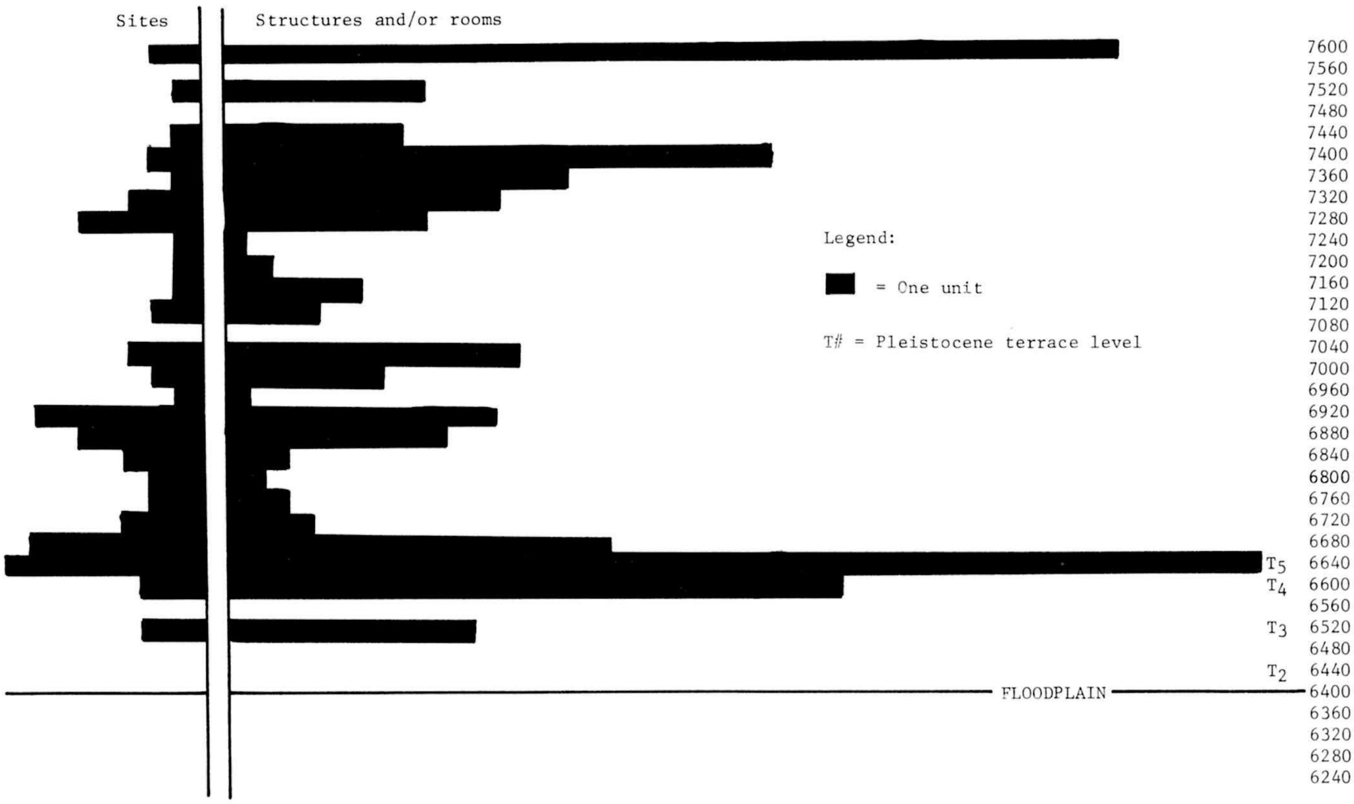


FIGURE 9. Distribution of sites and structures plotted against elevation, Chimney Rock Mesa.

Arable Land

Given the size and nature of the floodplain farmlands, one can fairly accurately account for the size and density of the nearby prehistoric site groups. The largest and most varied site clusters are the Northern Piedra Group and the High Mesa Group. The former is closely associated with the ample floodplain found at the junction of Devils Creek and the Piedra River, while the latter is tied to the ravine fans and broad western margin of the Stollsteimer Valley.

On the other hand, the low density of isolated sites along Devil's Creek is related to the narrow floodplain of that drainage. Again, the small size of sites making up the Stollsteimer Group is related to the more narrow reach of Stollsteimer Valley which lies directly south of that community.

Drainage and Available Water

A community-by-community review of the water supply indicates that springs and seeps played a minimal role in supporting the prehistoric inhabitants. The only really dependable water supply seems to have been the permanent watercourses in the valley bottoms. Thus the upland occupants must have made long daily treks during the summer to haul water for drinking and cooking. Melted snow probably answered the needs during at least some parts of the winter. The large quantities of water needed for mud mortar for construction must certainly have been acquired from snowpack, and thus masonry construction was probably a late fall and very early spring activity.

Vegetation

Correlation of the modern vegetation cover with the distribution of prehistoric sites shows changing patterns over the district. The dense and extensive prehistoric communities distributed along the eastern margin of the mesa are predominantly located within pinyon and juniper association although they are often at the edge of ravines which contain ponderosa pine and its associates. This vegetation pattern existed in prehistoric times, according to pollen studies at 5AA86 and 92, thereby supplying the resources of two plant associations. On the western side of the study district the natural ecology shifts to a plant cover more dominated by ponderosa pine although sage and mixed shrubs are often important understory. The riparian willow and cottonwood cover along the Piedra River provided further important nearby natural plant resources. However, unlike for the High Mesa Group area, we presently have no fossil pollen evidence that ponderosa pine existed along the Piedra River in prehistoric times.

In summary, these distributional patterns generally reflect vegetational settings in which one major plant association is favored but often with a second and sometimes a third plant association nearby. The prehistoric occupants apparently chose locations with the widest possible variety of plant resources readily available: the plant-association boundaries. Of course it is the modern, not the ancient, vegetation which we are observing. In order to prove that such boundary situations were indeed favored in prehistoric times, it would be necessary to conduct a massive pollen study with data from many prehistoric ruins across the mesa.

PORTABLE ARTIFACTS

Due to the vagaries of preservation, only two artifact industries are consistently preserved on the surface of prehistoric sites at Chimney Rock: broken ceramic vessels and stone tools. These specimens were collected from the surface of each prehistoric site, bagged, and returned to the archaeological laboratory in Boulder for detailed study. The following is an account of these investigations as they relate to the activities of the prehistoric peoples.

Surface Ceramics

Broken fragments of pottery are the most common artifacts to be found on prehistoric sites of the Chimney Rock District. The study of these specimens can generate a variety of inferences concerning prehistoric human behavior. For instance vessel shapes are indicative of function. The distributional variation of the different vessel classes sheds light on the changing needs of peoples located at different places on the landscape. And finally, the different decorative styles and manufacturing techniques reflect their age.

Functional Classes of Vessels

Three vessel-shape classes can be recognized among the potsherd fragments: wide-mouthed jars, narrow-necked jars, and bowls. These will be briefly described and interpreted below.

Wide-Mouthed Jars: Generally, but not invariably, sherds showing exterior indented coils (corrugations) are fragments of wide-mouthed jars. The vessel walls show a slight bulge at the shoulder, a slight incurve of the upper body, and a wide, open mouth. The vessel base is curved to flat. Specimens obtained by excavation often have a soot-covered exterior indicative of use in direct flame cooking.

Narrow-Necked Jars: Most plain gray vessels have large, globular bodies and high, narrow necks. The exterior surface is smoothed but usually neither polished nor painted. Their size and shape indicate they are containers for transport and storage of water. The narrow necks are well suited to pouring and covering. Even if left open, the narrow, restricted orifice would appreciably cut down on spillage compared to wide-mouthed jars or open bowls.

Painted Bowls: Most painted vessels are open bowl forms with smoothed, polished, white-slipped, and sometimes painted exteriors and interiors. Vessel walls and base are curved. Based on their shape, small size, and painted decorations, it is inferred that they were employed in food service.

Water Transport: When the problem of water supply for settlements was considered elsewhere (*see* Description of Site Groups), it was postulated that only the perennially flowing surface drainages could have dependably supplied drinking water. Therefore, the upland sites located from 0.5 to 1.0 mile away would have had a major problem in hauling water for domestic uses. From this postulate, an hypothesis was deduced that the frequency of water jars (plain gray necked jars) would be inversely proportional to the straight-line distance from a site to the nearest running stream. Roughly the same relation should hold with regard to vertical elevation. To test these hypothetical predictions, six sites with large pottery surface collections were selected according to their straight-line distance to the nearest permanent water source. These were ranked by distance, which ranges from 1.2 to 0.2 miles, on Figure 10. Next the frequency of the different functional vessel classes were computed by each site, with percentage of water jars contrasted to the combined percentages of cooking (corrugated) and serving (painted) vessels. Inspection of the two graphs shows the general trend of declining frequencies of water jars as the streams are approached and the elevation diminishes. Thus our hypothesis based on settlement location and available water resources is upheld when tested with the frequency distributions of vessel shapes.

Ceramic Styles and Dating

In order to study prehistoric settlements and community organization, it is necessary to differentiate between contemporary and sequential occupations. The most common means in the American Southwest is through dating of surface-collected pottery. This procedure rests on the assumption that the styles of ceramics found on the surface of a site are chronologically associated with the fixed architectural remains. Later we will deal with other kinds of chronological information, such as stratigraphy and dendrochronology.

Table 11 shows the principal ceramic types collected from the surface of the Chimney Rock sites. These are organized according to the stages of the Pecos classification. The table indicates that 94.5 percent of all of the ceramics are of Pueblo II age. Further, only a small percent (1.2) of unslipped black-on-white pottery is affiliated with the Pueblo I stage, and an equally small proportion (0.9) is of Pueblo III age. To refine this ceramic dating somewhat, it is argued that the Chimney Rock Phase extends back to about A.D. 925 since the two most abundant Pueblo I types, Piedra and Bancos Black-on-white, have life histories lasting not much later than A.D. 950. An upper limit is placed on the Chimney Rock occupation by the dominance of Mancos Black-on-white which is most abundant between A.D. 1075 and 1125 (Breternitz 1966:85). Further, the predominant Pueblo III decorated types, McElmo and Mesa Verde Black-on-white, do not appear in the survey collections at all and are very rare among the excavated samples. Since the McElmo type is dated as early as A.D. 1090 by tree-rings, its general absence will not allow us to push the end date of the Chimney Rock

TABLE 11
Frequency list of indigenous pottery types of the Chimney Rock Phase. Percentages taken from the site survey collections.

	Percentage	Sherd Counts
Pueblo I types: 1.26%		
Piedra B/w	0.9	33
Bancos B/w	0.3	12
Pueblo II types: 94.9%		
Mancos B/w (+ Arboles variety)	2.4	90
Cortez B/w	1.9	69
Wetherill B/w	0.1	2
Mancos Corrugated	44.7	1660
Payan Corrugated	4.3	159
Plain Gray	41.5	1541
Pueblo III type: 0.8%		
Mesa Verde Corrugated	0.9	32
Mixed Types:		
Mesa Verde white ware (all white slipped but undecorated)	3.1	116
Trade pottery types derived from outside of the District*	0.1	4
TOTAL	100.1%	3718

*-Gallup B/w-2 sherds from 5AA108
- La Plata B/r- 2 sherds from 5AA128

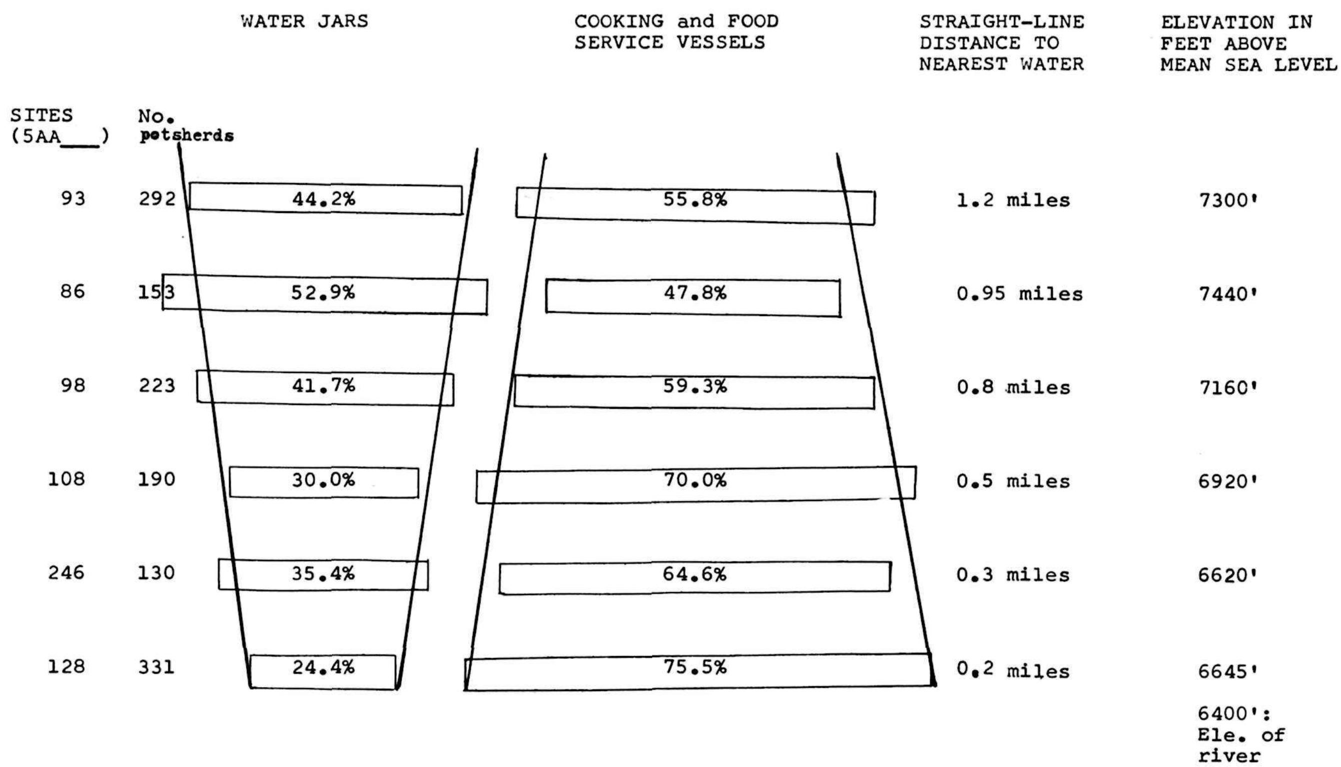


FIGURE 10. Frequency trends of vessel shape classes by distance from nearest potable water source.

Phase much beyond A.D. 1125 (Breternitz 1966:84). This argument is generally supported by the tree-ring derived dating of Mesa Verde Black-on-white which Breternitz (1966:85) gives as most reliable between A.D. 1030 and 1284 (Fig. 11).

This reasoning, which is based on the histories of Mesa Verde ceramic types, is supported by the few pieces of trade pottery found on site survey. One trade type, Gallup Black-on-white, is assigned a span of A.D. 1000 to 1125 in its home area at Chaco Canyon although it is dated as late as A.D. 1200 as a trade item (Breternitz 1966:76). La Plata Black-on-red, a second trade type identified in the survey, is dated as a trade ware between A.D. 850 and 900 (Breternitz 1966:81). Thus the Gallup decorated sherds verify the final date of the Chimney Rock occupation and the La Plata type supports the initial date.

This entire chronological problem can be solved when we consider the excavated ceramic samples with much tighter provenience control. The type frequencies are more meaningful and the list of cross-datable trade ceramics is much more complete. (See Excavations at the Chimney Rock Pueblo, 5AA83, Room 8 excavations.)

Surface Stone Tools

Artifacts of stone cover two classes of specimens: finished implements and the by-products of manufacture. Finished implements, according to their general functional classes, will be considered first, followed by the manufacturing debris.

Finished Implements

A total of 255 stone tools were collected from the surface. These are organized into four functional classes: (1) manufacturing tools (28.70 percent), (2) projectile points (10.6 percent), (3) processing tools (21.6 percent), and (4) milling tools (39.20 percent) (Table 12). Many of these items are of such a generalized nature that they cannot be related to a single activity but in fact were probably used for a variety of technical operations. For instance stone hammers could have been employed for knapping stone tools, pecking sandstone slabs into milling tools, smashing bones to extract marrow, and shaping bone tools.

On the other hand, such tools as projectile points were chipped specifically to tip arrow shafts for hunting medium and large animals. To judge from the relatively large proportion of such artifacts, hunting was an important activity at Chimney Rock, an inference amply supported by the recovery of much animal bone in excavated trash areas.

Milling tools, of which the companion mano and metate are in the majority, are food processing tools specifically designed to pulverize seeds, nuts, and maize. The widespread occurrence of these grinding tools on many residential sites is a direct function of the fact that the women spent some time every day milling maize.

Manufacturing Debris

Although individual counts by site were not made in the laboratory, nearly every site collection yielded quantities of waste stone flakes as well as cores. Both classes of artifacts

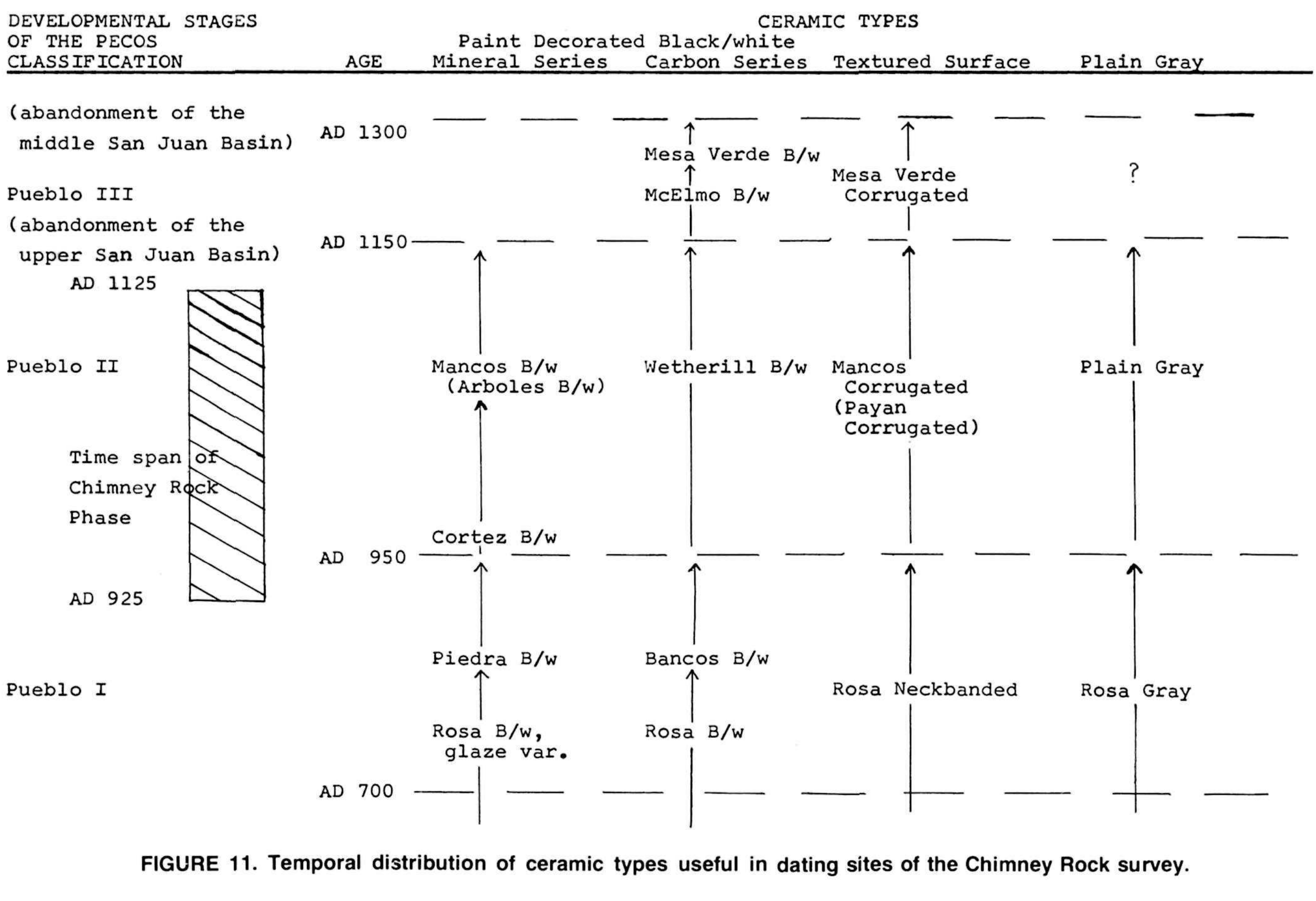


FIGURE 11. Temporal distribution of ceramic types useful in dating sites of the Chimney Rock survey.

TABLE 12
Frequency list of stone tools of the Chimney Rock Phase. Percentage taken from the site survey collections.

Functional Classes of Tools	Percentage	Tool Counts
Tools used in the manufacture of other tools: 28.70%		
Hammers	20.4	52
Drills	2.0	5
Gravers	0.4	1
Abraders	3.1	8
Polishing stones	2.8	7
Hunting tools: 10.6%		
Projectile (arrow) points	10.6	27
Tools used in processing materials: 21.6%		
Scrapers	16.9	43
Utilized flakes (scrapers and knives)	0.8	2
Knife blades (bifaces)	3.1	8
Mauls	0.8	2
Milling tools: 39.20%		
Manos	27.8	71
Metates	10.2	26
Mortars	1.2	3
TOTAL TOOLS	100.1%	255

are discarded by-products of stone tool manufacture. Flakes of a suitable size and shape were then further fashioned into tools while those unsuitable for additional shaping were simply discarded. The water-rounded appearance of the unmodified cortex of many cores and flakes indicates that most of the flaking material was collected either from ancient Pleistocene gravels which cap the terraces along the Piedra River or from the gravel beds of the perennial streams. The significant finding of the survey collections is that these river cobbles were usually transported to the site of permanent residence before stone knapping was begun. In a few cases, of course, the non-architectural sites identified in the field as workshop locations were places of stone tool manufacture. Since nearly every site had some quantities of discarded knapping debris, it seems reasonable to infer that every man was capable of fashioning his own implements and no one specialized in this activity to the exclusion of other daily pursuits.

SOCIAL ORGANIZATION INFERENCES

Traditionally archaeologists of the Southwest interpret the social and religious facets of prehistoric data by reference to the contemporary practices of modern Pueblo Indians who inhabit portions of northeastern Arizona and the Rio Grande Valley of New Mexico. Instead, I plan to examine here the internal structure of the prehistoric settlements as a means of reconstructing the ancient social organization. This approach is based on the proposition that the layout of houses, buildings, sites, site groups, and regional settlement distributions are a physical reflection of the social units formerly in residence (Trigger 1968). Further, patterning in this architecture will be expressed as a structural hierarchy of units made up of the individual domestic room and its combinations into larger settlement groupings. Patterning in human relations, on the other hand, is expressed with the nuclear family as the building block from which larger social units are constructed (Schusky 1965; Service 1962). In order to read social organization out of settlement data, then, one must seek parallels by comparing the structural arrangement of architecture against the general organization of primitive kinship systems, a logical procedure suggested by Clarke (1968: 362-365). An attempt at such a structural analysis employing the internal settlement evidence from Chimney Rock is outlined on Table 13 (Eddy 1974).

Single Room Residences

Separate domestic residences consist of circular surface rooms, rectangular surface rooms, and subsurface pit house rooms. That these buildings can be considered minimal units of settlement is demonstrated by the way they factor out of large settlement aggregates by appearing as isolated Single Units of occupation. It follows then, that many large sites which we now observe as staggered linear strings of spaced rooms were initiated by a single founding family and subsequently grew as the population expanded or new colonizers arrived.

It is proposed that the occupants of single domestic structures were related: probably a household composed of father, mother, and children to form a nuclear family of three to five people. It seems highly unlikely that single structures would have been occupied by an unmarried male or female since unmarried adults rarely reside alone in tribal society; it requires both a male and female to perform the minimal economic functions of acquiring and maintaining food, clothing, and shelter.

Multi-Room Residential Buildings

By simply doubling or tripling single room structures, a multi-room building can be created, examples of which are masonry lobate structures and jacal buildings of several contiguous rooms. Architectural studies of the room abutments at 5AA86 or 5AA92 show that just this process took place. At Mound 3 in both sites, the architectural stratigraphy indicates that a multi-room building was founded with one circular living room having attached storage structure. Subsequently, more circular rooms were abutted to the first, which then became the nucleus of a radial ground plan. At Site 92, the storage rooms were torn down and a new and enlarged row of rectangular structures was erected. Something quite similar happened at 5AA86, where the earlier storage room was filled in with trash and the floor raised with new milling bins and storage cists installed.

That such multi-room buildings are independent units is demonstrated by the appearance of this architectural type as isolated Multiple Unit sites. It is proposed here that they were inhabited by an extended family of three generations. This kinship unit was composed of several nuclear families, each of which inhabited a single living room. The founding occupants of the nuclear room were undoubtedly the original parents. As their children married partners from other households, new living quarters were constructed by abutting rooms directly to those of the founding parents. The new marriages in turn produced a third generation. More members of the family required increased agricultural production, which required enlarged storage facilities. But at the same time, the work force was expanded, leading to greater productive capacity.

TABLE 13
Chart showing the nature of social integration, social groupings, and their settlement expression at Chimney Rock Mesa.

Nature of Social Integration	Level of Social Grouping	Level of Settlement Expression
Self-identity or group image	Tribe	District-wide settlement
The neighborhood - solidarity derived by neighbors sharing a locality and inter-lineage marriage exchange	Community	Named Site Groups (cluster)
Ritual solidarity derived through shared ceremonial observances	Multi-lineage residential group	Village-size sites (1) gridded Pueblo with kivas (2) six or more buildings with a Great Kiva association.
Kinship bonding through conjugal (descent) and affinal (marriage) relations	Localized lineage	Multi-Unit Site (2-5 buildings)
Economic cooperation and generational ties	Extended family	Multiple room buildings generated from a single nucleus.
Marriage bonds	Biological (nuclear) Family	Single room residence.

Multiple Unit Sites

Large sites of either a big gridded pueblo or Village of many-roomed structures could have housed a lineage composed of several related extended families. Ethnographically, lineages are made up of the founders of a number of extended families all of which have descended from a common ancestor, the lineage founder.

Great Kivas

Individual circular structures with diameters of 35 feet or more, whether indicated by surface depressions or crater-shaped mounds of rubble, are interpreted as evidence of Great Kivas because of their size and shape; this conclusion is born out by excavation in Mound 17 at 5AA88. Thirty-six of these oversized buildings occur in five of the seven Site Groups excepting only the East Slope and Stollsteimer communities. There is a strong tendency for these structures to be affiliated with the larger sites. For instance, of the 17 sites displaying the large kivas, 11 are Villages and the remaining 6 are Multiple Unit sites. In contrast, no Single Unit site has a Great Kiva and none appear by themselves without associated architecture ($x^2 = 21.5$, which is highly significant, $p > .001$). The only isolated site to display a Great Kiva is Multiple Unit Site 5AA98, and this location lies between the High Mesa and Stollsteimer site groups where it may have served to integrate the two communities.

These Great Kivas probably served as a center or focus for the social and religious activities of the entire community, and the organization to carry out the community-wide ceremonies probably cross-cut the individual lineages. By this means the larger community was integrated in a manner not provided for by the descent system. Thus, it was at the religious level that the entire village derived its principal solidarity.

Named Site Groups:

Spatial clusters or aggregates of sites, here termed Site Groups, are inferred to be the residue of a prehistoric community. Named Site Groups of this nature form sets of from 2 to 16 sites composed of a variety of residential architecture. There is considerable variation, ranging from 7 to 75, in the number of architectural structures per site group. Since some of these buildings are many-roomed pueblos, particularly in the Northern Piedra Group, the actual numbers of rooms is considerably higher in some cases.

From these large settlement units, I infer the presence of two or more lineages. At this level of social complexity, inner-group cohesiveness was probably obtained by reciprocal exchange of marriage partners between lineages so that the member lineages were integrated by a network of affinal lines. Through this kinship integration, the various lineage members could cooperate in social and economic activities.

The District-Wide Settlement

At a final level of settlement hierarchy, we can consider the entire spread of Chimney Rock Phase sites: all seven prehistoric communities as well as the sites which are isolated from the site groups. Since this total settlement spread is generally thought to represent an unique and quite isolated Pueblo II occupation practicing the same basic cultural pattern, albeit with community-specific idiosyncracies, it is reasonable to refer to the totality as a single tribe. It is likely that some intermarriage took place between communities and at least in the case of two of them (High Mesa and Stollsteimer) they seem to have been integrated by religious means. Further, that social and economic intercourse took place between the eastern and western communities is suggested by the linear distribution of the Ravine Group sites which trace out an actual travel and communication route connecting the upland and lowland settlements.

Basic Social Units

Social organization of any society can be constructed a number of ways depending upon the different kinds of social glue employed to integrate people for the various tasks necessary to their maintenance. Much has been made of the role of kinship bonds, both consanguineal and affinal, as a means of organizing the nuclear family and lineage and clan extensions. But other equally valid forms of group integration are known, including sodalities or voluntary groupings resulting from economic cooperation (work groups) and shared ritual observances (ceremonial groups). Equally important in human organization are neighborhood groupings formed from local proximity and identity bonds engendered from mutual sharing of the same cultural behavior.

Conclusions

I have merged the two kinds of structural hierarchies at Chimney Rock beginning with the basic and minimal residential unit and continuing through the more complexly organized levels (Table 13). Single rooms with domestic furnishings have been equated with the nuclear family as the most probable residents. Multi-room buildings are interpreted as the residence of an extended family while sites composed of several closely associated buildings are inferred to be the home of a single localized lineage. Village sites are interpreted as the residences of multi-lineage groups, with solidarity achieved by shared ceremonial observances in a Great Kiva. The site group or localized cluster of many different-sized sites is thought to have been integrated through its neighborhood identity as well as by ritual means in the village Great Kiva. And finally, the district-wide dispersal of all sites is thought to represent a tribal organization based on the shared cultural pattern, the Chimney Rock Phase.

HUMAN POPULATION SIZE

Estimates of human population size have been made using structure-room counts and two family-size constants. By these means, the prehistoric population of the Chimney Rock District is placed somewhere between 1,215 and 2,025 people or a density of 198.5 to 330.0 persons per square mile.

In order to compute the number of architectural structures that could have been lived in, counts were made on the total number of residential units. Furthermore, since the pueblo buildings are known to be many-roomed, it was necessary to make additional room-count estimates for these structures. Unfortunately, in most cases the survey party could not see actual cross-walls and therefore field observations are usually given in terms of size of the pueblo mound. In a few instances, however, room outlines were visible from which an estimate of the room size could be obtained. Using this rough estimate, the number of rooms was calculated from the size (length and width) of the other mounds. By this means, the room estimate figures given on Table 14 were determined. Within the district, we recorded 26 pueblo buildings containing an estimated 219 rooms. The room count was then added to that of all other structures (minus the number of pueblo buildings) and a total of 405 structures and rooms obtained (Table 14).

To convert structure-room counts to actual numbers of people, two constant family sizes were assumed: one of three persons and the second of five persons. Using the lower average figure we obtain an estimate of 1,215 people while the higher figure yields 2,025 for the Chimney Rock population. These figures do not take into account the fact that some of the structures may have been kivas or have been used primarily for storage of goods, factors which make the population estimates too large. On the other hand, the surface inventory of structures certainly underrepresents the actual number of domestic buildings and rooms. Probably the population figures are too low; but they do provide some gross estimate of the number of people making up the prehistoric Chimney Rock tribe.

Inspection of Table 15 also provides some idea of the variation in the number of people residing in the different site group communities. The largest community, the Northern Piedra Group, contained between 624 and 1,040 people while the smallest, the East Slope Group, had between 21 and 35.

Another noticeable difference is between the upland communities located along the eastern rim of the mesa (estimated population between 354 and 585 persons) and those living on the high terraces near the lowlands by the Piedra River (estimated population between 705 and 1,175 persons). The population of the two Piedra groups appears to have been nearly double that of the upland communities. This difference can be explained in terms of the greater agricultural potential of floodwater farming along the Piedra River compared to the farming potential of the Stollsteimer Valley.

LAND USE PRACTICES

The third kind of interpretive conclusion which I had hoped to draw from an investigation of the site survey data is that of land use. This expectation was originally suggested by the statement of Jeancon (1922:11) that many of the draws and gullies, including the main Chimney Rock Ravine, were dammed prehistorically with stone walls to create what he called waterworks, that is, small catchment basins and reservoirs to impound surface runoff. With this in mind, our site survey party watched carefully for all evidence of such prehistoric land use as reservoirs, soil check dams, agricultural fields, and any other evidences of resource exploitation. However, we were not able to verify Jeancon's observations and, although documented elsewhere in the Southwest (Woodbury 1961), we noted no signs of such developments at Chimney Rock.

The possible field locations, therefore, can only be inferred on the basis of the distribution of different kinds of arable soils, the known kinds of prehistoric farming techniques, and proximity to the different named site groups. On the basis of these inferences, I suggest that the lower-elevation communities located on the Pleistocene terraces fronting the Piedra River practiced floodwater farming along the river itself, as well as dry farming on the terraces immediately around their villages. Furthermore, the Stollsteimer Site Group, located on the southern portion of the mesa top, likely practiced floodwater farming on the alluvial land just below the community.

The High Mesa Group presents the greatest interpretive problem. Since these sites are so high above the bottomland, one wonders where their fields were located. Since the soil immediately around and among these sites is so shallow and rocky, I concluded that upland dry farming must have been at a minimum. In order to support the 300 to 500 people who occupied this community, I believe at least farmers must have journeyed down to the large outwash flats at the base of the mesa along the west side of the Stollsteimer Valley. Here is an ideal location for akchin farming using outwash waters from the many ravines which drain the upper slopes of the mesa (Hack 1942). Supporting this contention is the finding of a number of temporary campsites (lower East Slope Group) on the tips of ridges flanking the ravines. These non-architectural sites may well have been the field-side camps occupied during the summer season by High Mesa

TABLE 14
Room Estimates in Pueblo Buildings: Northern and Southern Piedra Groups

Site Number	Room Count By Survey Party	Size Bldg. (meters)	Estimated Room Size	Estimated Number of Rooms	Number Of Pueblo Bldgs.	Remarks
5AA248	5	4 x 26 m.	4 x 5 m.	5	1	
5AA247	—	10 x 50 m.	5 x 5 m.	24	4	2 tiers
	—	5 x 10 m.	—	2	—	
	—	5 x 10 m.	—	2	—	
	—	5 x 10 m.	—	2	—	
5AA246	9	not given	unknown	9	7	
	—	10 x 86 m.	—	34	—	L-shaped 2 tiers
	—	11 x 15 m.	—	6	—	2 tiers
	2	6 x 6 m.	—	2	—	
	—	5 x 36 m. 5 x 15 m.	—	9	—	L-shaped
	—	12 x 12 m.	—	5	—	
	—	6 x 25 m. 8 x 25 m.	—	9	—	L-shaped
5AA243	—	8 x 23 m. 8 x 15 m.	—	8	1	L-shaped
5AA242	—	4 x 20 m. (plus)	—	4+	1	greater length by unknown amount
5AA245	—	4 x 15 m.	—	3	7	
	5	Small one room structure, size not given		5	—	
	—	10 x 30 m. 12 x 34 m.	—	30	—	2 tiers
5AA128	—	6 x 13 m.	—	3	1	
5AA131	—	7 x 35 m. 5 x 7 m.	—	8	1	L-shaped
5AA132	4	8 x 20 m.	5 x 8 m.	4	1	room count given by survey party.
9 sites				174 rooms	24 pueblos	

TABLE 15

Human Population Estimates Based on Structure-room Counts and Standard Family Sizes (3 and 5 persons)

Site Group	Number Structures	Number of Pueblo Bldgs.	No. of Ground Floor Rooms in Pueblos	Total Structures Plus Rooms*	Population Estimate 3 pers.	Population Estimate 5 pers.
High Mesa	75	1	35	109	327	545
East Slope	7	—	—	7	21	35
Stollsteimer	9	—	—	9	27	45
Ravine	15	—	—	15	45	75
Pyramid Mtn.	12	—	—	12	36	60
So. Piedra	15	3	15	27	81	135
No. Piedra	70	21	159	208	624	1040
Isolated Sites	19	1	?	18	54	90
TOTALS	222	26	209	405	1215	2025

*— Total structures plus pueblo rooms is derived by subtracting the number of pueblo buildings from the total number of structures and adding on the room estimate for the pueblo buildings.

Group farmers, who tilled the land just in and at the mouths of the intermittently flowing ravines using spring runoff waters to wet their fields.

Potable water, in the form of lingering snow banks, was handy to upland sites only during the winter. During the summer the few upland seeps seem completely inadequate to have supported the water needs of the indicated population. In order to test the hypothesis that the prehistoric inhabitants of the mesa top carried drinking water to their homes on a daily basis, I predicted that the frequency of narrow mouthed, plain gray water jars (ollas) would be greater in sites at higher elevations and at greater distances from the perennial streams than in sites at lower elevations and near the Piedra River. When the data were plotted, the hypothesis was accepted since the frequency of water jars decreased systematically from the mesa top, where they appear in frequencies of 44.2 percent, to the Piedra River, where the frequency is 24.4 percent (Fig. 10).

As an indication of the kinds and quantities of inorganic resources, I turned to an analysis of the on-site artifact materials. Table 16 provides an outline of these resources, their uses, and the probable source locations. Use of organic resources is discussed elsewhere under headings "Studies of Prehistoric Vegetation" and "Studies of Prehistoric Wildlife."

TABLE 16
List of local inorganic resources exploited, their uses, and source locations.

Materials	Uses	Source Locations
1. Cobbles	1. Building stone for terrace-located sites only.	1. Modern river and Pleistocene terraces.
	1. Knapping materials for flaked and chipped stone tools.	1. Modern river and Pleistocene terraces.
2. Sandstone slabs	2. Building stone for masonry houses.	2. Pictured cliff formation mesa-top cap rock.
	2. Grinding tools such as metates and manos.	2. Pictured cliff formation mesa-top cap rock.
3. Reddish-brown Residual soil	3. Mud mortar for masonry wall construction.	3. Mesa-top.
	3. Interior wall plaster.	3. Mesa-top.
	3. Daub on frame constructed rooms.	3. Mesa-top.
	3. Daub on frame roofing.	3. Mesa-top.
	3. Vessel plugs and ritual objects.	3. Mesa-top.
4. Gray clay	4. Manufacture of pottery vessels.	4. Lewis shale formation, talus slopes.
	4. Floor plaster.	4. Lewis shale formation, talus slopes.

III. Excavations

EXCAVATIONS AT THE CHIMNEY ROCK PUEBLO, 5AA83

Purpose of Work

A large Chaco-style pueblo building is located on the upper mesa some 1,000 feet above the surrounding valley floor (Fig. 12). The immediate contract requirement justifying excavations at the Chimney Rock Pueblo was to clear a room and test a kiva in preparation for wall stabilization and eventual ruins display. But beyond this immediate pragmatic problem was the desire to investigate a site which by its masonry styling, room characteristics, and building layout appeared to be completely foreign to the great mass of other ruins architecture described by the site survey information. Similarities of architecture at 5AA83 and in Chaco Canyon, about 93 miles to the southwest, strongly suggest cultural affiliations between the two. In fact, these cultural similarities are so pronounced that these affinities have been explained as the result of a Chaco colony migrating into the Chimney Rock District and the High Mesa community (Peckham in Ford, Schroeder, and Peckham 1972:35). If this is the case it would be of considerable interest to know what the social composition of this colony was, what circumstances led the Chaco natives to move to Chimney Rock, how the colony was received by the local peoples when it arrived, and what the role of this colony was at Chimney Rock.

Another archaeological research problem I hoped to solve through excavation at 5AA83 involved the recovery of data for dating purposes. Fifty years ago when the basic excavations were conducted here, Southwestern archaeology had no standardized ceramic taxonomy nor did it have available dendrochronology as a technique of precise dating of artifacts. For this reason, our excavations were instigated to recover a sample of pottery suitable for both taxonomic classification and dating by style analysis (*see* Ceramic Styles and Dating). Further, we hoped to recover some charred roof beams which would allow dendro-dating of the building construction as well as the ceramic types found in these same rooms. Both of these goals were realized and we now have a collection of Pueblo II pottery which is well dated to the late 1000s by dendrochronology. This tight association in turn allows us to project these dendro-dates to other contemporary sites at Chimney Rock from which we have no precise bark cutting dates but which do have an identical ceramic complex.

History of Investigations

The first excavations conducted at the Chimney Rock Pueblo were carried out during the summer of 1921 by an expedition jointly sponsored by the State Historical and Natural History Society of Colorado and the University of Denver under the direction of Jean Allard Jeancon (1922). Digging at 5AA83 completely cleared five living rooms (Rooms 6, 9, 10, 11, and 12) and partially excavated two others (Room 3 and a room then labeled Number 34). In addition, the Large Kiva (later renamed the East Kiva) was cleared of about 80 percent of its interior fill as well as the dead spaces in the rectangle surrounding this structure. Six other small unnumbered rooms believed to have been used for storage were also cleared just outside of the kiva complex. These storage compartments have been labeled Rooms 38 to 43 in this report.

The following summer, the State Historical Society again sponsored research at the Chimney Rock Pueblo under the overall leadership of J.A. Jeancon, although the records show that the actual field supervision was in the hands of Frank H. H. Roberts, Jr., a student returnee from the 1921 field season. The 1922 excavations of Roberts (Jeancon and Roberts 1924:115-171) completely cleared five large rectangular rooms (Rooms 31 through 35) as well as the West Kiva (renamed by direction after its original Jeancon designation of Small Kiva was found to be inappropriate) and the dead spaces surrounding it (two of these areas were labeled 1-A and 2-A [1924: Figure 7]). No part of these excavations was backfilled and the ruin stood open to weathering and vandalism for 50 years.

Nothing more was done here until 1970 when the United States Forest Service contracted with the University of Colorado to make such excavations as were necessary to prepare the ruin for stabilization. The actual rebuilding, which was designed to strengthen the walls and put the structure back into a shape approximately as Jeancon and Roberts found it, was carried out by a crew of skilled Navajo Indian masons under the direction of Jack Fitzgerald of the Forest Service. This work was begun in 1970 soon after the archaeological crew went into the field.

The University of Colorado excavations were conducted in two locations: Room 8, a previously unexcavated rectangular room, and in a small block of previously unexcavated fill left on the north side of the East Kiva by Jeancon. In both cases we were looking for floor artifacts and charred timbers suitable for tree-ring dating, and in addition, we had in mind certain stratigraphic and roof construction problems unresolved by Jeancon's work in the East Kiva. Work was conducted on these two operations for part of the summer field seasons in both 1970 and 1971. In addition, excavations were conducted in 1971 outside of the building to the south and east of the East Kiva in order to examine the nature of outdoor work areas in these two locations. A very cursory test was also made into the trash deposit associated with the ruin and located at the base of the cliff along the north side of the upper mesa.

Setting

The Chimney Rock Pueblo occupies a high (7,600 feet elevation) triangular-shaped rock platform (the upper mesa) southwest of the two pinnacles called the Chimneys (Fig. 2). In turn, this small mesa or butte is connected to the main and lower mesa by a spine-like ridge called the causeway. At the head of the causeway is a single structure named the Guard House (5AA84) by Jeancon (1922:13-14) as well as site 5AA85 which extends along the lower portion of the causeway. No ruins lie between the Chimney Rock Pueblo and the Chimney pinnacles, although a single structure (5AA269) lies off to the northeast on a talus slope ridge just under Companion Chimney (Fig. 12).

The terrain immediately around the Chimney Rock Pueblo is extremely precipitous with a short cliff dropping off to a long and very steep gradient talus slope. On the south this slope is bare and eroded, while the north-facing gradient is covered with oak shrubbery and ponderosa-fir woods. The vegetation cover of the site is mostly grass with some scattered shrubbery (Schmoll 1932:32-34).

Slabs for building construction are immediately available in parts of the Pictured Cliff sandstone, which is the underlying bedrock and forms the cliff of the upper mesa. Mud for masonry mortar was obtained both from the gray Lewis Shale making up the talus slopes and from soil weathered from the Pictured Cliff formation. Surprisingly, our excavations revealed that the walls, both interior and exterior, had all been footed directly upon the sandstone bedrock without use of footing trenches. This observation indicates that the upper mesa was a bare, inhospitable rock platform devoid of soil or vegetation when the first members of the Chaco colony ascended to this summit. Therefore, every scrap of the literally tons of rock and soil seen there today was carried up in order to erect the large pueblo building.

Description of the Site

Before initial excavation, the ruin was an elongate, L-shaped rubble mound containing a gridded masonry building measured by Jeancon (1922:14) as 209 feet long and 70 feet wide at the widest point. He describes the depth of the mound by saying that the deepest room excavated was about 14 feet. Jeancon estimated that 35 ground floor rooms were present, although some of the cleared quarters gave evidence of a second story. The main gridded body of the ruin was found to contain eight rows of rooms while the narrower eastern extension has only three (Fig. 12).

On the southern side of the building are two Chaco-style kivas incorporated within the rectangular room block: one labeled the East Kiva (Large Kiva) and the other the West Kiva (Small Kiva). Both are set within a quadrangle of straight walls so that dead spaces were filled by the prehistoric occupants to the level of the kiva roofs, thereby forming one-story-high courts within the body of the building. A single row of small storage compartments borders the East Kiva on the south and east sides.

In 1971, our test excavations outside of the building south and east of the East Kiva produced evidence of a southern plaza and a smaller elevated court on the east within the two arms of the L-shaped building. A retaining wall in Excavation Units 6 and 7 subdivides the two courts.

All along the top of the talus slope under the northern cliff is a sheet of prehistoric trash. Jeancon (1922:29) reported finding a large mass of calcined human bones within this trash area, which he interpreted as resulting from cremation of the dead.

Room 8 Excavations

Excavations in Room 8 were designed to study the stratigraphy of the interior fill and recover the specimens found on the floor. In order to accomplish these ends, the structure was dug in quarters, first the northeast quadrant followed in order by the southwest, northeast, and finally the southeast. The initial work in the northwest quadrant was carried out in arbitrary 0.5 foot levels measured below local Datum A positioned within the wall intersection of Rooms 8, 9, 11,

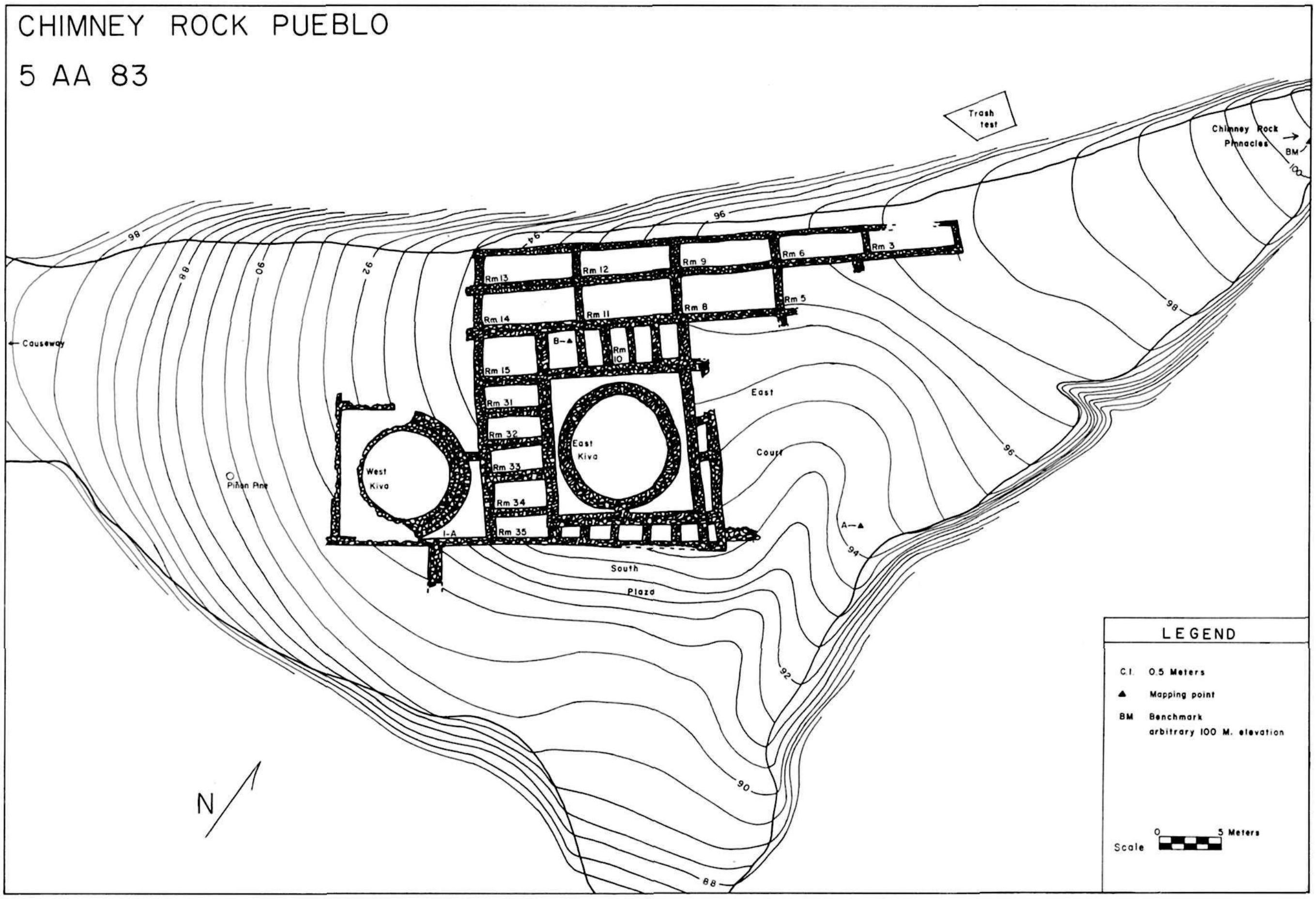


FIGURE 12. Map showing upper mesa and plan of exposed portions of the Chimney Rock Pueblo, 5AA83.

and 12. The results of this work revealed 5.10 feet of collapsed wall underlain by 10 inches of intensely burned roof fall, two floors, 10 inches of intentionally laid fill, and finally sandstone bedrock. Since the wall fall deposits in the first quarter yielded very little in the way of cultural artifacts, we excavated by deposits for the remaining three quarters. Specimens were recorded horizontally by triangulation to local Datum A plus a second metal pin designated Datum B. Depth measurements were taken below Datum A.

In the southwest quadrant we removed the wall fall deposits in the reverse order from which they had fallen into the room in an effort to reconstruct the manner in which the upper walls had collapsed. From this study we learned that the slab rubble had fallen into the room differentially, forming several separate piles of rubble in the southwestern corner of the room and opposite the doorway connecting Room 8 and Room 9.

As each quadrant was cleared to the floor, profiles were recorded; by this means we eventually compiled four profile sections which could be matched to form two composites, which run at right angles across the room interior (Fig. 13).

The layout of Room 8, as well as the entire gridded room layout of the building, is actually northeast by southwest. However, for ease of designation, the structure was arbitrarily treated as if it were on an east-west axis with the doorway facing north. Only by noting this fiction will the quarter-section designations of northwest, northeast, southwest, and southeast make sense as a convention to refer to horizontal distribution of floor contact specimens.

The excavations of Room 8 are important because of the association between artifacts found on the floor and in the fallen roof, which had 41 datable tree-ring specimens (Fig. 14). Because of the very thick overburden of fallen wall masonry, the dated artifacts can be thought of as a discrete sealed deposit providing a firm comparative sample suitable for dating other less securely controlled artifacts such as the surface collections obtained from site survey. The materials deposited upon the upper floor of Room 8 represent tools and equipment which were in use right at the time the room was destroyed by fire. As such, they reflect the artifacts actually in use at a single moment rather than discarded specimens gradually accumulated over centuries.

Room 8 is connected to Room 9 by a doorway. Evidence in the form of massive wall fall as well as a large, shaped hatch cover indicates that there was a second floor room probably connected to Room 8 by an interior ladder and roof hatchway located in the northwest room quadrant.

Wall Construction

After being cleared, the walls of Room 8 were still standing to a maximum height of 6.75 feet along the east side. To judge from the large quantity of fallen masonry slabs filling the room, the remaining walls were at least twice that height

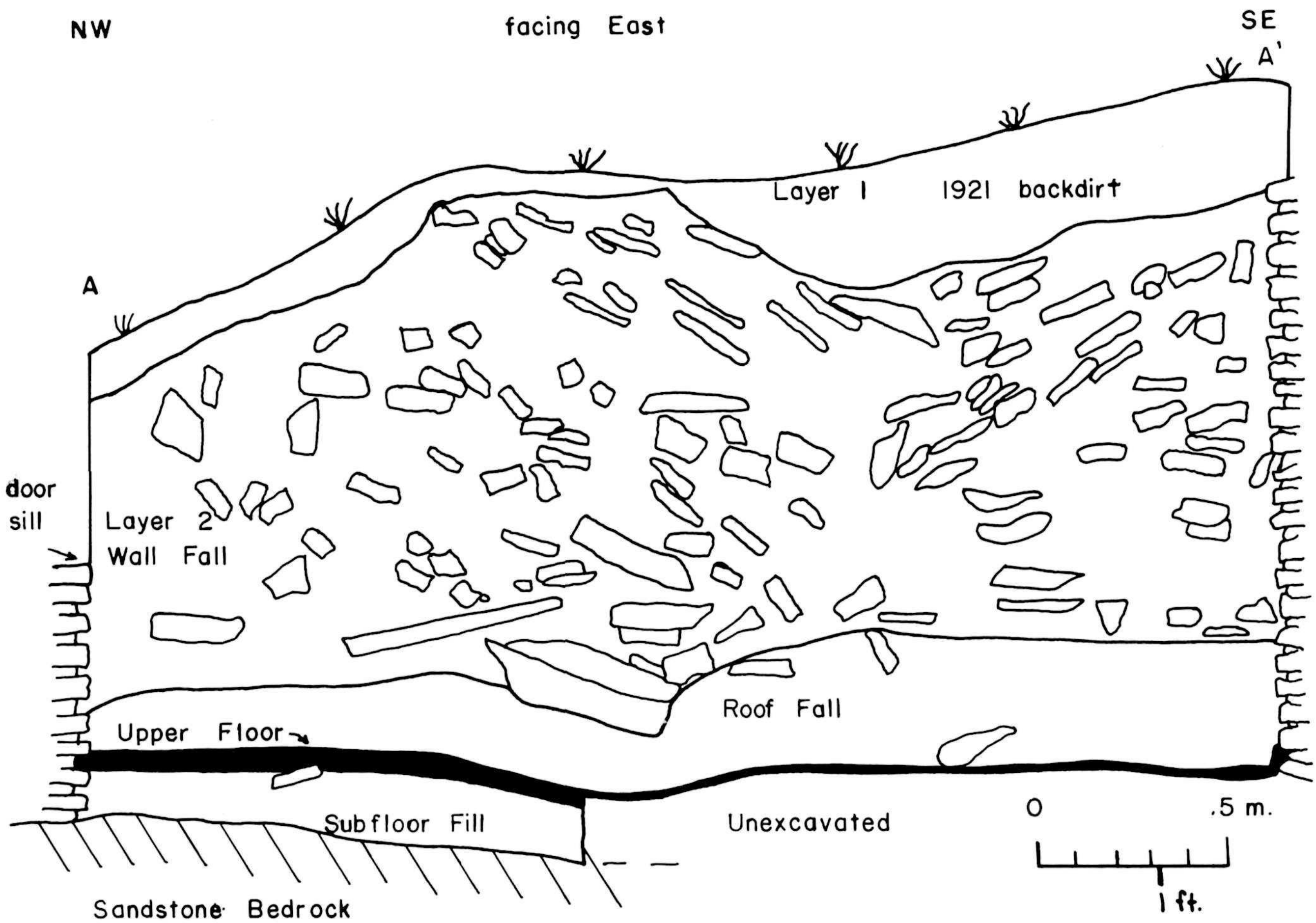


FIGURE 13. Lateral cross section showing profile and fill deposits of Room 8, 5AA83.

to provide for a second story. Although wall sockets for cross beams used to roof Room 8 were not present in the standing wall, it can be conjectured on the basis of the present height that the room ceiling was once at about the present ground surface.

In cross section, the walls of Room 8 consist of an exterior veneer of finely coursed masonry covering an interior core of sandstone rubble and earth. The finished veneer is made of tabular slabs of sandstone laid in discontinuous courses mortared with yellow clay mud. Small flat pieces of sandstone were used to chink the masonry by insertion into the still wet mortar. The exposed faces of the masonry slabs have been pecked to shape and smoothed. Construction of the core consists of about half rock and half earth by volume (Fig. 15 d). Core and rubble construction, as well as the fine banding of the coursed masonry, are architectural characteristics which indicate that the prehistoric masons were trained in the tradition of Chaco Canyon.

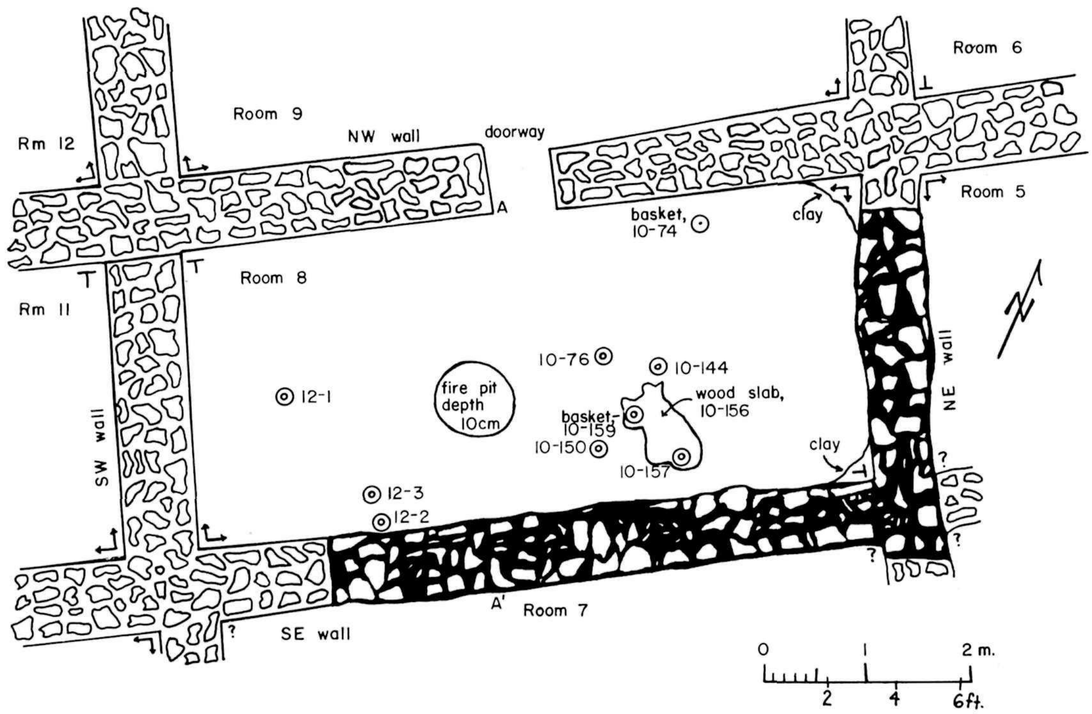
Detailed inspection of the wall junctions shows that the northwest and southeast room corners were abutted while the opposite diagonal corners are joined, indicating that the south wall of Room 9 and west wall of Room 5 were constructed at one time and that Rooms 8, 7, and 11 were built at another (Fig. 14).

Floor Construction

All four walls were footed directly upon the sloping sandstone bedrock. In order to level up for the floor surface, the downslope portion of the room on the west end was covered with 1.0 foot of fill. A flagstone floor was placed over this fill.

Subsequently a second floor surface was paved immediately over the lower one. This floor was made of yellow mud, which continued up the masonry wall facing as an interior plaster. In the northeast and southeast corners of the room this mud was laid very thickly to round the otherwise square corners (Figure 15b). It should be pointed out that the tree-ring dates for this room (A.D. 1093), which were derived from the roof fall, pertain to the renovation of the room at the time of construction of the upper floor while the initial construction of the room at the time that the lower floor was made took place at an unknown prior date. All floor contact specimens shown on Figure 14 were found on the upper clay floor; no artifacts were encountered on the surface of the lower, flagstone floor.

Room 8 is 8.7 by 20.1 feet with 174.9 square feet of floor space. Somewhat offset from the middle of the room is a basin-shaped pit which was dug from the surface of the upper floor to serve as a fireplace. The excavation was somewhat uneven and no clay lining was observed when this feature was cleared. Heat from the fire had oxidized the surrounding soil to a light orange color and fine ash filled the pit. This facility was undoubtedly for heating the room as well as cooking, which perhaps took place in some of the soot-



◎ - floor contact specimen

- wall tie

T - wall abuttment

? - bonding unknown

- schematic wall masonry

- measured wall masonry and clay mortar (black)

SPECIMEN NUMBER	TYPE	FORM
5AA83-10-74		basket, charred
-10-159		basket, charred, under wood slab
-10-76	Mancos corrugated	jar
-10-144	Mancos Black/white	bowl
-10-150	Mesa Verde corrugated	jar
-10-157	Mesa Verde corrugated	jar
-12-1	Chaco Black/white	jar
-12-2	Mancos corrugated	jar
-12-3	San Juan white ware (slipped vessel)	
-10-156		charred wooden slab cover

FIGURE 14. Plan of Room 8 showing distribution of floor contact specimens, 5AA83.

covered corrugated jars found on the floor of the room.

Another floor feature is a large, shallow, basin-shaped depression in the southeast quarter of the room. This pit is mud-plastered—really just a continuation of the upper floor surface. When opened, the pit was found to contain several smashed pottery vessels and a mass of corn husks, all of which had been charred by the fire that destroyed the room. The pit was probably used for storage of corn and other foods and materials.

Roof Construction

Inspection of Jeancon's (1922: Plate XVIII) plans for the roofing of nearby Rooms 10 through 12 shows a variety of construction types involving variations in the layout of main beams and secondary stringers. With his work as a guide, I had anticipated encountering a fallen but largely intact burned roof. Unfortunately the collapsed roof of Room 8 was not intact but rather a mass of burned clay and jumbled charred logs forming a layer of variable thickness but resting directly upon the upper floor (Fig. 13). From this material, it is not possible to identify any of the intricate roofing patterns reconstructed by Jeancon. However, we recovered 66 charred timbers; 41 were dated. Assuming that all of the timbers were cut during the summer of A.D. 1093, then the oldest specimen is 130 years in age, the next oldest is 107, and all the others less than 100. When the dendrochronologist first inspected this beam series, he remarked that their uniformly young age, small cross-sectional diameter, and large number of pieces suggested that most of it "looked like all secondary-type roofing—or—the kind of roofing occasionally seen where close-packed small beams are used instead of the usual main and secondary set up" (William Robinson, personal communication).

> [Another] interesting thing about these cutting dates is that the 1093 ring is always incomplete—meaning simply that they were cut during the growth season. Since the species is mainly ponderosa pine, this would mean at . . . [the Chimney Rock] . . . elevation and latitude that the trees were cut during June and July. Very strange behavior for an agricultural group! Usually our evidence (in late Pueblo II or Pueblo III) shows only complete rings, indicating winter cutting—or at least off-agricultural season cutting (Robinson, personal communication).

Baked clay fragments form the other common kind of material composing the roof fall layer. Samples of this material were collected in the field and examined in the laboratory. Examination of these orange to dark gray soft fired mud fragments revealed the following kinds of impressions: (1) smooth, curved indentations, (2) flat, striated prints, and (3) hand prints. The curved impressions were formed as molds against the sides of the logs described above. The flat, striated prints appear to be impressions formed in the soft mud by pressing against split logs. Usually these molds indicate just one layer of flat, split shingles, but in one case two layers are indicated running at right angles to one another. A few specimens show impressions of both the round poles and the flat wood shingles. And finally, some clay fragments show human hand prints (both palm and fingers) as if the worker were forcing the plastic clay into interstices of a wooden framework.

Distribution of Artifacts

The positions of the artifacts suggest a concern for traffic patterns. The heat and light for the room was from a fire built in an informally prepared basin-shaped pit set off center so as

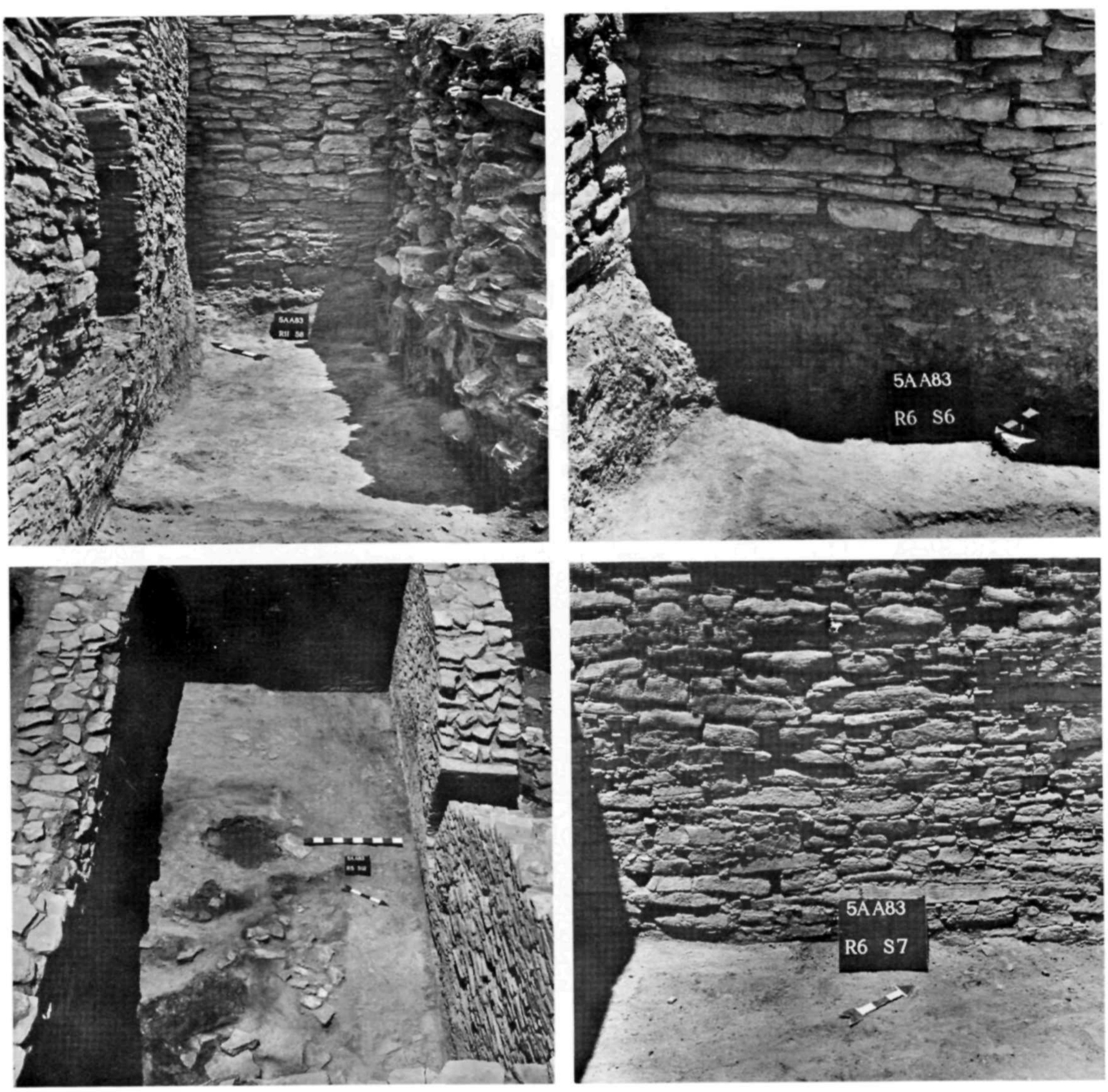


FIGURE 15. Interior details of Room 8, 5AA83: A, view facing east down the northeast quadrant, intramural doorway on left and block of unexcavated room fill on right; B, southeast corner of room showing thick wall plaster creating a curved cornering; C, view into room at completion of excavations, with restoration completed on the north wall; D, close-up of coursed masonry along interior of north wall.

to be out of alignment with the doorway, thereby avoiding drafts and freeing the way for foot traffic. Another subfloor feature is a pit dug into the floor of the southeast quadrant for storage where its off-center position also lessened the danger of anyone falling in it. Movable containers for food storage, food service, and food preparation were provided by two coiled baskets and seven restorable pottery vessels found distributed in (southwest, southeast, and northeast) quarters but not in the northwest quarter (Fig. 14). As a rule these containers were placed against or near the walls.

East Kiva Excavations

Work in the East Kiva was conducted in order to prepare it for stabilization and display to the general public. Particularly, the establishment of the upper floor position was important as a guide to the room layout for the last building stage of the kiva (Fig. 16).

Samples and observations obtained from the excavations verify two episodes in construction: an early building and a later rebuilding of the interior. Tree-ring specimens obtained from both the lower ventilator tunnel and the burned roof fall resting upon the upper floor surface validate the stratigraphic order of construction: the first kiva was built in A.D. 1076 and the second 17 years later in 1093. These findings provide firm support for the stratigraphic conclusions of Jeancon (1922:17-19) made almost a half century earlier.

On the other hand, in the matter of the upper structure roof reconstruction, our investigations fail to reproduce the in-

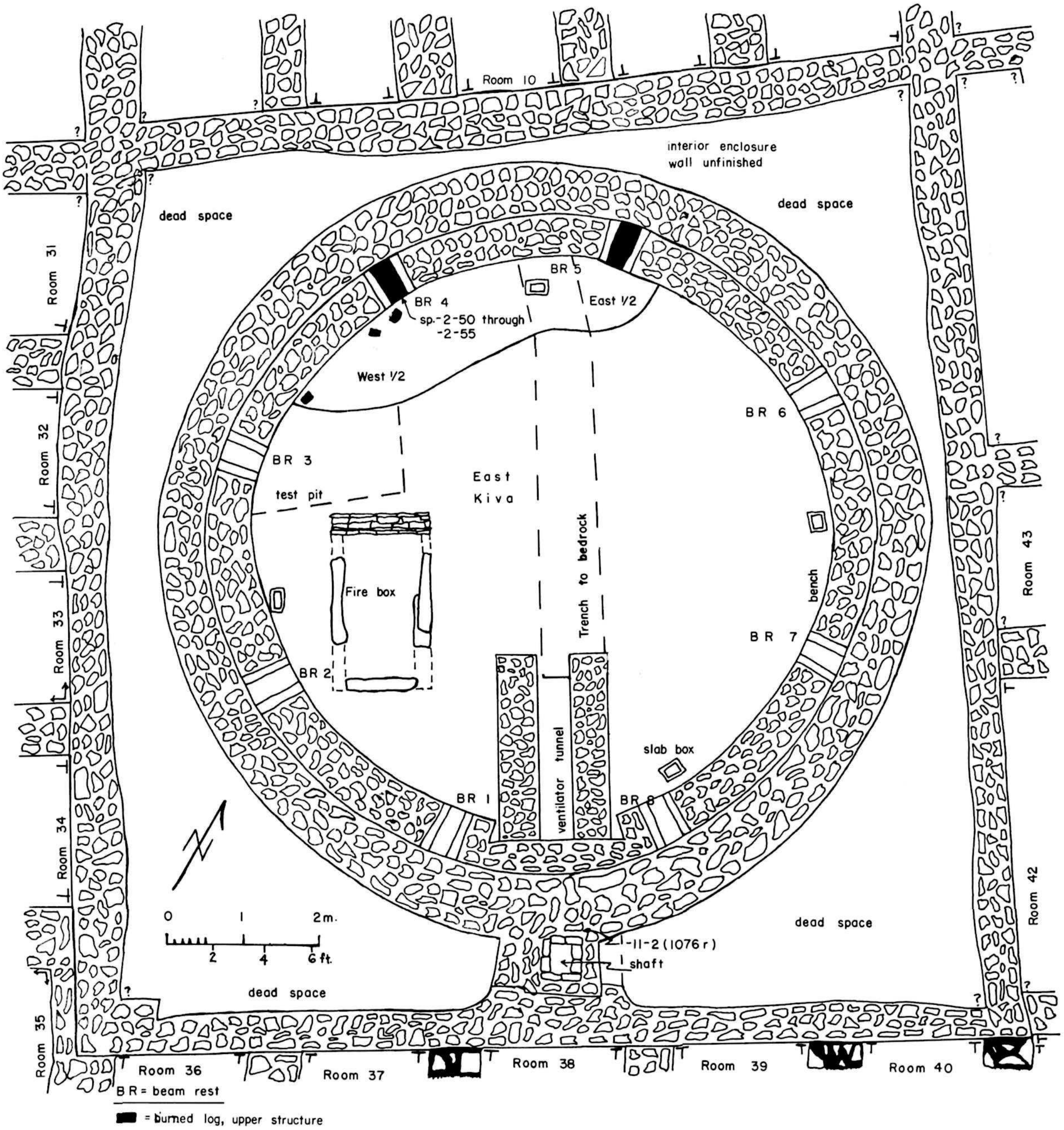


FIGURE 16. Plan of the East Kiva showing interior architectural details, limits of 1970 excavations, and the surrounding quadrangle enclosure, 5AA83.

terpretations of Jeancon (1922:18, Plate XIII). He believed that the roof of the latest building was supported by eight main beams which projected from the walls with support on a rectangular frame erected in the middle of the room. It did bother him that these beams, which he says were secured in the beam rests on the banquette surface, would have been only two feet, ten inches above the floor, leaving very little headroom. Neither the Layer 2 roof fall deposit nor the charred beams examined in Beam Rests 4 and 5 support his reconstruction. Instead, I think it much more likely that the Chaco practice of cribbed roofing was employed, thereby providing the necessary headroom for the occupants.

The circular plan of the building with enclosure within a large quadrangle is basic to the structure both originally and as reworked. This continuity is also true with regard to the ventilator system, the same vertical shaft having been used for both stages of the building. Further, the vent tunnel, although completely rebuilt for the second structure, was maintained in the same horizontal location. Another architectural persistence is the completely encircling interior banquette which was first built as part of the lower structure.

When constructed in A.D. 1076, the early building was a large Chaco-style kiva with ventilator system (shaft and tunnel) positioned on the south. A 5.0-foot high banquette completely encircled the room interior except for a recess above the ventilator tunnel. The exterior walls of this structure, built of Chaco-style masonry in the core and veneer technique, were footed directly upon the sloping sandstone bedrock. Interestingly enough, both the interior and exterior facing of this wall were of finished masonry, so that the banquette was installed against a completely finished wall surface with no means of tying the two together. Before the banquette was built, a thin pad of soil (Layer 5) was laid over the stepped and sloping bedrock surface. This fill runs under the banquette bottom course but abuts the exterior wall. Over this Layer 5 fill was laid a thin clay floor, labeled the Lower Floor on Figure 17. This constructed surface slopes to the south in conformity with the gradient of the bedrock. By projecting the lower floor surface from the north check block across the portion of the structure excavated in 1921 it can be seen that the floor at one time intersected the lower ventilator tunnel near the roof of that feature.

Ventilation for this building was provided by a square vertical shaft built within a masonry column wedged between the exterior kiva wall and the outside enclosure wall. A long horizontal tunnel connects to the shaft by means of which fresh air was introduced into the kiva. Within the body of the kiva wall, the tunnel is roofed by a series of cross poles, one of which was dated 1076 (spec. 5AA83-11-2). These poles carried the entire weight of the upper walls. But within the room proper, the lower tunnel was roofed with three courses of sandstone slabs, and from the reconstruction shown on Figure 17, it would appear that the tunnel roof projected slightly above the kiva floor so as to be visible to the occupants. No evidence was discovered as to the roof construction of the earlier structure nor was there any record of heating-lighting facilities, ceremonial features, or other floor details.

We have a much more complete knowledge of the interior layout of the later kiva. It was constructed upon a thick pad of clean fill (Layer 4) which effectively raised and leveled a surface for a new clay floor, part of which we cleared in the north check block while the remainder was investigated 50 years earlier by Jeancon. This upper floor lies immediately over the upper ventilator tunnel. It also contained a large rectangular firebox outlined with upright sandstone slabs and a coursed masonry wall (Fig. 16). The plaster-lined firebox, which was eight inches deep, was recessed into the floor so that only the top of the walls were visible.

Under the clay floor surface, Jeancon (1922:19) found three small slab boxes which were oriented generally to the cardinal directions and completely hidden by the mud floor plaster (Fig. 16). In the 1970 excavations, we found a fourth box in the north check block, completing the symmetry of the arrangement. This box, which was empty, was constructed just under the floor surface so that the floor plaster was laid directly upon the shaped sandstone slab cover of the box. The box itself had a slab floor with four masonry walls faced on the interior but not the exterior. The walls were backed with a thick coat of mud which served as a mortar to hold the small sandstone masonry slabs in place (Figure 18c).

Jeancon (1922:19) interpreted these boxes as receptacles for the storage of small ceremonial articles, but if so, they were completely inaccessible without tearing up the kiva floor. He also suggests that they served the same function as wall niches present in other Chaco-style kivas. Because of their inaccessability, I would imagine that whatever was placed in the boxes was perishable and that once put in the containers, it was not removed again. It is likely that the contents were some sort of dedicatory offering, such as pollen or a wood and feather fetish, which continued to work in a ritual sense without any need to have the box or its contents revealed again.

Upon the banquette surface were built eight beam rests which have been numbered clockwise from the ventilator. These consist of three parts: (1) a basal sandstone slab which rests directly upon the bench surface, (2) two parallel masonry walls erected perpendicular to the kiva wall upon the edges of the basal slab, and (3) a hole or niche piercing the kiva wall directly behind the beam rest construction. Burned and rotted beams about seven inches in diameter lay horizontally in the trough and extended through the hole in the kiva wall. It is inferred that these horizontal beams served as base supports for wooden upright timbers which in turn carried a cribbed roof at an unknown distance above the upper floor.

Jeancon (1922:19) tells us that "neither the upper or the lower floors showed any indications of a sipapu or deflector, nor were there any pilasters present in the building." The lack of pilasters, of course, is his interpretation rather than the one given here. Nevertheless, his general point that "the only things suggesting a kiva were the circular form of the room, the banquette and ventilators" is well taken.

Exterior Excavations

Excavations were conducted outside of the building in 1971 in order to define court and plaza areas. It was our expectation that prehistoric work and leisure activities would have been conducted to the south of the building since it is only in this direction that any appreciable portion of the upper mesa remained open for prehistoric use.

Stratigraphic Studies in the East Court

The East Court consists of an elevated surface lying between the two arms of the L-shaped pueblo building (Fig. 19). On the north the court is edged by an unexcavated row of large rectangular rooms numbered 1, 4 and 7 in the original Jeancon (1922: Plate XII) sketch map. Along the west side of

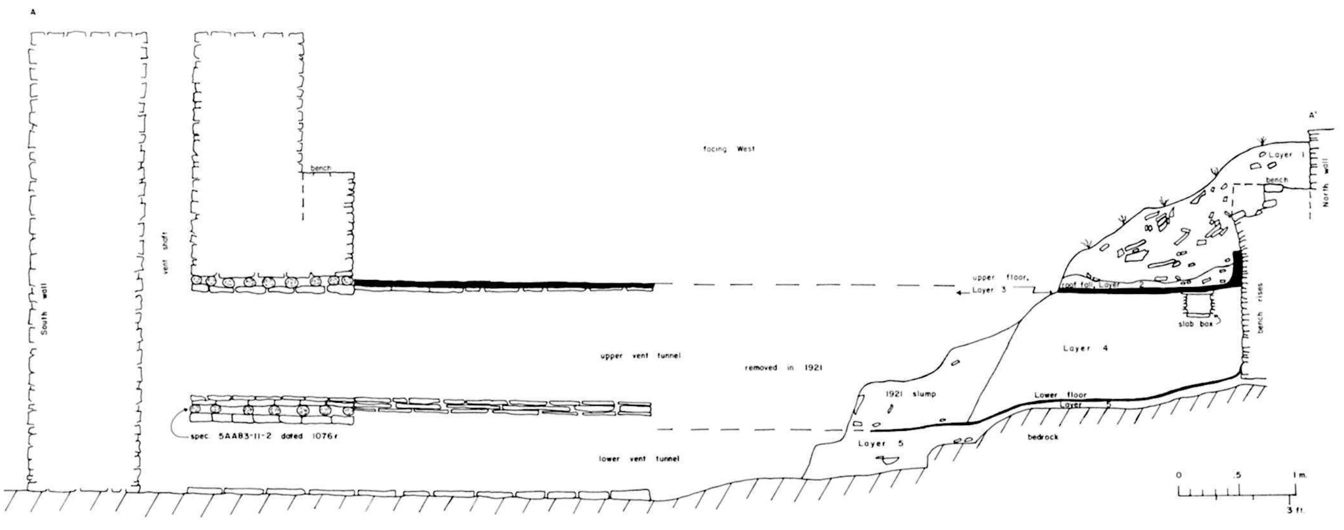


FIGURE 17. Cross section showing profile and fill deposits of the East Kiva, 5AA83. Right half of the profile showing fill deposits revealed in north check block was observed in 1970. Left half of the profile showing longitudinal cross section of the ventilator system with walls cut away has been compiled from Jeancon (1922: Plate XIV).

Layer 1: **A deposit of post-occupational wall fall resulting from infilling of the structure as the upper walls collapsed. A loose, loam soil containing quantities of fallen slabs.**

Layer 2: **Burned roof fall lying directly upon the upper floor. Contents consist of charred beams collected for species identification (ponderosa pine, Douglas fir, true fir, juniper) and dating (Table 19) as well as smaller charred woody materials such as pole-size pieces, brush-size stems, and bark which was field identified as juniper. The loam deposit is stained dark gray from diffused grains of charcoal. Also, lenses of reddish orange burned construction clay and burned angular fragments of sandstone are present throughout.**

Upper floor: **Layer 3 or the upper floor is made of a light yellow clay stained to a gray color on its surface because of foot traffic. This deposit curves up on to the bench riser where it forms a thick plaster which is well burned (baked) to a dark brownish color. In the area of Beam Rest 5, the bench riser plaster is three layers thick. The floor clay is cracked into irregular polygonal patterns and is drilled through with both filled and unfilled insect burrows, some of which still contain worms. Under the floor plaster the soil of Layer 4 is burned to a light pink color.**

Layer 4: **A massive deposit of loam fill was intentionally dumped into the kiva to obliterate the lower building and level up for construction of the upper structure. The fill is a light yellowish brown color containing little rock or artifacts.**

Lower floor: **The lower floor is a dark brown thin clay deposit with light gray surface staining. It has pronounced films and mycellium of lime deposited upon its surface. This floor was apparently not recognized by Jeancon who identified a "lower floor" as an adobe (i.e., clay) wash lying directly upon the bedrock. My inspection of the bedrock surface indicates rather that his "floor" is nothing more than the surface disintegration on the sandstone.**

Layer 5: **A thin deposit of mottled light yellowish brown loam soil laid directly upon the sandstone bedrock surface in order to level up for the paving of the lower mud floor. The Layer 5 fill contains some sandstone rocks and charcoal hunks scattered throughout the deposit.**

the court is a series of small storage compartments numbered in this report as Rooms 41 through 43. Several unexcavated and unnumbered rooms probably lie between Room 43 and Room 7, judging from the available space. On the south side, a retaining wall was found in Excavation Units 6 and 7 which extends out from the exterior building wall to close off the court in this direction. It is estimated that this wall extends 4.8 feet to the bedrock surface (Fig. 20). This retaining wall holds back the fill of Layer 4 which contains the earliest court surfaces. Stratigraphically later, the gray clay mortar of Layer 3 was thrown out in the East Court during a subsequent building stage in the building proper. During the formation of this deposit, a banquette was constructed along the base of the then exposed exterior wall of the building. This narrow apron structure is constructed of a facing of coursed sandstone masonry backed by a mud fill. Its full height is only 1.2 feet while its width is 2.0 feet. Due to its bench-like form and position in the court, is is interpreted as a place to sit during ceremonies or perhaps just for a rest during the day. During the life span of the banquette, mud mortar of Layer 3 continued to accumulate until much of its construction lay buried (Fig. 21).

Stratigraphic Studies in the South Plaza

The South Plaza covers an area of unknown size on the south side of the building between the exterior wall and the cliff edge. In the area of Excavation Unit 4, just outside of Room 38, was found a mud plaster paving which is all that remains of the original plaza surface (Fig. 22). This man-made surface was laid directly on the bedrock, which is flat in this area. Probably it once extended over the entire bedrock surface in the area of Excavation Units 1 through 3 but the steep slope of the bedrock below EU 4 precluded the preservation of the thin plaza plastering. No artifacts or features were found on the plaza. (Fig. 23).

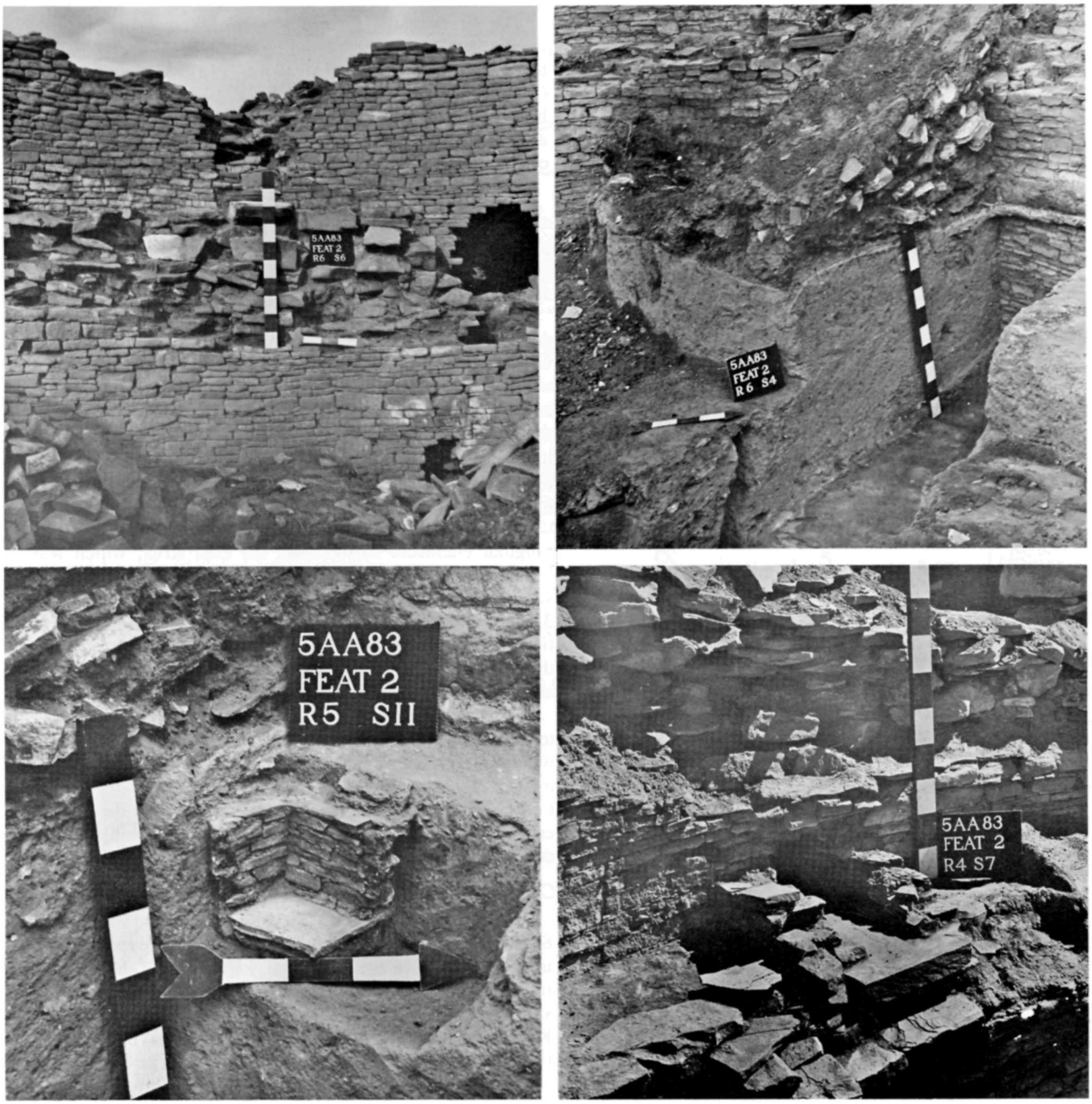


FIGURE 18. Architectural details of the East Kiva: A, exposed banquette core on southwest side of the kiva illustrating the core and veneer technique of construction; B, test trench cut through the north check block showing stratigraphic deposits, bedrock, and the north bench riser; note the position of the upper floor (top of scale) at contact of Layers 2 and 4; C, slab box exposed under mud plaster of the upper floor; D, Beam Rest 5 with charred timber removed.

Trash Deposit

A deposit of trash lies at the base of the cliff all along the north side of the building. This dark gray loamy material consists of charcoal-stained soil mixed with pottery, stone, and bone artifacts—the residue of garbage which was heaved over the side of the cliff by the village occupants. As this debris fell, it became incorporated in the head of the talus slope which drops steeply from the base of the sandstone cliff to the foot of the mesa. Jeancon (1922:29) reported finding areas within the trash where human bones were cremated but nothing of this sort was discovered in Excavation Unit 14.

Chronology of the Site

Dating of the Chimney Rock Pueblo and its contained deposits rests on three lines of evidence: stratigraphy, ceramic styles, and dendro-samples. Stratigraphy provides a relative framework for constructional and depositional events while the other two chronologies assign these events to fixed positions along a time scale. Since each dating technique has its own limitations and temporal coverage, all must be employed to build a composite chronology for the site. Through this means, each separate chronology can provide a degree of internal verification for the other two.

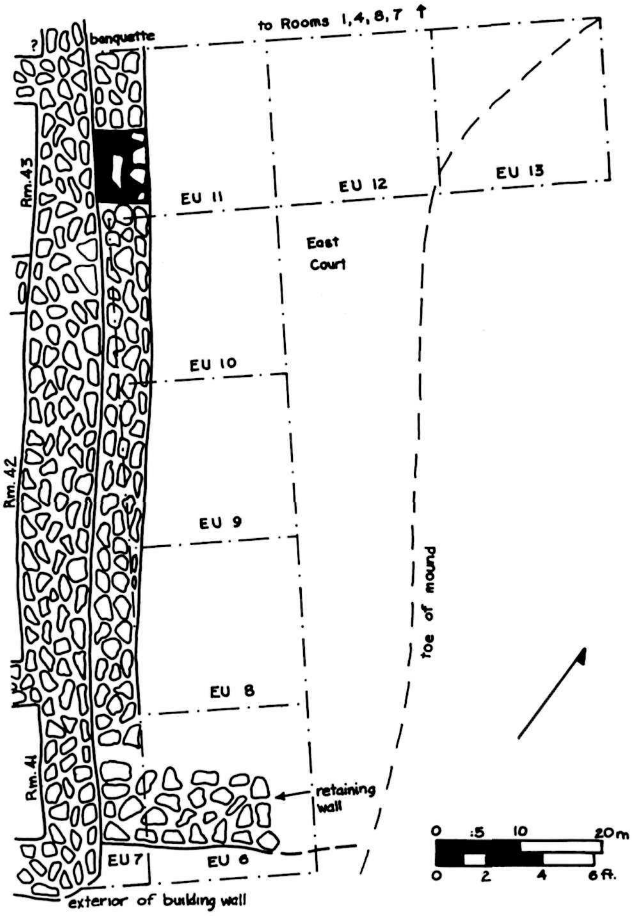


FIGURE 19. Plan of East Court excavations showing exterior wall, banquette, retaining wall, and the Excavation Units, 5AA83. (See Fig. 14 for symbols.)

Stratigraphy

As previously mentioned (see Setting), all of the exterior and some of the interior walls of the building were footed directly upon the sandstone bedrock with no evidence of footing trenches. These observations are based on exposures in the East Kiva, Room 8, Excavation Unit 4 outside of Room 38, and Excavation Unit 11 outside of Room 43. From this bare beginning, all subsequent deposits, both fills and architectural constructions, are the work of, or result from the action of the prehistoric occupants. The buildup of fill deposits consists of trash and sterile soil mixtures quarried and brought into the building to raise and level the unevenly sloping bedrock so that floors could be constructed. Outside the building are somewhat different fill accumulations such as the discarded mud mortar forming Layers 3 and 4 of the East Court.

Other deposits found within the building are stratified floors. Examples of such architectural renovations are present in both Room 8 and the East Kiva. Outside the building is another example of stratified architecture: the East Court banquette which lies within Layer 3 and which overlies Layer 4. The building's abandonment is signaled by burning of ceiling timbers which produced the roof deposits resting on the upper floors of both Room 8 and the upper structure of the East Kiva. That the conflagration was more widespread is alluded to in the excavations of Jeancon for Rooms 10 through 12.

The stratigraphic history is recorded at many different locations throughout the building as can be read from bottom to top in the depositional sequence: (1) sandstone bedrock, (2) subfloor fill, (3) lower floor, (4) intermediate fill, (4) higher floor, (5) burned roof fall, (6) wall fall, and (7) modern surface.

Sequence of Wall Abutments

By a careful examination of room cornerings, the sequence of wall constructions was determined in part on the basis of masonry ties and abutments. That Jeancon (1922:15) appreciated the value of this kind of stratigraphic data 50 years ago is illustrated by his statement that the Large Pueblo "was, in part at least, built on a preconceived plan as evidenced by certain of the long walls which are continuous and with the partition walls put in afterwards." Our observations verify that the outer walls are continuous, abutted by the interior rooms. The first tier of excavated rooms lying along the north wall (Nos. 3, 6, 9, and 12) appears to have been installed in an initial construction stage followed in a less patterned manner by the second and third rows lying north of the East Kiva.

Another early construction was the erection of the quadrangular enclosure surrounding the East Kiva, which was built as a unit to enclose the kiva, followed by all of the surrounding room compartments which abut it (Rooms 10, 31 through 35, and 36 through 43). On the other hand, Room tiers 31 through 35 are all tied to the enclosure surrounding the West Kiva, indicating that the latter was built sometime after the initial construction of the East Kiva.

All of these observations strongly support Jeancon's contention that the Chimney Rock Pueblo was planned as a whole by architect-masons who laid the building out according to master design and filled in the details at a later date as time permitted. As will be shown by the tree-ring dating, the entire duration from ground-plan layout to completion of details may not have been great.

Ceramic Dating

The only large sample of pottery was obtained from Room 8, which yielded 950 potsherds, mostly from the roof fall and upper floor where they can be associated with the massive number of tree-ring dates of A.D. 1093. Other ceramic samples collected from the trash, East Court, and the East Kiva are uniformly small. However, nothing in these collections refutes the Room 8 dating and all appear to be basically comparable in the ceramic type-frequencies.

The major classes of ceramics found in Room 8 are as follows: local black-on-white decorated, 29.29 percent; corrugated, 64.63 percent; plain gray, 4.21 percent; and trade, 1.91 percent. This distribution differs significantly from the random collections of ceramics recovered from the surface of sites on the lower mesa which show a much higher proportion of plain gray pottery (24.4 to 52.9 percent) and a much lower frequency of painted (3.9 to 14.6 percent). On the other hand, the corrugated cooking vessels are present in Room 8 in approximately the same frequency as were found on site survey (43.9 to 69.8 percent) (Table 11). These differences are probably not due to noncontemporaniety but instead likely reflect the specific kinds of activities which were conducted in Room 8. The high frequency of painted ceramics as well as corrugated pots implies that food service and cooking were routinely carried on, whereas water storage, inferred to have been made in the plain gray vessels, was

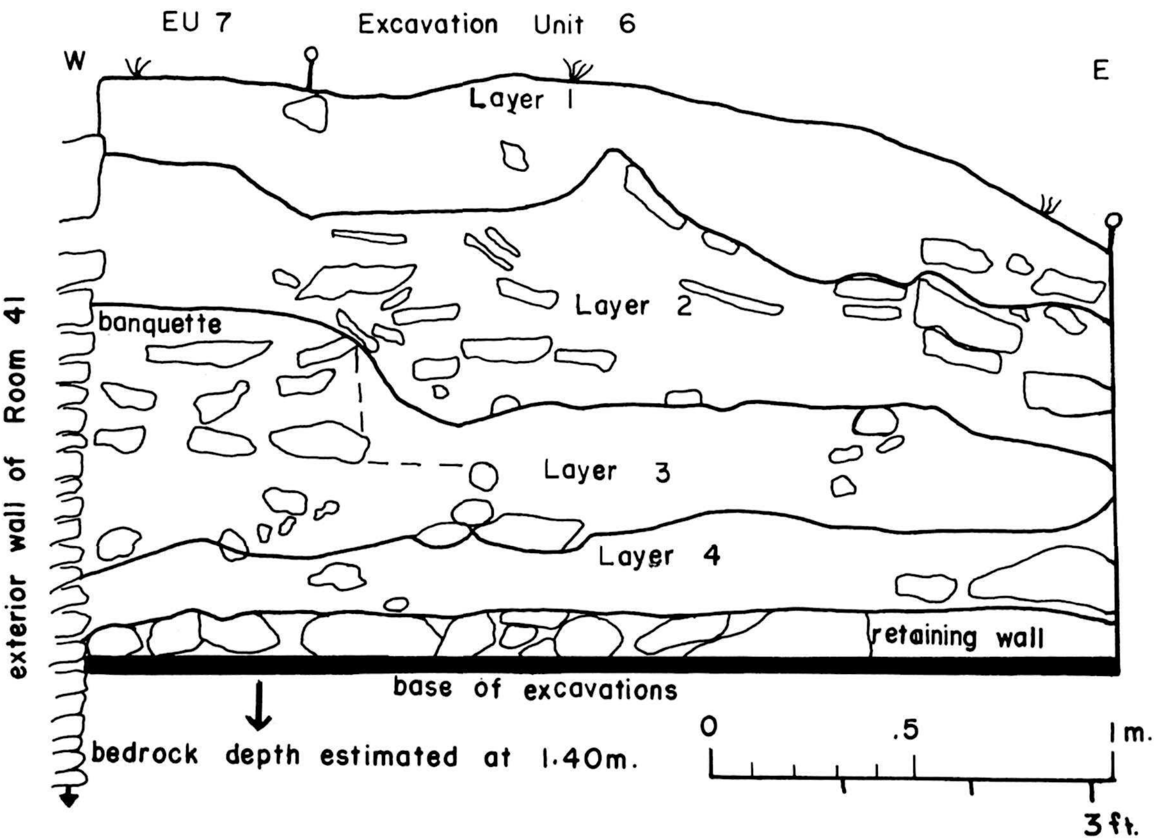


FIGURE 20. Cross section showing stratigraphy of East Court deposits abutting the exterior of Room 41, 5AA83.

Layer 1: **A deposit of light brown loam soil believed to be backdirt from Jeancon's 1921 excavation of the East Kiva. Low rock content relative to underlying Layer 2.**

Layer 2: **A gray brown loam soil containing considerable quantities of sandstone masonry slabs pitched with the slope (eastward). Deposit was formed with the outward collapse of the building.**

Layer 3: **A mottled and horizontally banded light yellow and gray clay loam. The yellow mottles are sand derived from decomposed bedrock and the gray patches are clay mortar. Very low rock content. This layer is an intentionally constructed pad forming the East Court. The horizontally banded laminae represent accumulation of mud at various times as wall construction took place on the building and the waste mortar was thrown out in the nearby court. Enclosed within Layer 3 is the narrow bench (banquette) which forms an apron along the outside base of the exterior wall (see Fig. 21).**

Layer 4: **A mottled gray and reddish brown clay loam. Like Layer 3, this deposit is an accumulation of occupational debris, most of which is clay mortar thrown out as the initial construction of the building took place. Stratigraphically it underlies the banquette of Layer 3. Probably the retaining wall, exterior building wall, and Layer 4 continue down to the bedrock surface.**

not common in Room 8. Thus the ceramic classes found in Room 8 are highly skewed by the selective living activities performed there. On the other hand, the pottery collections made on site survey were randomly obtained, thereby representing a full range of food service, cooking, and storage activities at these sites.

Like the type frequency list described from site survey, Room 8 yielded large percentages of decorated ceramics (Mancos and Wetherill B/w) of Pueblo II age (1075 to 1125) with very few Pueblo I age decorated ceramics (Piedra and Bancos B/w) and no Pueblo III age types (Table 17). This age range is supported by the high frequency of Mancos Corrugated, which is most securely tree-ring dated between A.D. 1066 and 1090 (Breternitz 1966:85).

An independent check can be made on this ceramic dating by cross-dating with trade ceramics (Fig. 24). Room 8 yielded decorated trade pottery identified as Chaco B/w, Tusayan Polychrome, Tusayan B/r, and an unidentified redware. The three identified types were abundantly exported from northwestern New Mexico and northeastern Arizona (Kayenta District) after A.D. 1050. Their overlapping temporal distributions best fit the interval A.D. 1075 to A.D. 1200. Considering the age span of both the local and trade pottery types, it seems most reasonable to date Room 8, and by extension the entire Chimney Rock Pueblo, between A.D. 1075 and 1125.

Tree-ring (Dendrochronological) Dating

Ninety wood specimens were collected from the excavations at 5AA83 of which 14 were duplicates, leaving 76 original trees. Of this number, a total of 47 specimens were datable. Forty-one of these were obtained from the roof fall of Room 8 while the remaining six specimens are from the stratified building stages of the East Kiva.

Room 8 Dendro-Dates

Of the 41 dates obtained from Room 8, 26 or slightly over 63 percent are dated at A.D. 1093. The remaining 15 dates fall between 1066 and 1092. All of these pre-1093 dates are questionable since they were obtained from logs in which the

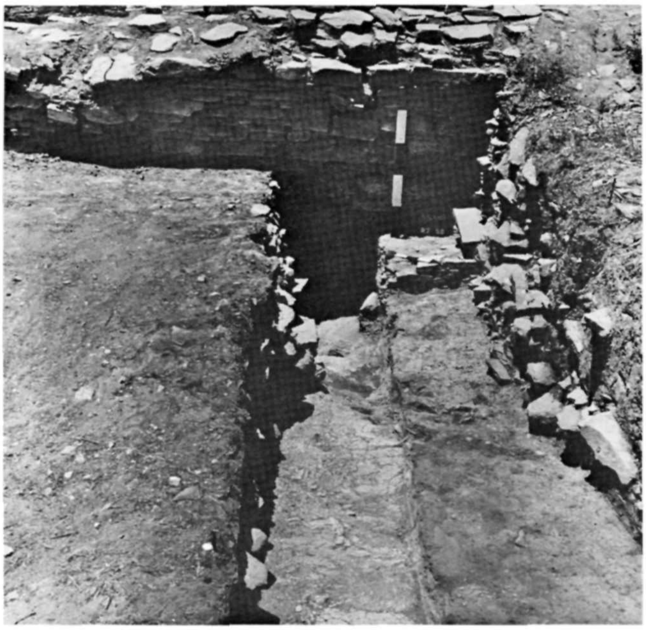


FIGURE 21. View within the East Court looking down the exterior wall of Room 43, 5AA83. Right half of the trench shows surface (Layer 3) of the court while left half has been dug through to bedrock. The banquette can be seen under the photographic mug board. Note the massive post-occupational wall fall deposits resting on the court surface.

last ring is variable around the circumference, indicating that an unknown number of outer rings has been lost (suffix symbols v, vv, +v, +vv). Also it should be noted that no logs were dated after 1093 (Table 18).

An examination of the 26 logs dated A.D. 1093 shows that 13 have an "r" suffix, meaning that the outermost ring is continuous around the portion of the specimen present and therefore it is a possible cutting date. One other specimen has an rB suffix meaning continuous outer ring with bark (B) present; therefore, this specimen indicates a definite cutting date. Two logs have a "c", meaning that the last ring is constant around its circumference and therefore it is probably a cutting date. One other specimen has a "cB" suffix and a definite cutting date. Therefore, 17 of the 1093 dates are reliable evidence that a work party was out during the summer (June and July) felling young trees to roof Room 8 for the last time (see Room 8 description). No cutting dates fall before 1093, indicating that logs were not salvaged from other structures for the re-roofing of Room 8. Further, no logs date after 1093, meaning that it was never necessary to repair or renovate the roofing; it remained in good shape until it was destroyed by fire.

East Kiva Dates

The six dated logs obtained from the East Kiva contribute to the chronological understanding of two events: construction of the lower structure and roofing of the upper kiva. Just one specimen (5AA83-11-2), from a ponderosa pine pole taken from the horizontal ventilator tunnel next to the vertical vent shaft, applies to the lower structure. This pole is dated A.D. 1076r, which places the construction of the lower kiva in absolute time. With no other specimens to rely on for verification, we are left with a choice of accepting or reject-

TABLE 17
Distribution of Pottery Types in Room 8, 5AA83

	Local Types										Trade Types				Totals
Stratigraphic Provenience	Piedra B/w	Bancos B/w	Mancos B/w	Wetherill B/w	San Juan White Ware	Unident. Decorated	Mancos Corrugated	Payan Corrug.	Mesa Verde Corrugated	Plain Gray	Chaco B/w	Tusayan Poly.	Tusayan	Unident. Redware	
Wall fall, Layer 2	—	—	—	—	2 0.21	—	—	—	—	2 0.21	—	—	—	—	4 0.42
Roof fall	3 0.32	1 0.11	90** 9.47	46** 4.84	25 2.63	—	231*** 24.32	48 5.05	19* 2.00	20 2.11	—	1 0.11	5 0.53	2 0.21	491 51.70
Upper floor contact	2 0.21	1 0.11	44* 4.63	1 0.11	32* 3.37	7 0.74	188**** 19.79	2 0.21	66* 6.95	12 1.26	7** 0.74	—	2 0.21	—	364 38.33
Subfloor pit	—	—	19* 2.00	—	1 0.11	—	25 2.63	—	35* 3.68	—	—	—	—	—	80 8.42
Fire basin fill	—	—	—	—	3 0.32	1 0.11	—	—	—	2 0.21	1 0.11	—	—	—	7 0.75
Subfloor fill	—	—	—	—	—	—	—	—	—	4 0.42	—	—	—	—	4 0.42
Totals %	5 0.53	2 0.22	153 16.10	47 4.95	63 6.64	8 0.85	444 46.74	50 5.26	120 12.63	40 4.21	8 0.85	1 0.11	7 0.74	2 0.21	950 100.04%

*— all from one vessel

TABLE 18
Distribution of Dated Tree-ring Specimens in Roof Fall of Room 8, 5AA83

Laboratory of Tree-Ring Research Specimen Number	Chim. Rock Archaeo. Proj. Field Number	Species Ident.*	Horizontal Quadrants of Room 8: Northwest Inside-Outside**	Southwest Inside-Outside	Northeast Inside-Outside	Southeast Inside-Outside
CRE-16	5AA83—10-5	PP	1057p—1093v	— —	— —	— —
CRE-17	—10-6	PP	963 —1090+v	— —	— —	— —
CRE-18	—10-10	PP	1026p—1086vv	— —	— —	— —
CRE-21	—10-10	PP	1069p—1093r	— —	— —	— —
CRE-26	—10-30	PP	1056p—1093r	— —	— —	— —
CRE-28	—10-38	DF	1065p—1089vv	— —	— —	— —
CRE-27	—10-38	PP	1043p—1092+v	— —	— —	— —
CRE-29	—10-52	DF	— —	1062p —1083vv	— —	— —
CRE-33	—10-56	DF	— —	1029p —1093v	— —	— —
CRE-34	—10-57A	PP	— —	1057p —1085vv	— —	— —
CRE-35	—10-57BC	Fir	— —	1045p —1093v	— —	— —
CRE-37	—10-58	PP	— —	1063p —1092+vv	— —	— —
CRE-36	—10-58	PP	— —	1059p —1093vv	— —	— —
CRE-38	—10-60	Fir	— —	1035p —1066vv	— —	— —
CRE-41	—10-75	PP	— —	— —	1063p—1093r	— —
CRE-46	—10-93	PP	— —	— —	— —	1074p—1093c
CRE-47	—10-96	DF	— —	— —	— —	1029p—1087vv
CRE-48	—10-97	PP	— —	— —	— —	1027p—1092+v
CRE-50	—10-99	DF	— —	— —	— —	1071p—1093vv
CRE-52	—10-103	PP	— —	— —	— —	1050p—1093r
CRE-54	—10-106	PP	— —	— —	— —	986p—1084vv
CRE-56	—10-109	DF	— —	— —	— —	1074p—1093v
CRE-58	—10-111	PP	— —	— —	— —	1040p—1093r
CRE-59	—10-112	PP	— —	— —	— —	1074p—1093r
CRE-60	—10-115	PP	— —	— —	— —	1063p—1093r
CRE-61	—10-115	PP	— —	— —	— —	1070p—1093cB
CRE-66	—10-119A	PP	— —	— —	— —	1062p—1093r
CRE-67	—10-119B	Fir	— —	— —	— —	1049p—1093rB
CRE-72	—10-124	PP	— —	— —	— —	1075p—1093c
CRE-73	—10-125	PP	— —	— —	— —	1061p—1093v
CRE-74	—10-126	PP	— —	— —	— —	1038p—1081vv
CRE-75	—10-127	PP	— —	— —	— —	1072p—1093r
CRE-76	—10-128	PP	— —	— —	— —	1064p—1093v
CRE-78	—10-133	DF	— —	— —	— —	1023p—1093v
CRE-79	—10-134	PP	— —	— —	— —	1057p—1093r
CRE-81	—10-136A,B	PP	— —	— —	— —	1070p—1093r
CRE-83	—10-140	PP	— —	— —	— —	1037p—1092+vv
CRE-84	—10-141	PP	— —	— —	— —	1073p—1093r
CRE-85	—10-149	DF	— —	— —	— —	1028p—1073vv
CRE-87	—10-152	Fir	— —	— —	— —	1012p—1090+vv
CRE-88	—10-154	PP	— —	— —	— —	1077p—1093r
Total	41 Specimens	29 PP 8 DF 4 Fir 41 Total	7 Specimens	7 Specimens	1 Specimen	26 Specimens

* PP, Ponderosa pine; DF, Douglas fir; Fir, true fir; Jun, juniper.
** Inside (inner ring): year only, no pith ring present; p, pith ring present;
(outer ring): +, outer rings crowded, probably some absent in series.
Outside conditions: v, outside shows erosion, last ring variable around circumference; if no other symbol, unknown number of rings lost;
vv, outside shows extreme erosion, last ring very variable around circumference; if no other symbol, unknown number of rings lost.
Outside (outer rings): c, last ring constant around circumference, probably a cutting date:
r, outermost ring continuous around the portion of specimen present, possible cutting date;
G, beetle galleries present on surface, very near cutting date;
B, bark present on surface, definite cutting date.

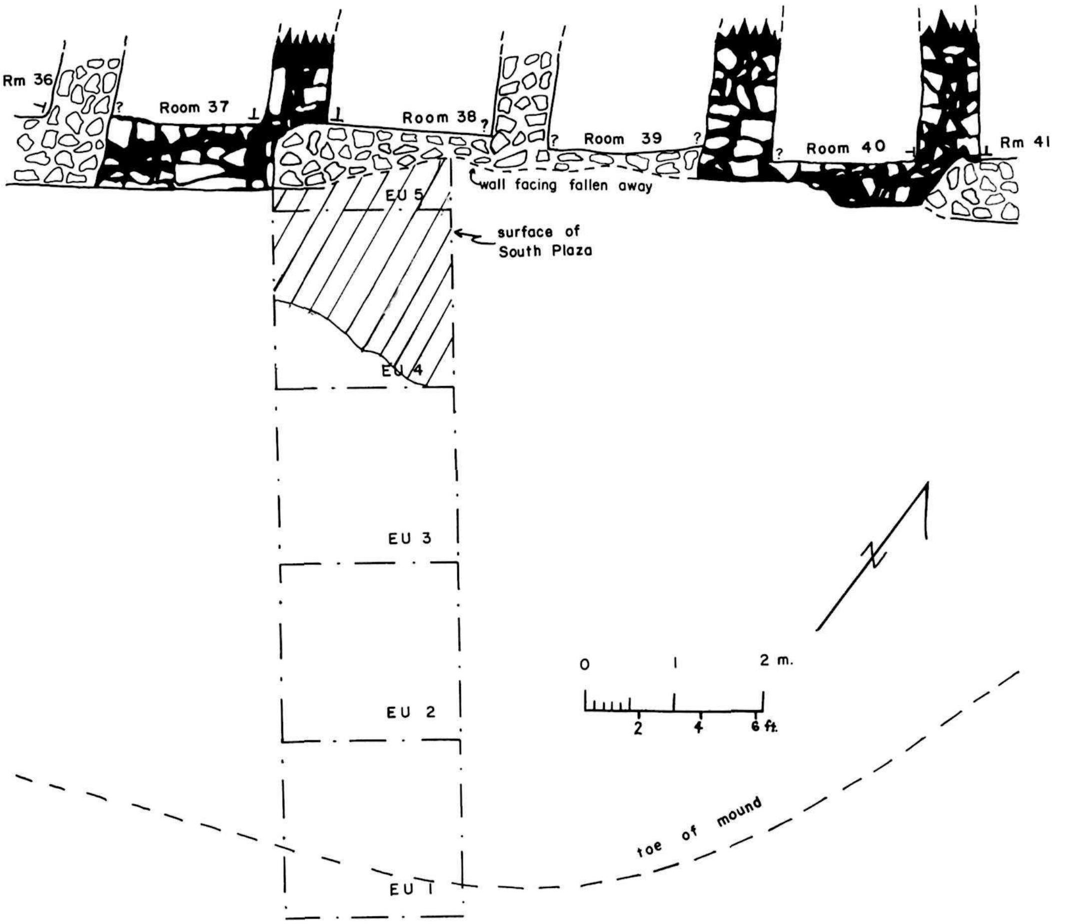


FIGURE 22. Plan of the South Plaza excavations showing exterior wall, South Plaza surface, and toe of mound, 5AA83. (See Fig. 14 for symbols.)

ing the single assay. But because of its appropriate relative order within the stratigraphic sequence of this building, I am inclined to accept the date at face value and state that the lower kiva construction was carried out in A.D. 1076.

Five other tree-ring dates, all of which relate to the upper kiva structure, were obtained from the roof fall and beam rests of the north check block. Only one of the specimens has a continuous outer ring; the remainder are very eroded. The possible cutting date of A.D. 1093r comes from specimen 5AA83-2-15, a ponderosa pine log from the roof fall (Layer 2) (Table 19). Although reliance on a single specimen is risky, in the case of this date we do have some support from the other specimens since all fall prior to A.D. 1093 as expected because of their outer ring erosion. Thus probably all five specimens once had outer rings that would have dated them at 1093. Additional support is given by the fact that Room 8 is also dated to A.D. 1093. I can't believe that this fact is coincidental; rather, it seems more likely that the same summer work party were felling young ponderosa pine in order to roof both structures.

Conclusions Concerning Chronology

To summarize this discussion, the chronology of events identified from the Chimney Rock Pueblo will be reconstructed on the basis of present understanding. The initial construction of the building was undertaken by a colony of immigrants after their arrival from Chaco Canyon. The building was laid out to an L-shaped plan, and the exterior walls were erected in one stage. Based on the sequence of wall abutments as well as the fact that the main walls are footed on bedrock, it is thought that the East Kiva was built as part of the initial construction. If true, then the single dendro-date of A.D. 1076 may well apply to the primary building of the entire site. Unfortunately, we lack supporting evidence for this conclusion in the form of datable ceramic samples.

About A.D. 1093, the lower structure of the East Kiva was filled in with a thick deposit of relatively clean (i.e., few artifacts) fill in order to cover that structure and raise the floor surface for a new structure. This upper building was roofed with logs which have been dendro-dated just 17 years after the initial kiva construction and, by extension, of the entire site. At the same time that the East Kiva was being rebuilt, the upper floor of Room 8 was being roofed for the second time, suggesting that there may have been widespread renovation throughout the entire site. Some support for this interpretation is provided by the two construction stages observed in the stratigraphy of the East Court where Layers 3 and 4 are thought to represent mud mortar dumped there from two major building activities.

TABLE 19
Distribution of Dated Tree-ring Specimens from the East Kiva, 5AA83

Laboratory of Tree-Ring Research Specimen Number	Chim. Rock Archaeo. Proj. Field Number	Species Ident.	Dating Inside-Outside	Provenience	Remarks
CRE-5	5AA83 —2-15	PP	1041p —1093r	Roof fall on floor of upper structure. East ½ of N check block.	Dates upper struct.
CRE-6	—2-16	Fir	1020p —1087vv	Roof fall on floor of upper structure. East ½ of N check block.	Dates upper struct.
CRE-7	—2-50,51,52 53,54,55	Jun	918 —1055vv	Contents of Beam Rest (BR) 4.	Dates upper struct.
CRE-8	—2-61	PP	836 —875vv	Roof fall on floor of upper structure. West ½ of N check block.	Dates upper struct.
CRE-9	—2-62	DF	1049p —1084vv	Roof fall on floor of upper structure. West ½ of N check block.	Dates upper struct.
CRE-89	—11-2	PP	1048p —1076r	Roofing pole from lower ventilator tunnel taken from near ventilator shaft on east wall of the tunnel.	Dates lower struct.
TOTAL	6 Specimens	3 PP 1 DF 1 Fir 1 Jun 6 Specimens			

Note—see Table 18 for symbols

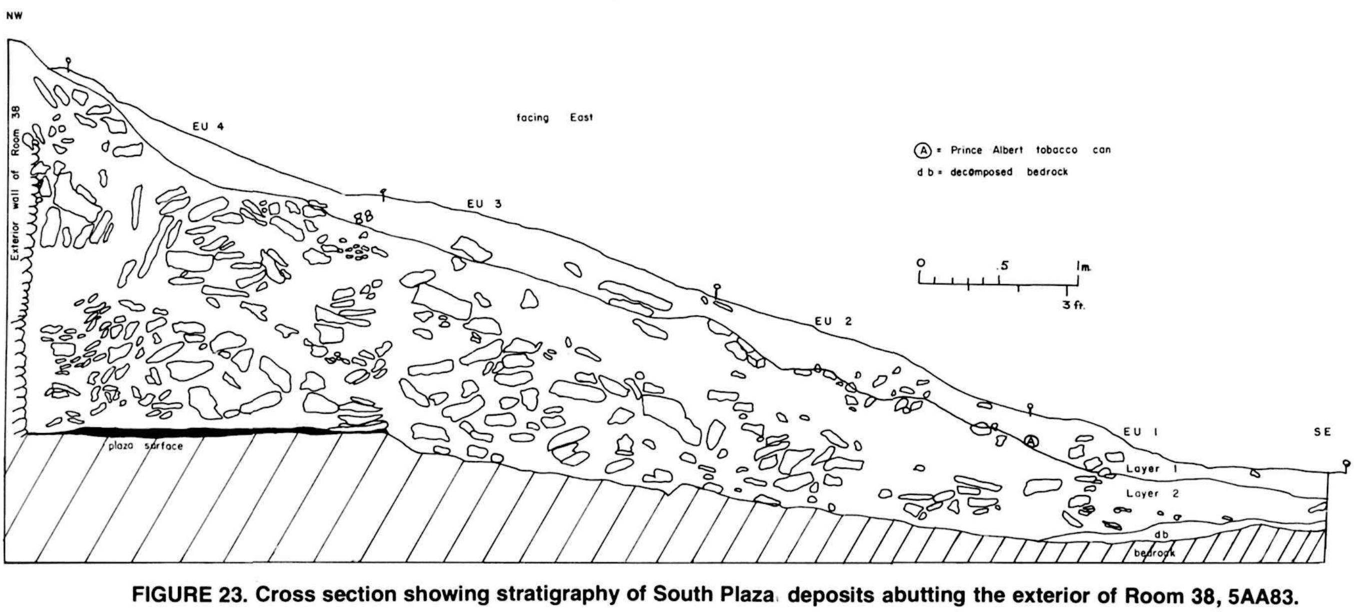


FIGURE 23. Cross section showing stratigraphy of South Plaza deposits abutting the exterior of Room 38, 5AA83.

Layer 1: A deposit of moderate yellowish brown loam soil believed to be backdirt from Jeancon's 1921 excavation of the East Kiva. Low rock content relative to underlying Layer 2. A Prince Albert tobacco can was found near the base of this deposit in Excavation Unit 1 thereby establishing the recent age of this layer.

Layer 2: Yellowish brown loam soil containing quantities of sandstone masonry slabs and washed gray mortar derived from outward collapse of the building. This post-occupational wall fall formed a massive wedge-shaped deposit sloping to the south coincident with the talus slope, but, in the area immediately under the exterior wall of Room 38, local piling has formed a talus cone in the area of EU 4. Slabs between the epicenter of this cone and the building wall show an incline pitched to the north contrary to the general trend of the talus slope.

Plaza Surface: A thin (1 to 2 inches) lense of mottled yellowish orange to dusky yellowish brown sandy clay lies at the contact between the wall fall (Layer 2) and the flat-lying bedrock surface. This deposit, which is entirely confined to EU 4, is all that is left of the South Plaza surface. The mud plaster surface over the bedrock was constructed coincident with Room 38 and the outside building which also rests on bedrock. The plaza plaster meets the base of the outside building wall but does not appreciably extend up the exterior facing.

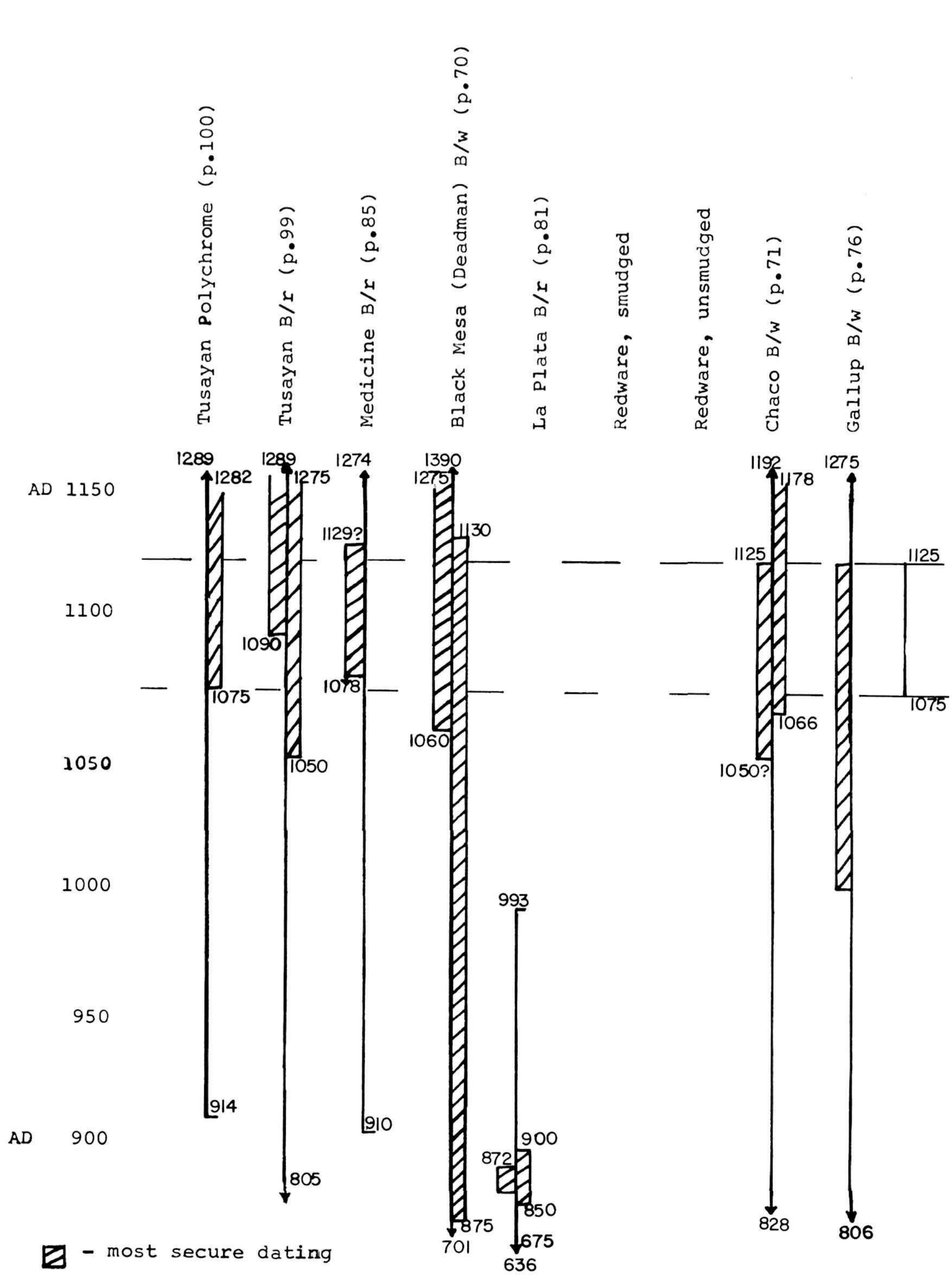


FIGURE 24. Cross dating by trade pottery types. Age limits taken from Breternitz (1966). Occupational limits of 5AA83 shown by horizontal lines.

A large ceramic collection obtained from the upper floor and the roof fall of Room 8 is given bracket dates of A.D. 1075 and 1125. The styles of these artifacts indicate that the site was probably abandoned no later than A.D. 1125, a conclusion which reveals a suprisingly short interval of site occupation. If correct, the Chimney Rock Pueblo was occupied from A.D. 1076 to A.D. 1125, a duration of 50 years (Table 20).

Site Conclusions

At the beginning of this chapter on the archaeology of the Chimney Rock Pueblo, a series of research questions having to do with the nature of the site as a fossil relict of an immigrating colony was outlined. Specifically, it was postulated that 5AA83 is the material residue of a colony derived from the Chaco Canyon area around A.D. 1076 which intruded into the High Mesa Community made up of local

TABLE 20
Chart correlating three lines of chronological evidence: stratigraphy, ceramic dating, and tree-ring dating, 5AA83.

Indicated Age	Stratigraphy	Sequence of Wall Abutments	Ceramic Dating	Tree-Ring Dating
AD 1921	Modern surface	—	—	—
Post-AD 1125	Wall fall	—	—	—
AD 1125	Burned roof fall	—	Ceramics found in the roof fall and on the upper floor of Room 8 date ruins abandonment as no later than AD 1125.	
AD 1093	Higher floors	—		41 dendro-dates from the burned roofing on the upper floor of Room 8 provides sound evidence of construction during the summer of AD 1093. A possible cutting date from the upper floor of the East Kiva supports this finding.
Just prior to AD 1093	Intermediate fill	—	Essentially "clean" fill with very few ceramic artifacts.	
AD 1076	Lower floors	Construction of exterior building walls to a master plan followed by continued erection of interior rooms.	No ceramic artifacts.	A single tree-ring obtained from the lower structure in the East Kiva suggests construction in AD 1076.
Just prior to AD 1076	Subfloor fill		Essentially "clean" fill with very few ceramic artifacts.	
Geologically ancient	Sandstone bedrock	—	—	—

Chimney Rock residents, indigenous Indians whose ancestors had resided in the upper San Juan Basin since at least A.D. 1 (Eddy 1966, 1972).

If true, what was the social background of these migrants in the Chaco Canyon and why did they come to Chimney Rock? Vivian (1970:66-68), in a review of the social organization of the Chaco dwellers, describes the settlements of the ninth through twelfth centuries as following two patterns: villages and towns. In nearly every aspect the Chimney Rock Pueblo matches the eleventh century towns among which are such famous ruins as Pueblo Bonito, Pueblo del Arroyo, and Chetro Ketl. Excavations have demonstrated that large segments of many of these buildings were constructed at one time to a preconceived plan. The ground plans in most cases are composed of a linear, compact mass of rooms forming L- and E-shaped pueblos. "An open plaza surrounded by room-blocks was present in all the towns" (1970:67) and buildings were from two to four stories high. Before A.D. 1130, wall construction was of the core-veneer type. Kivas were almost always in the Chaco style (typified by the East Kiva, 5AA83) while at least one Great Kiva is also present; often in the open plaza. But Great Kivas have also been found isolated between major towns where they served an integrative function. Characteristically at Chaco, towns contain high quality luxury handicraft objects, and human burials show considerable differentiation in status to judge from the variation in grave goods.

Based on the room layout, kiva distribution, and town partitioning, Vivian postulates a prehistoric social organization as follows: "It is proposed that 'town' sites in Chaco Canyon were dual-division residence units characterized by nonexogamous moieties with a bilocal residence pattern. Social cohesion was achieved by moiety sharing in governmental and ceremonial responsibilities of the town and by community associations which cross-cut moiety membership" (1970:81).

This cultural settlement pattern was under way as early as A.D. 850, persisting for some three centuries. But by A.D. 1130 the Chacoans were beginning to abandon their large town communities and all had departed by A.D. 1150 (Vivian 1970; Ford, Schroeder, and Peckham 1972: map 4).

Vivian (1970:76-78) describes the rise of complex irrigation agricultural systems after A.D. 1000 as an attempt by the Chacoan townsmen to control high velocity thunderstorm precipitation during a summer-dominant climatic episode. By implication, he suggests that headward arroyo cutting associated with this storm pattern destroyed the favorable canyon-bottom farmlands, leading to abandonment of the district (1970:76-77). If so, this environmental thesis cannot completely account for the dispersal of Chaco colonists to Chimney Rock since the time of departure was some 50 years earlier (A.D. 1076 rather than 1130). That the Chimney Rock colony is not a unique case has been noted by Peckham (Ford, Schroeder, and Peckham 1972:35), who has detailed a pre-1130 exodus by Chaco colonies to such widely scattered locations as Chuska, Zuni, Chimney Rock, and Tesuque.

Having established that the Chimney Rock Pueblo is likely to have been derived by colonization from Chaco Canyon, let us consider the social composition of these migrants. One line of evidence is the precise and detailed transference of masonry styles, architectural planning, and kiva construction from the towns of Chaco to the Chimney Rock Pueblo. As a rule, masons and architects are male members of most primitive societies and thus it seems reasonable to infer that at least some of the Chacoan colony were men. Further, since they had such minute knowledge of the ceremonial architecture, they probably were priests, who also carried religious customs and lore. Also the twin layout of two Chaco kivas (East and West Kivas) is consistent with the moiety ceremonial and governmental organization postulated by Vivian (see quotation above).

Now let us consider the evidence for the presence of female Chaco colonists, for if male activities were transferred during the migrant move, so should female-related behavior. The potters craft is generally a female-related industry in pre-wheel, agricultural societies and this evidence would be our most direct indication of the presence of Chacoan women. But at the Chimney Rock Pueblo the local ceramics all follow exactly the manufacturing and style traditions found across the entire mesa, High Mesa community as well as the other communities. I take this to mean either that the pottery found in 5AA83 was made there by local rather than foreign women or else that it was made by indigenous women elsewhere in the High Mesa community and imported to Chimney Rock Pueblo. In either case, the ceramics industry presents strong evidence that Chacoan women did *not* accompany the Chacoan men on their migration from their homeland. Instead, the immigrants seem to have been selectively males. If so, then they likely would have married local women, who would have manufactured local ceramic products.

Marrying in without disrupting local marriage customs, is most easily accomplished by males when the descent system is matrilineal. On the other hand, if the Chimney Rock marriage rules were patrilineal, the local lineages would have provided a competitive descent group which would have acted to discourage the acceptance of a group of foreign males.

Vivian has suggested that the A.D. 1130 to 1150 emigration by the general population was environmentally induced. If this view is accepted, then it is not unreasonable to suppose that 50 years earlier the agricultural base to support the Chacoan town-organized population had already begun to decline to the point that small colonizing groups of religious elite began to disperse to new locations. As part of this dispersal process, there may have been religious schisms which selectively affected the high status priests so that some members of this theocracy were forced into exile.

The reception of the priestly colony by the local Chimney Rock society seems to have been amicable enough since there is no sign of violence upon their arrival—only upon their departure as evidenced by burning of the building. This view is supported by the need for cooperation because of the proximity of the High Mesa community members as well as the need to share natural resources such as farmlands, timber, water, and game.

Certainly the commanding situation of the Chimney Rock Pueblo, located as it was upon the upper mesa and immediately adjacent to the Chimney Rock pinnacles, suggests that the colonizing inhabitants exerted a dominating influence on the remainder of the High Mesa community and perhaps on the entire indigenous population. Perhaps the local people accepted the Chaco variety of the Pueblo religion as practiced by the male immigrant priests, who then became the ceremonial leaders. The very location of 5AA83 high up near the base of the Chimney Rock pinnacles suggests an association between these two natural spires and the religious theme of the building. We know that the pinnacles were part of a shrine to the Twin War Gods according to the Taos Indians (Ellis 1969; Ellis and Brody 1964), and it may be that this attribution was first made in prehistoric times by the priests of 5AA83. Since there is no sign of warfare, trade, or other practical reason why the occupants of the Chimney Rock Pueblo should construct their home 1,000 feet above the canyon floor, a religious motivation to build and live up near the gods seems to be the most likely compelling motive for what was otherwise a difficult living arrangement.

EXCAVATIONS AT THE PARKING LOT SITE, 5AA86

Mound 3 of the Parking Lot Site was excavated in its entirety during the summers of 1970 and 1971 (Fig. 25). This set of structures was chosen because of the expectation of finding well-preserved masonry walls of a local type different from the Chacoan architecture at 5AA83 (Fig. 26). Some of the other specific research problems which were tackled through investigations at Mound 3 involved the recovery of well-controlled artifact assemblages, chronological evidence, and environmental specimens. I particularly wanted to know if the occupation at the Parking Lot Site was contemporary with that of the Chimney Rock Pueblo, a question which we were able to answer in the affirmative.

The results of our excavations in Mound 3 revealed three linked circular masonry rooms (Nos. 2, 3, and 4) backed by two other rectangular masonry rooms (Nos. 1 and 6) attached on the north side of the building complex (Fig. 26). One of these rooms (No. 1) was found to be over an earlier rectangular room (No. 5) (Fig. 27). In addition, incomplete evidence of two other thick-walled circular masonry rooms was partially exposed to the west (Rooms 7 and 8) in the swale between Mounds 3 and 4.

The three thick-walled, circular masonry Rooms 2, 3, and 4 form a linked series of habitation structures, the actual nucleus of the building. Because of the numbers and distributions of everyday artifacts, these rooms are thought to have been for domestic living purposes rather than functioning as kivas or ceremonial rooms. All three rooms have a central fire basin and ventilator system (shaft and tunnel). Two of the three rooms (Nos. 2 and 4) also have postholes in the floor. One room has a sub-rectangular ash pit (Room 4) and another a subfloor pit suitable for use as a pot rest (Room 3).

These rooms differ from the conventional Mesa Verde or Chaco style kivas in the lack of *sipapu*, bench, pilasters, loom holes, or keyhole recess. They further contrast with pit houses in being largely above ground as well as lacking deflector, partition wall, or bench. But because Rooms 2, 3, and 4 are circular structures rather than the more usual Pueblo II rectangular living rooms, they have been referred to as "above ground pit houses " (D. Breternitz, personal communication). This popular label aptly conveys the feeling of an architectural tradition of ancient heritage in the upper San Juan Basin where circular houses were common domestic residences from A.D. 400 to A.D. 1050 and later.

To the north and contiguous to circular living Rooms 2 and 3 lie two long rectangular masonry rooms (Nos. 1 and 6). Stratigraphically below Room 1 is an earlier, intentionally filled rectangular room (No. 5). The axis of these three rooms is east-west, and they are outfitted with such interior details as a metate bin with associated metate and manos as well as five or six slab-lined storage cists. Based on the lack of fire basins, their rectangular shape, thin rather than thick walls, milling equipment, and storage facilities, it is reasonable to suppose that Rooms 1, 5, and 6 were specialized for food processing and storage rather than for everyday living activities. In addition to architecture, other features making up the Parking Lot Site include a sheet of prehistoric trash which completely encircles Building 3 from which it was thrown. Other trash was dumped so as to intentionally fill Rooms 5 and 6.

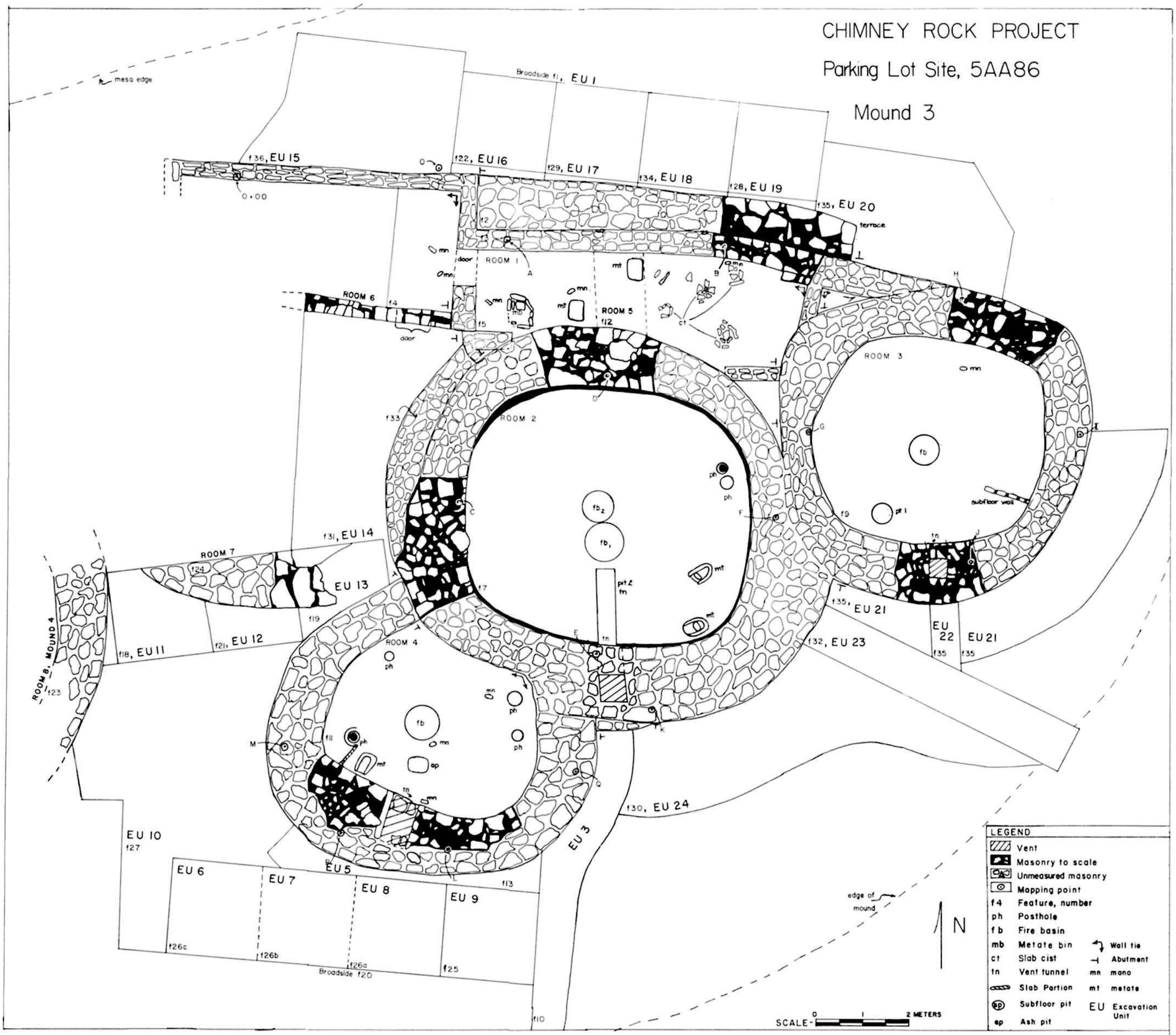


FIGURE 25. Plan of Building 3, 5AA86, showing the room arrangement and excavation units.

Dating of the Mound 3 deposits is based on (1) the stratigraphic order of construction and deposition, (2) the complex of time-sensitive ceramic types, and (3) a short series of low confidence tree-ring specimens. The relative stratigraphy is outlined in Table 21 in terms of five sequent sets of architectural and depositional events. This reconstruction, which is based on wall abutments and direct overlap of rooms and deposits, indicates that the core of the building was circular Room 3 with rectangular Room 5 attached. Occupants of this residential unit discarded trash over the area downslope and to the southwest of their living room. Judging from the abutment of Room 2 against 3, as well as the wall tie existing between Room 2 and 4, the latter two were built simultaneously after construction of Room 3. Because of the settling of the north wall of Room 5, this room was next filled with trash and a new storage and milling room (No. 1) built on a platform directly over it. This room adjoins Room 3 and overlaps Room 2. The final construction was the building of Room 6 which abuts the west end of Room 1. Although no more major building took place, evidence of continued occupation is revealed by the accumulation of trash both within and north of Room 6. Most likely at this time Room 2 was paved with a mud-plastered upper floor and a new fire basin was built. The ventilator tunnel was refurbished at this time also, and most likely the room was re-roofed. The timbers are tree-ring dated in the late 1000s.

The ceramics include a full range of painted, corrugated, and plain gray types principally assigned to the Pueblo II stage, which is dated at Chimney Rock between A.D. 925 and 1125. However, the ceramic complex lacks many of the Pueblo I pottery types found at other Chimney Rock sites suggesting a dating rather late in this age span; probably after A.D. 950 or 975. At the other end of the age range, the general lack of Pueblo III pottery types rather strongly suggests that the 5AA86 occupation did not extend any later than A.D. 1125. Corroboration for this ceramic dating is provided by the presence of a few Tusayan B/r trade sherds obtained from northeastern Arizona. This exotic type has been securely dated in its home setting between 1050 and the late 1200s, suggesting a late Pueblo II age range for the occupation of 5AA86. Considering both the local and exotic ceramics, I estimate that Mound 3 of the Parking Lot Site was

TABLE 21
Stratigraphic Sequence of Architectural Constructions and Depositional Layers at Mound 3, 5AA86

Order of Stratigraphic Events	Events
1. (early)	a. Construction of circular Room 3
	b. Probable construction of rectangular Room 5 (underlies Room 1)
	c. Accumulation of trash under Room 4
2.	Simultaneous construction of circular Rooms 2 and 4 (abut Room 3)
3.	Construction of rectangular Room 1 (abuts Room 3 and overlaps Room 2)
4.	Construction of rectangular Room 6 (abuts Room 1)
5. (late)	a. Accumulation of trash fill within abandoned Room 6
	b. Accumulation of trash outside of Room 6 (laps against wall)
	c. Construction of upper floor and associated upper fire basin (tree-ring dated late 1000s), Room 2

occupied between A.D. 950 and 1125. This age range overlaps that obtained from 5AA83 indicating that the two quite different sites were contemporary in their use.

Six tree-ring dates contribute confirming evidence for the ceramic dating (Table 22). All of the wood specimens are of poor quality for dating because of their highly eroded outer surfaces. However, the general agreement of the latest four dates (A.D. 1051 to 1078) matches well with the ceramic estimates. The two older tree-ring dates (A.D. 782 and 883) are most likely deadfall timber found lying on the forest floor.

One can speculate that Building 3 is a residence once occupied by an extended family of perhaps 9 to 15 people assuming one family of 3 to 5 persons living in each of the three circular living rooms. That these families were related is suggested by the proximity of the attached living rooms as well as the sharing of the two storage and milling rooms. Study of the wall abutments indicates that residence Room 3 was built first followed by the simultaneous construction of Rooms 2 and 4. This construction sequence makes sense if we posit a founding grandparental couple who begot children who in turn married and raised families in the second generation rooms.

EXCAVATIONS AT THE RAVINE SITE, 5AA88

5AA88 is a large village comprised of 19 masonry buildings dispersed along the northwest rim of the lower mesa at the head of the Chimney Rock ravine (Fig. 6). It lies southwest of the parking lot and site 5AA86 previously described. The Ravine Site, as well as all other excavated sites described here, is a member of the High Mesa Site Group, a settlement cluster of 16 sites on the highest portion of the Chimney Rock Mesa.

Investigations at Mounds 16 and 17 were conducted during the 1972 summer season under the field direction of Marcia Truell. The summary account of this work presented here has been taken from the preliminary field report to the Forest Service (Truell 1972), my own personal observations of this work made during the 1972 field season, and Truell's master's thesis dealing with the Ravine Site excavations (Truell 1975).

Attention was first drawn to 5AA88 because of the presence of an oversized crater-shaped mound (No. 17) which lies on a slope leading into the head of the Chimney Rock ravine. Based on the interior surface dimension of 40.0 feet, it was anticipated that Mound 17 contained a Great Kiva, an oversized community structure which could have served as the religious and social focal point for the integration of all community members of the many sites comprising the High Mesa settlement. Since it appeared to contain a unique ceremonial building in the High Mesa community, the mound was excavated in order to discover the nature of the building as well as to prepare it for stabilization and eventual display to the general public.

As an adjunct to the excavation of Mound 17, simultaneous excavations were also conducted in a nearby residential structure (Building 16) which lies some 41 feet to the north. Work at this multi-room building was justified for two

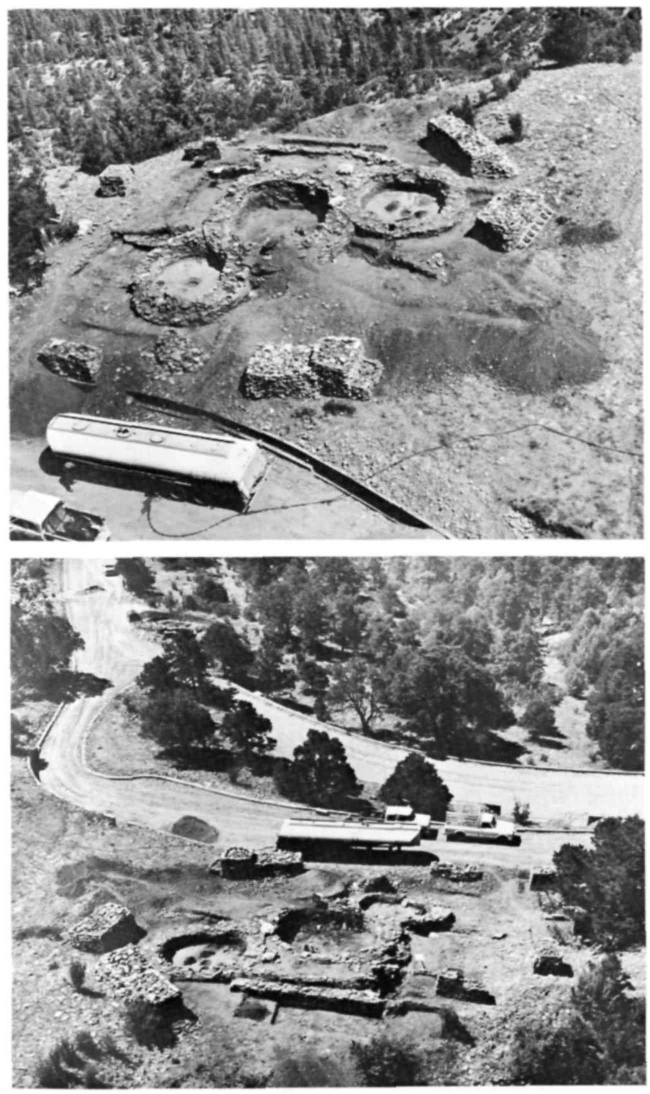


FIGURE 26. Views of the Parking Lot Site, 5AA86, taken from helicopter overflight. *Upper,* facing north showing the proximity of Mound 3 to the cliff edge. Square piles of rock have been removed from the excavations and stacked by the archaeologist. *Lower,* facing south showing Mound 3 with exterior paved terrace in the foreground. Recently constructed parking lot lies just beyond the ruin.

TABLE 22
Distribution of dated tree-ring specimens, 5AA86*

Laboratory of Tree-Ring Research No.	Field No.	Species	Dating Inside-Outside	Provenience	Remarks
CRE - 94	5AA86 -7-10	PP	918p - 1051v	Wall fall deposit within northwest quarter of Room 2	Fallen roofing timber
CRE - 101	-7-10	jun	749 - 782vv	Wall fall deposit within northeast quarter of Room 2	Fallen roofing timber
CRE - 109	-7-160	jun	731p - 883++vv	Pole Serving as lintel to ventilator tunnel of Room 2	
CRE - 110	-8-1	PP	1059 - 1078vv	Top of north wall, Room 2	Specimen may have fallen out of place from Room 1
CRE - 112	-12-3	fir	1005p - 1056vv	Intentional trash fill of Room 5 stratigraphically underlying floor of Room 1	Postdates use of Room 5 and predates Room 1
CRE - 113	-31-20	PP	1054 - 1072vv	Interior of Room 1 wall on southwest corner of structure and junction of Room 6 wall	Dates construction of Room 1

*See Table 18 for explanation of symbols.

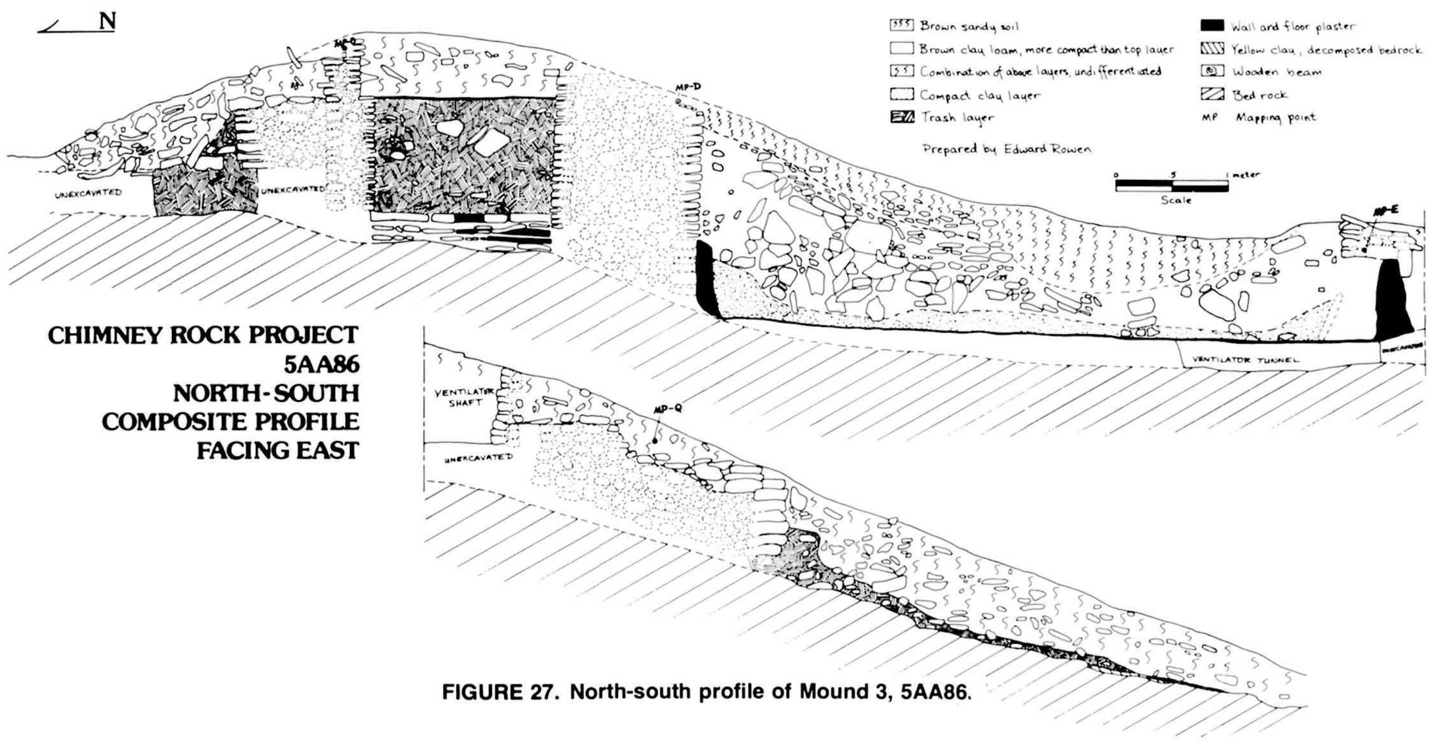


FIGURE 27. North-south profile of Mound 3, 5AA86.

reasons: (1) plans of additional structures are required in order to define the pattern of domestic architecture, and (2) the presence of holes left from the illegal digging of vandals displayed burned beams suitable for tree-ring dating as well as quantities of charred corn kernels.

Structure 17—The Great Kiva

When cleared, Mound 17 was found to contain the large intra-community ceremonial structure which had been expected from its surface remains (Fig. 28). This thick-walled masonry structure, with an interior diameter twice that of common domestic rooms, is not identical to the Great Kivas of the Mesa Verde and Chaco districts, but its size and interior details indicate it must certainly have functioned in an analogous fashion in the social organization of the High Mesa community (Vivian and Reiter 1960). Structure 17 is a large circular room containing 14 subfloor, rectangular cists laid out end to end around the east, south, and west interior perimeter and numbered clockwise from upper right by the excavator (Truell 1975: Fig. 20). Nine of these cists were covered at the time of excavation by large plank lids. Although virtually empty at the time of excavation, these features would have been suitable storage containers for perishable ceremonial costume and ritual paraphernalia. Although not precisely parallelled by any other known Great Kivas, at Aztec National Monument similar small rooms have been found concentrically arranged around the outside of a Great Kiva (Morris 1919). There is a further parallel between the cist arrangement within Structure 17 and the exterior layout of small rooms along the south and east sides of the East Kiva

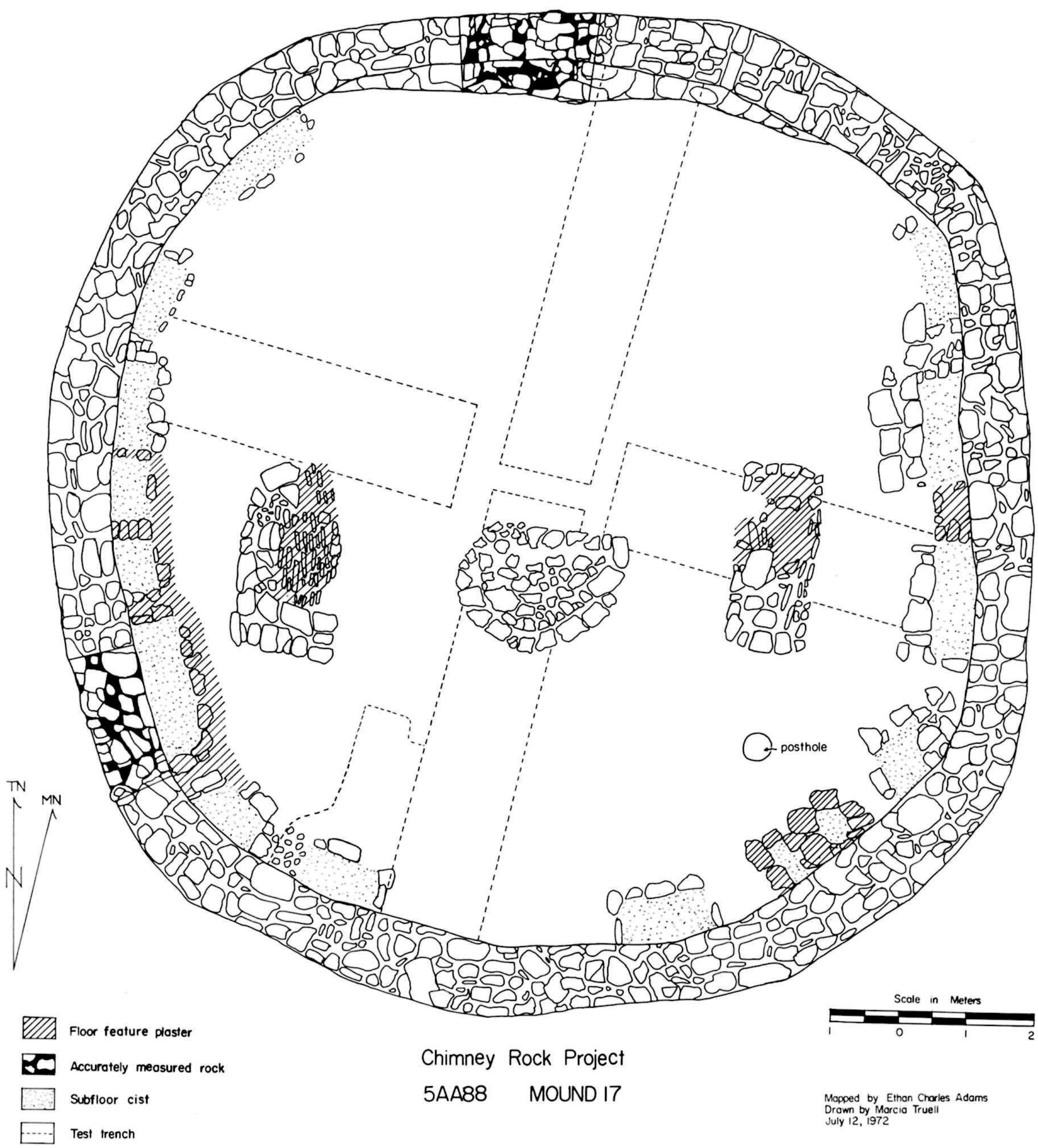


FIGURE 28. Plan of Structure 17, 5AA88.

at the Chimney Rock Pueblo.

Other interior architectural details found in Structure 17 include a narrow bench along the north interior wall, two subfloor vaults, and a central masonry altar. A thin deposit of burned roof fall (Layer 3) and a single posthole containing charred wood indicate that the structure was roofed, but the nature of this construction is not inferable in detail.

Building 16

Building 16 turned out to be very similar to the domestic architecture already described at the Parking Lot Site. Like that building, Building 16 at the Ravine Site is composed of an arrangement of a single circular living room (Room 2) backed on the upslope side by three small rectangular storage and milling rooms (Nos. 1, 4, and 3, Fig. 29). Rooms, 2, 3, and 4 had been intensely burned, while substructure Room 5 as well as mealing Room 1 had not been so destroyed.

Room 2, the circular domestic structure, has a thick masonry wall lined with a post-reinforced mud plaster wall. Patches of white and red paint adhere in spots to the inner surface of the wall. On the south side is a ventilator system composed of a vertical shaft and horizontal tunnel. A plaster-lined fire basin lies near the center of the room, and four upright roof-support posts, three of which are ringed with clay plaster collars, are laid out in a quadrilateral arrangement. Four shallow circular holes containing clean sand fill are in the northern portion of the room. Because of their size and shape, these depressions are thought to have served as rests for round-bottomed pottery vessels. The heavy roof fall (Layer 3), consisting of burned logs and baked construc-

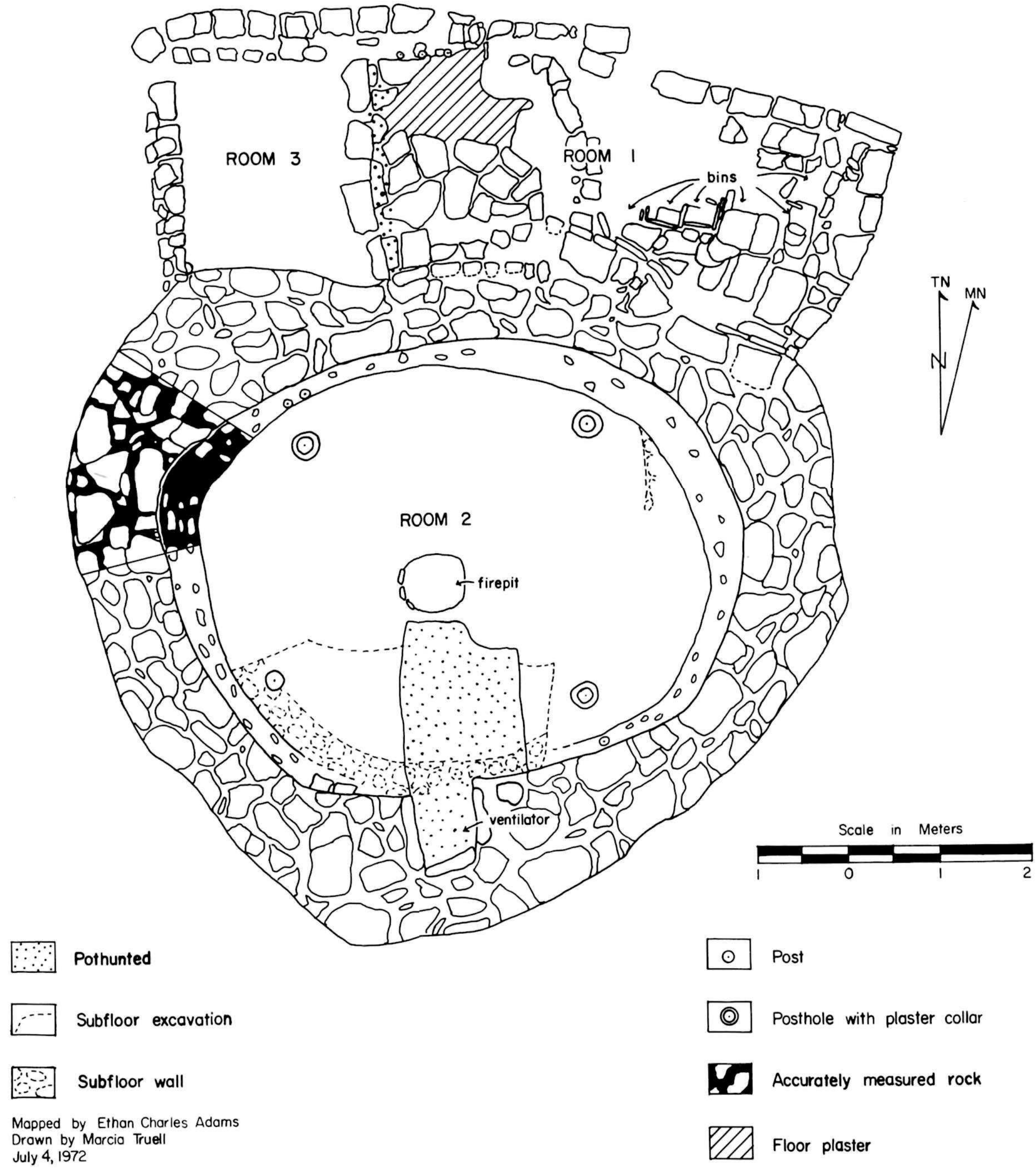


FIGURE 29. Plan showing room layout of Building 16, 5AA88.

tion clay, allowed Truell to reconstruct the roofing as a quadrilateral frame covered with a flat roof and enclosed on the sides with leaners inclined from the main crossbeams to the top of the building wall. Since no sidewall doorway was found, entrance into the room must have been by way of a ladder through the hypothetical roof smoke hole, an access route similar to that of circular rooms in the other excavated sites. Beneath Room 2 was found evidence of a stratigraphically earlier circular substructure (Room 5), but it was insufficiently cleared to allow description.

The east end of Room 1 had been used as a milling area to judge from the presence of five and possibly six slab-lined bins which once held metates. The storage function of Room 3 was amply supported by finding a subfloor cist (extreme southwest room corner) which was partially filled with charred maize and topped with a wooden plank lid. Additional storage found in this room include five large restorable corrugated jars which still contained charred maize kernels, beans, and wild plant seeds.

Artifact Industries

The artifacts recovered from the Ravine Site represent the only completely studied excavated collection available for comparison with the site survey material (see Portable Artifacts, Chapter II). Truell conducted a study of the artifacts in which she paid equal attention to the form and to the wear marks of the implement. Of particular importance was her examination under the microscope of utilized edges and surfaces, facilitated by micrograph photography (1975: Chap. 3). The data was reported in terms of four industries: ceramic, stone, bone, and wooden artifacts.

Building 16, the domestic residence, produced 1,175 pieces of pottery of which 2.8 percent is decorated white ware; 78.4 percent is soot covered open-mouthed corrugated jars; and 18.9 percent is smooth, gray, necked jars (ollas) (Truell 1975; Table 5). Of these sherds, one restorable group of five wide-mouthed corrugated jars were found on the floor of storage Room 3. These vessels, with capacities ranging between 16.0 and 23.8 dry liters, were found standing upright containing stored maize kernels, wild plant seeds, and beans (Truell 1975:79). On the floor near the jars were a clay plug and a shaped sandstone slab lid used to seal the vessels against rodents. One other restorable corrugated jar, of 13.0 dry liter capacity, was found on the floor of Room 2.

By comparison, the Great Kiva, Structure 17, produced 1,094 potsherds comprised of 6.8 percent decorated, 50.6 percent corrugated, and 42.7 percent plain gray pieces (Truell 1975: Table 5). This distribution compares with the plain gray water jar frequencies expected from Figure 10, whereas the Building 16 residence has a higher percentage of corrugated cooking and dry storage jars and a lower percentage of ollas.

Several clay vessels thought to be ritual objects are distinct from the utilitarian vessels. One is a double-spouted bifurcated miniature plain gray jar found on the floor of Room 2, Building 16. Another is a miniature corrugated jar with a high neck found on the floor of Room 3 in association with the large corrugated storage jars. Other objects are interpreted as prayer plume holders. One of these is a solid ball of sun-baked, brown clay with a thumb hole poked into it. Four other objects of sun-baked clay are more neatly finished. These prayer plume holders are rectangular with a curve in longitudinal section. Pressed into the clay are six holes, thought to have once held feathers. The objects were found as a set on the floor of Room 2, Building 16, where they may have been stored for ceremonial use on the Great Kiva altar. Truell (1975:98) has documented "the use of a similar object in the Walpi (a Hopi Pueblo) Flute ceremony where it rested on an altar with at least four projecting plumes (feathers)." Identical ritual objects were described by Jeancon (1922:27, Plate XIX) from his 1921 excavations in 5AA83. Excavations in 1970 and 1971 turned up another example from Room 8 (roof fall) of the Chimney Rock Pueblo as well as specimens from 5AA92.

The most common class of stone tools recovered are those manufactured by pecking and grinding: manos, metates, hafted side-notch axes, polishing stones, paint grinder, lap anvils, whetstone (grinding slab), and pot lids. The companion manos and metates were used to grind maize kernels and wild seeds into meal. Only one metate, a slab form, was found in Building 16, in a location near the mealing bins of Room 1. Presumably other metates once occupied the bins but were removed for use elsewhere when the mealing room was abandoned. Further support for the idea that the Room 1 bins were the sites of milling activities is the close association of four slightly worn sandstone manos. Another cluster of five very worn manos were found in a storage pile of tools east of the Room 2 ventilator shaft. Two other manos were found on the floor of Room 3 in Building 16.

Study of the bit wear on the three recovered axes indicated to Truell (1975:114) that two of the three had been used to split wood. Diagnostic wear from splitting had developed steep, thick blades with edge angles of 63 and 68 degrees. "Wear on these examples is on the back portion of the blade which Semenov (1964:129) describes as a result of the depth of penetration . . ." (Truell 1975:117). Supporting this interpretation are the many plank-impressed pieces of burned construction clay in Room 3 indicative of logs split lengthwise for the frame construction of the jacal superstructure (Truell 1975:47). Axes employed for splitting were found in sub-floor Cist 13 of the Great Kiva as well as on the floor of Room 2 (Building 16) in the southeast pile of tools. The third axe exhibits "a thinner, wedge-shaped profile with wear restricted to the front part of the bit" (Truell 1975:117). These attributes are thought to result from more general wood working such as making grooves and angles. This last axe head was found in the tool pile near the ventilator of Room 2. Since a sandstone file, or whetstone, was found in the Room 2 tool pile with the two worn axe heads, Truell (1975:117) reasoned that the axes had been placed there to be resharpened.

Six of the polishing stones are limestone cobbles showing extremely high polish from burnishing some soft, flexible material such as hides. All were found grouped in the ventilator tool pile of Room 2. Other polishing tools were made of small basalt and shale pebbles. The surface luster, crisscross wear striations revealed under the microscope, and the small size indicate that these were tools for smoothing and polishing ceramic vessels prior to firing. Three pebble pot polishers were found on the floor of Room 2, Building 16, while the fourth came from the fill of the Great Kiva.

A single paint grinder was made from a porphyry cobble. Multi-directional marks and red hematite (iron oxide) stains cover two slightly convex faces of the cobble, providing evidence of its use in grinding mineral paint. The patches of red paint on the interior wall of Room 2, where the grinding tool was found, gives good evidence that the mineral paint was prepared and applied on the spot. Since the ends of the cobble are battered, it seems reasonable to infer that hematite was broken down from larger chunks and powdered with the same implement (Truell 1975:130).

Lap anvils recovered from the Ravine Site are inferred to have been used like their modern analog—the kitchen cutting board. These large cobbles show wear of two kinds: a polish over the convex faces and crisscross cut marks. Given the size and weight of the implements, it is thought that they were used as work surfaces on which to cut flexible materials such as meat, hides, and/or vegetal materials. Some of the anvils had one or two small depressions pecked into their convex faces. These may have been used to hold nuts or other materials being crushed. Several of the larger anvils may have rested on the floor while the lighter ones could have been held on the lap. Two anvils were found in the ventilator tool pile on the floor of Room 2, Building 16, while the other two came from Rooms 1 and 4 of the same structure.

Five shaped sandstone slabs are thought to have been used to seal large-mouthed corrugated storage jars. The fragmentary lids were circular and thin. They were edge shaped by hammer percussion flaking. Three lids were found on the floor of Room 2, one on the floor of Room 3 (in association with the corrugated storage jars) and one in the fill of Room 2.

The chipped stone tools recovered from the Ravine Site were made almost entirely from stream cobbles collected and carried from the valley bottom to the mesa top. Once transported to the Ravine Site, the weathered cortex of the cobble cores was removed by direct hammer blows to produce thin, sharp-edged flakes which in turn were used for a variety of cutting and scraping purposes. Fully 61.7 percent of the waste flakes from this core reduction showed stream cobble cortex on their outer surface. Materials utilized in this fashion were sedimentary quartzite (66.0 percent), chert (17.6 percent), jasper (3.4 percent), chalcedony (0.7 percent), basalt (4.5 percent), granite (3.9 percent), metamorphic quartzite (2.1 percent), sandstone flakes (1.1 percent), quartz (0.6 percent), and miscellaneous (0.28 percent). Tools manufactured by percussion flaking include flake scrapers, gravers, choppers, hammerstones, projectile point, drill, and multiple-use artifacts.

Flakes classified as scrapers exhibit unifacial edge shearing thought to have been developed as the tool was pulled or dragged over material such as hides, flexible vegetal matter, and/or wood surfaces. In addition, a few of the 100 scrapers show edge polish over the pressure shearing, wear attributed to wood whittling according to Truell (1975:153).

Gravers are incising tools with the cutting point at the tip of a projection made either on a flake or core. The projecting tip is trimmed by retouch into one of two shapes, either a pointed tip or a chisel-shaped tip. These implements are commonly thought to have been used for gouging or grooving bone or wood or separating vegetal fibers such as those in yucca leaves. Support for this interpretation is provided by wear characteristics including pressure shearing along the upper spine of the graver projection as well as polish, illustrated by micrograph study (Truell 1975: Fig. 55). Most gravers were recovered from the fill of the Great Kiva; one came from the fill of Room 1, Building 16.

Five choppers show a bifacial percussion-manufactured cutting edge with use indicated by step fracturing of the bit. These tools are thought to have been used for heavy duty cutting such as severing plant parts and/or butchering game. Two choppers came from the Great Kiva while the other three are from Room 4, Building 16.

Stone hammers are similar to choppers in form but distinctive in wear attributes; a crushing and battering developed from impact against a hard, rigid material. Hammers were likely used in core reduction, percussion knapping other flaked tools, edge shaping pot lids, shaping masonry building blocks, and working metates and manos by pecking. By far the largest number of hammers (18 out of 26) were found in Room 4, Building 16, which Truell (1975:168, 186, Table 19) believes to have been a special percussion knapping work area. Supporting her contention was the discovery in this same room of a rejuvenation flake indicating hammer resharpening by percussion.

A single side-notched, broad spur projectile point was found on the modern surface just northeast of Building 16. The yellow jasper point was an arrow tip used in hunting. The general lack of points in Ravine Site excavations is in marked contrast to the relatively large number of arrow tips from the Parking Lot Site (5AA86) and to a lesser extent the Access Road Site (5AA92).

One drill bit was found in Room 2, Building 16. The chalcedony drill shaft, the tip of which is broken off, had been shaped and thinned to a convex cross section by pressure retouch. Lateral edge crushing from rotary use is evident near the tip break. The specimen was found in the roof fall layer of Room 2, Building 16.

The multiple-purpose tools, single stone implements which exhibit several uses, include (1) hammer/scrapers, (2) hammer/polishing stones, and (3) hammer/chopper polishing stones (Truell 1975: Table 21).

Unlike the other material categories, Truell (1975:173) did not study the bone and antler tool industry in detail. However, field examination indicates the presence of "6 or possibly 7 awls; 5 prepared antler tines; 2 polished wedge-shaped objects" (fleshers); 3 beads; 1 flat, polished, rectangular piece of antler; and several pieces of cut bone (1975:173). Harris has noted that most of the bone and antler is artiodactl (i.e., either elk, mule deer, or mountain sheep) (Harris in Truell 1975: Appendix B).

The only wooden artifacts found in the Ravine Site excavations are the covers for subfloor cists. Nine of the 14 cists in the Great Kiva as well as the single cist in the southwest corner of Room 3, Building 16, were still covered with charred wooden lids when found. Truell (1975:178) reports that the rectangular lids were made of Douglas fir and ponderosa pine planks one or two boards wide constructed in such a fashion that the wood grain ran lengthwise. Due to the burning, no lashing or other means of securing boards together could be discerned. When found, the planks were about 2 inches thick and sufficiently long to span the length of the cist (see Fig. 28 for dimensions). Given the problems involved in converting a cylindrical tree trunk into a wooden plank, it seems likely that the boards were split lengthwise using the hafted splitting axes. Planing of the board surface and shaping of the edges must have been accomplished with large flake scrapers and choppers. Final smoothing of the surface, now destroyed by fire, would have been possible with sandstone abraders.

Activity Areas

Two distinctive aspects of Truell's (1975:181) study of the Ravine Site are her emphasis on (1) the association of portable implements and (2) the relationship of portable objects to architectural context. By such an examination of artifact distribution, she was able to detect that each room in Building 16 served a somewhat different set of functions. For instance, Room 2, the living quarters, contained artifacts indicating cooking and food service. Further, a group of 28 tools piled in a kind of temporary storage between the wall and the southeastern roof support post close to the ventilator tunnel (1975: Table 24) are thought to have been used in (1) tool and house maintenance, (2) hide working, and (3) ritual practices. Elsewhere the room was relatively free of artifacts.

Behind and attached to the circular domestic residence is a line of three special function rectangular rooms. On the east end of the line Room 1 contains the six mealing bins. Associated with these fixed features are at least one of the metates which were formerly housed there as well as four unworn manos used in hand milling maize. Certainly Room 1 functioned as a food processing area. In addition, the presence of six hammers suggests that the milling tools were sharpened on the spot when the need arose.

The middle structure, Room 4, was distinctive in its artifact content because of the relatively large number of hammerstones present. A possible reason for the hammerstone concentration was percussion manufacture of stone tools at this location.

On the west end of the row is Room 3, a storehouse where shelled maize, beans, and wild seeds were kept in wide-mouthed corrugated jars as well as in the subfloor cist. In both cases the containers were carefully sealed against spoilage by rodents and/or dampness. Truell (1975:187) found evidence of stone knapping in the form of core reduction waste and pressure retouch with elk antler tines. Further, the presence of at least four mule deer bones and one elk bone bearing cut marks indicates some butchering within the room.

Chronology

An age estimate for the occupation of these two buildings is based on known age range of the pottery styles. Both structures yielded comparable pottery types of which the bulk are locally made Pueblo II styles. Because of this association, an age range of A.D. 925 to 1125 is assigned to the 5AA88 occupation. Support for this dating is given by a trade pottery type, Gallup Black-on-white, which is securely tree-ring dated in its home area between A.D. 1000 and 1125 (Fig. 24).

The 38 dated tree-ring specimens obtained from the two excavated structures at 5AA88 provide chronological data which are as significant as those obtained from Room 8 at 5AA83. Twenty-three dates were obtained from charred ponderosa pine and Douglas fir logs excavated from Room 2 in Building 16 (Table 23). These were almost all recovered from the burned roof fall or directly from floor contact of the upper structure. In addition, one specimen was part of the southwest roof support post (CRE-208). They range in age from 872vv to 1077r. Of the total of 15 that cluster at 1077, 10 are securely dated (indicated by the suffix "r," meaning that a portion of the outer ring is present). This data confidently places the construction of Room 2 as A.D. 1077, and most of the timbers with dates ranging from 1074vv back to 1030 ++ vv are probably also 1077 pieces with exterior ring erosion. On the other hand, two specimens with dates 898vv and 872vv are so much earlier that they are likely to have been either reused from earlier structures or more likely deadfall timber collected from the forest.

Fifteen wood specimens were dated from the Great Kiva, Structure 17 (Table 24). These charred ponderosa pine and Douglas fir timbers uniformly show outside ring erosion as indicated by "v" and "vv" suffix symbols. They range in age from 994vv to as late as 1084vv. These specimens indicate that the structure was roofed and that subfloor cist covers were installed sometime after A.D. 1084. But because of the general correspondence in age between these dates and those obtained from all other excavated structures, it is reasonable to suppose that the construction of Structure 17 was made not much later than A.D. 1084.

According to dendrochronologists J. Dean and W. Robinson (personal communication, 1974), most of the specimens with A.D. 1077 cutting dates had an incomplete outer growth ring indicating that the logs had been cut during the growing season, probably between June and July. This unexpected cutting season parallels the summer timbering inferred from the roof beams from Room 8, 5AA83, and demonstrates year-round residence on the mesa top with work parties taking time off from farming to cut and stockpile logs for fall house construction.

TABLE 23
Distribution of Dated Tree-Ring Specimens, Building 16, 5AA88*

CRE Lab No.	Field No.	Species	Dating Inside-Outside	Provenience
162	11-30	PP	844fp - 872vv	Room 2, wall fall
207	11-119a-b	PP	835p - 898vv	Room 2, roof fall
187	11-145	PP	892p - 1030++vv	Room 2, roof fall
186	11-144	DF	1028 - 1057vv	Room 2, roof fall
168	11-64a-c	DF	1015 - 1068vv	Room 2, floor
183	11-136	DF	1052p - 1073vv	Room 2, floor
199	11-167	PP	1054p - 1073vv	Room 2, roof fall
190	11-151	DF	1011p - 1074vv	Room 2, roof fall
170	11-69	DF	1010p - 1077vv	Room 2, floor
169	11-67	PP	1029p - 1077vv	Room 2, floor
192	11-157	PP	1050 - 1077vv	Room 2, floor
174	11-86	DF	1050p - 1077v	Room 2, floor
194	11-159	PP	1052p - 1077v	Room 2, floor
208	11-195a,b	PP	948p - 1077r	Room 2, floor; SW support post
195	11-160	PP	1028p - 1077r	Room 2, floor
193	11-158a-e	PP	1031p - 1077r	Room 2, floor
166	11-61a-c	DF	1032p - 1077r	Room 2, floor
205	11-173	PP	1037p - 1077r	Room 2, floor
185	11-127a,b	DF	1039p - 1077r	Room 2, floor
198	11-166	PP	1039 - 1077r	Room 2, floor
204	11-172	PP	1051p - 1077r	Room 2, floor
196	11-161	PP	1053p - 1077r	Room 2, floor
202	11-170	PP	1056p - 1077r	Room 2, floor

*See Table 18 for explanation of symbols.

TABLE 24
Distribution of Dated Tree-Ring Specimens, Structure 17, 5AA88*

Lab. of Tree-Ring Research No.	Field No.	Species	Dating Inside-Outside	Provenience
CRE-147	5AA88-4-9	PP	961fp - 1057vv	Wall fall
CRE-153	5AA88-5-13	PP	1022p - 1067vv	Wall fall
CRE-157	5AA88-9-19	DF	1040p - 1083vv	Floor contact
CRE-237	5AA88-22-3	DF	1023p - 1060vv	East foot drum
CRE-210	5AA88-12-4a.e	PP	905fp - 1033vv	Cist 2, cover
CRE-232	5AA88-18-1	PP	968fp - 1051vv	Cist 3, cover
CRE-234	5AA88-19-4	PP	986 - 1045vv	Cist 4, cover
CRE-245	5AA88-32-1	PP	1022fp - 1077vv	Cist 6, cover
CRE-224	5AA88-16-3	DF	997p - 1070v	Cist 8, cover
CRE-226	5AA88-17-1	PP	969fp - 1042vv	Cist 9, cover
CRE-225	5AA88-17-1	DF	1042 - 1080vv	Cist 9, cover
CRE-220	5AA88-15-4	DF	1051p - 1078vv	Cist 10, cover
CRE-215	5AA88-14-11	DF	1041p - 1072vv	Cist 11, cover
CRE-211	5AA88-14-6	PP	1011fp - 1084vv	Cist 11, cover
CRE-154	5AA88-5-24	PP	882fp - 994vv	Cist 12, cover

*See Table 18 for explanation of symbols.

SALVAGE EXCAVATIONS AT THE ACCESS ROAD SITE, 5AA92

The 13 to 15 crater-shape rubble mounds of 5AA92 form a staggered line extending north to south between the mesa rim and the east side of the Chimney Rock Ravine (Fig. 6). On

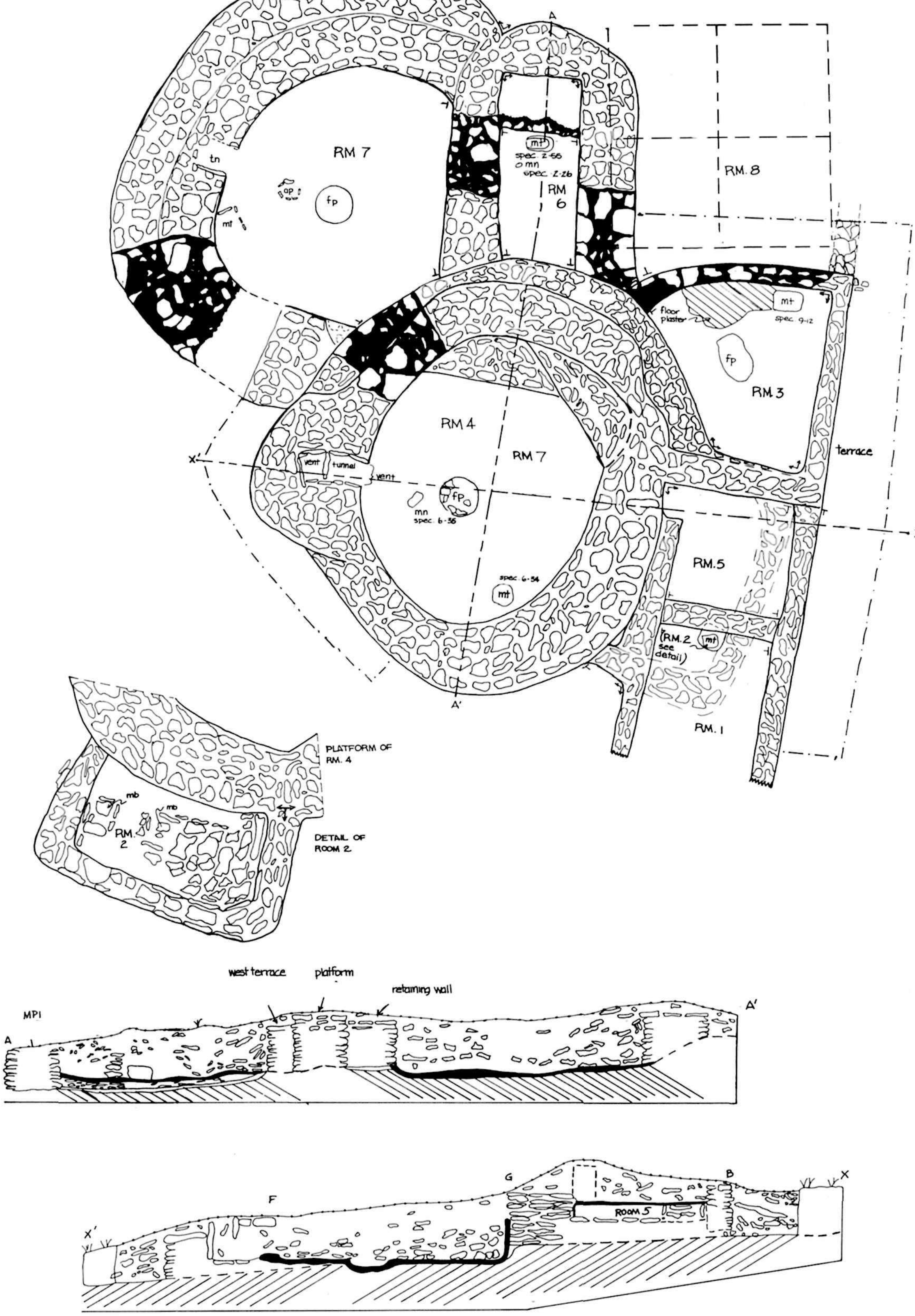


FIGURE 30. Plan showing room layout of Building 3, 5AA92.

site survey, these low mounds were arbitrarily numbered from north to south, Mound 3 appearing third from the upper end of the scattered line. Since the two recorded mounds located at the head of the line are questioned, it may be that Mound 3 is actually the lead structure in the dispersed site plan. To judge from the experience gained through excavation, each of these mounds contains a separate multi-room masonry building.

Once cleared, Mound 3 was found to contain an eight-room building, hereafter designated as Building 3 (Fig. 30). The nucleus of this architectural complex is a large circular living room (No. 4). Downslope to the southwest are two more attached lobate rooms (Nos. 6 and 7) while a line of small, burned, rectangular storerooms is joined on the upslope, north side. On the northwest corner of this building are the remains of an architectural unit thought to be a light frame construction sunshade or ramada designated Room 8. Below Rooms 1 and 2 lies another rectangular room (No. 5), which, as indicated by the presence of slab-lined metate bins, must have been a mealing room.

Circular Room 4 is a thick-walled masonry structure with a central fire basin and ventilator system (shaft and tunnel) on the south side. No postholes were present in the floor indicating a flat roof supported directly by the free-standing walls (Fig. 31a).

The second large circular living room is Room 7. It too has a clay-lined fire basin and ventilator system on about the same southern alignment as that of Room 4. In addition, Room 7 has a slab-lined ash pit between the fire basin and vent entrance as well as a floor-level metate bin next to the wall (Fig. 31b).

The third lobate room, Number 6, is divided into two portions by a north-south retaining wall. The west side was filled with burned roof fall and a single ritual artifact, a tiponi or corn mother fetish.

The three rectangular storerooms, Numbers 1, 2, and 3, have no postholes and therefore the roof must have been flat-lying timbers covered with mud and supported by the masonry walls. The rooms were found filled with burned construction clay derived from the burning of the roof. Uniformly distributed through the roof fall were quantities of charred maize kernels and beans thought to have been stored in bags hung from the ceiling rafters. The quantity of food suggests that the fire, which swept the back room row (Rooms 1, 2, 3, 6, and 8), took place in the fall or early winter following harvest time.

An unusual feature of Rooms 1 through 3 is the presence of unlined fire pits dug into the floor. Probably they were used on a temporary basis to warm and light the rooms during the winter.

Dating of Mound 3 is based on architectural stratigraphy, ceramics, and tree-ring assays. The first dating method, that based on room superposition and wall abutments, provides a relative sequence of building and renovation, beginning with the construction of circular Room 4 which was backed by a single rectangular room, Number 5 (Table 25). Next an exterior terrace was added around the west perimeter of Room 4 with the simultaneous construction of rectangular Rooms 3 and 8. A third building stage included Rooms 1, 2, 6 and 7. The progressive enlargement of both living and storage space is thought to be the result of the increasing size of the family. At peak size, this building would have housed from 6 to 10 people.

TABLE 25
Stratigraphic Sequence of Architectural Constructions at Mound 3, 5AA92

Order of Stratigraphic Events	Events
1. (early)	a. Construction of circular Room 4
	b. Simultaneous construction of rectangular Room 5
2.	a. Terrace added to the west exterior of Room 4 (abutment)
	b. Simultaneous construction of rectangular Room 3 (tied to Room 4 and the terrace)
	c. Simultaneous construction of ramada, Room 8 (tied to Room 3)
3.	a. Construction of combined rectangular room made up of Rooms 1 and 2 with an informal pit in the floor (overlies Room 5)
	b. Construction of lobate Rooms 6 and 7 (abuts terrace of Room 4)
4.	a. Partitioning of large retangular room to form two smaller rooms, Rooms 1 and 2; Partition wall overlaps and covers fire pit in floor
	b. A second and higher mud floor was paved in Room 6
5.	a. Wall collapse and partial filling of rooms including Room 7
6. (late)	a. Construction of a one-course crude stone wall in fill of Room 7
	b. Construction of a slab storage cist in fill of Room 7

A final occupational component is dated after the main building was destroyed. After Room 7 had filled by wall collapse, a brief reoccupation took place. This event was reflected in a single crude stone wall and a slab-lined cist erected over the northeast corner of Room 7. Associated with these remains of a light frame temporary structure are some late Chimney Rock Phase ceramics including Mesa Verde Corrugated vessels.

Ceramic styles recovered from the excavations in Building 3 include a preponderance of Pueblo II types but with a significant number of Pueblo I types. For this reason, it is dated earlier than 5AA86, with a beginning date of A.D. 925 and a destruction date of around A.D. 1100. Occupation of the temporary hut stratigraphically above Room 7 must have taken place just at the end of the Chimney Rock Phase about A.D. 1125.

Nine tree-ring dates ranging in age from 981 to 1087 are available from Mound 3 (Table 26). The specimens are of uniformly poor quality because of their eroded outer surfaces, but as a group they do provide some idea of the minimum terminal age of Building 3. The latest dates are the most useful and they indicate that minor renovations, such as the partition of a single rectangular room into Rooms 1 and 2 during the fourth construction stage of Building 3, were carried out no earlier than 1076 and 1087 (spec. CRE-131, 132). The true cutting dates, which are later than this age, indicate that this building is comparable in age to the latest construction at sites 5AA83 and 5AA86. At all three sites, the tree-ring assays date the latest construction and not the earliest.

TABLE 26
Distribution of Dated Tree-Ring Specimens, 5AA92*

Laboratory of Tree-Ring Research No.	Field No.	Species	Dating Inside - Outside	Provenience	Remarks
CRE - 128	5AA92-5-1	PP	972 - 1003v	Excavation Unit 5, trench exterior to lobate rooms, Nos. 6 and 7 at their junction, in outward wall fall	
CRE - 129	-5-2	PP	977 - 1040vv	Excavation Unit 5, trench exterior to lobate rooms, Nos. 6 and 7 at their junction, in outward wall fall	Spec. 5-1 and 5-2 found side by side
CRE - 132	-7-7	PP	1019 - 1076vv	Burned branch from fill of fire pit under partition wall dividing Rooms 1 and 2	
CRE - 131	-7-6	PP	1060p - 1087vv	Burned branch from fill of fire pit under partition wall dividing Rooms 1 and 2	
CRE - 136	-9-20	PP	1010 - 1057vv	Room 3, floor contact, northwest corner	
CRE - 139	-14-39	PP	946 - 981+vv	Ramada Room 8, contact with upper floor, southeast corner	
CRE - 140	-14-40	PP	916 - 982vv	Ramada Room 8, contact with upper floor, southeast corner	
CRE - 138	-14-36a, b	PP	911 - 1021vv	Ramada, Room 8, excavation level 6, roof fall	
CPE - 137	-14-31	PP	948p - 1073vv	Ramada, Room 8, excavation level 6, roof fall	

*See Table 18 for explanation of symbols.

FIGURE 31. Views of Building 3, 5AA92. *Upper,* completion of work at end of the 1970 field season showing rectangular Rooms 1 through 3 in foreground with circular Room 4 to the front. Note that east end of Room 1 has been destroyed by an old dirt road prior to salvage excavations. *Lower,* oblique aerial view of work under way in 1971 showing lobate Room 7 in the foreground and Room 6 beyond. The post-Building 3 slab cist can be seen in the center of the Room 7 fill. Construction of the modern access road has destroyed the remainder of the multi-room building.

IV. Environmental Studies

As an element of the archaeological studies, some funds were budgeted as part of each contract for environmental investigations. The purposes of such studies are threefold: (1) to reconstruct the environmental setting of prehistoric people, (2) to specify the nature of the natural resources available at the time of occupation, and (3) to discover changes in the past environment which could have affected the nature of the adaptation by people to their surroundings. In order to meet these goals, a generalized research design was employed. This plan consisted of two parts: study of the modern environment followed by investigation of the past.

DESCRIPTION OF THE MODERN ENVIRONMENT

The vegetation of the Chimney Rock Area was first described in detail by H.M. Schmoll in 1932 in an unpublished Ph.D. dissertation on file at the University of Chicago. Her ecological survey was initiated in 1924 while she was on the staff of the Colorado State Historical and Natural History Society and was directly stimulated by the archaeological research conducted in 1921 (Jeancon 1922). This plant reconnaissance was later supplemented by quantitative studies of the flora conducted during September 1931 (Schmoll 1932:2).

Schmoll (1932:15) found that the vegetation at Chimney Rock could be described in terms of two major life zones: the foothills or yellow pine zone and the upper sonoran or pinyon-juniper zone. The former is more characteristic of the mountains located to the north while the latter has its distributional center in the mesalands to the south at lower elevations along the San Juan River. Chimney Rock lies at the boundary of these two major plant distributions. In a normal distribution, the vegetation is zoned with yellow pine at higher elevations and with pinyon-juniper lower down. However, at Chimney Rock, Schmoll (1932:15) recognized a zonal reversal because the pinyon-juniper occupies the higher mesa top while the yellow pine is more common as continuous stands on the lower slopes. To explain this reversal, Schmoll (1932:15) posited that exposure and steepness of the slopes create local growing conditions which override the normal elevational effects of temperature and moisture.

> From observations in this region it is obvious that the south-facing slope has the warmest air, the greatest heat accumulating during the day, the least soil moisture, the lowest relative humidity, and the driest habitat; the west-facing slope is next in warmth of air and accumulated heat, and has slightly more soil moisture and a less dry habitat; then follow the east- and north-facing slopes with less heat and more moisture (Schmoll 1932:5).

For these reasons, the more xeric plants extend their distribution from the lower elevation mesalands up onto the southeast-facing mesa top at Chimney Rock. And the more mesic plants of the mountains are located at lower elevations on north-facing talus slopes at Chimney Rock.

Following Schmoll's work, Harris (1971) described the contemporary ecology of Chimney Rock in terms of five major habitats for plants and animals: (1) top of mesa (upper mesa of this study), (2) mesa or pinyon-juniper association (lower mesa of this study), (3) mountain shrub, (4) ponderosa pine-Douglas fir, and (5) riparian (Fig. 32). He characterizes each of these units in terms of the dominant plants as well as the associated minor floral species and animals. By way of conclusion, he analyzed this habitat mosaic for its resource potentials to sustain aboriginal Indian life. The archaeological sites are within what probably is the least productive of the natural areas, but other habitats are within easy range.* Potentially important amounts of plant food are available: pinyon nuts, juniper berries, and oak mast could produce many tons of high quality food within a few miles of the site in a good year. Numerous other plants known to be used by some Indian groups are available; though many must have been available only in restricted amounts, even these may have been important as sources of vitamins, as bulk for the diet, and for medicinal purposes (Harris 1971:12-13).

Of equal importance prehistorically would have been the mammals among which elk, deer, and rabbits occur in large numbers today, particularly as associates of the mountain shrub habitat. Harris believes that this plant association has been artifically expanded during historic times by lumbering and fire so that the food and materials potential of the prehistoric past may not have been quite as great as it is today. Important mammal resources common to other habitats are Abert squirrels and porcupines of the ponderosa pine-Douglas fir, as well as beaver of the riparian setting. In addition, small rodents are found everywhere in some number. Birds are also a major potential food resource, the greatest numbers and kinds of which are found along the streams.

STUDIES OF THE PREHISTORIC VEGETATION

Four separate investigations have been conducted on the Pueblo II age vegetation of Chimney Rock, two dealing with an analysis of pollen extracted from the mound deposits, one with the identification of charred plant parts, and a study based on animal bones.

1971 Pollen Study

Thirty soil samples were sent to Buge and Schoenwetter (Appendix B) for pollen extraction, identification, and interpretation. Of these, 6 modern and 10 prehistoric samples yielded useful results. The modern pinch samples provide a correlation between the pollen rain and the vegetation habitat from which they were obtained (Table 27). Sample 3, obtained from a Douglas fir stand, yielded an adjusted arboreal pollen (AP) count (85.5 percent of pollen sum after removal of the economic types, disturbed ground indicators, and riparian plants, Buge and Schoenwetter, Appendix B), indicating the most mesic growing conditions. The prehistoric samples compared much more closely with modern samples from drier sites such as collecting Station 2 with a preponderance of grass and sparse pinyon-juniper trees nearby. However, at two time periods, A.D. 950 and 1050, the percentages of oak increased, yielding a more mesic pollen spectrum which appeared most like that from collecting Station 4, a mountain shrub habitat that Buge and Schoenwetter called oak savanna.

Analysis of the prehistoric samples yielded three kinds of conclusions: (1) dating, (2) vegetation reconstruction, and (3) identification of economic pollen types. The preliminary archaeological age estimates were ordered by comparing the indicated moisture interpretations with the regional Colorado plateau climatic chronology (Schoenwetter 1970). At the time the archaeological dates for the pollen samples were supplied, the final chronological analysis of the mounds had

*This statement refers principally to the High Mesa Site Group located in the mesa or pinyon-juniper habitat. It does not refer to the other major prehistoric population centers at the North and South Piedra Site Groups which are found in the ponderosa pine habitat.

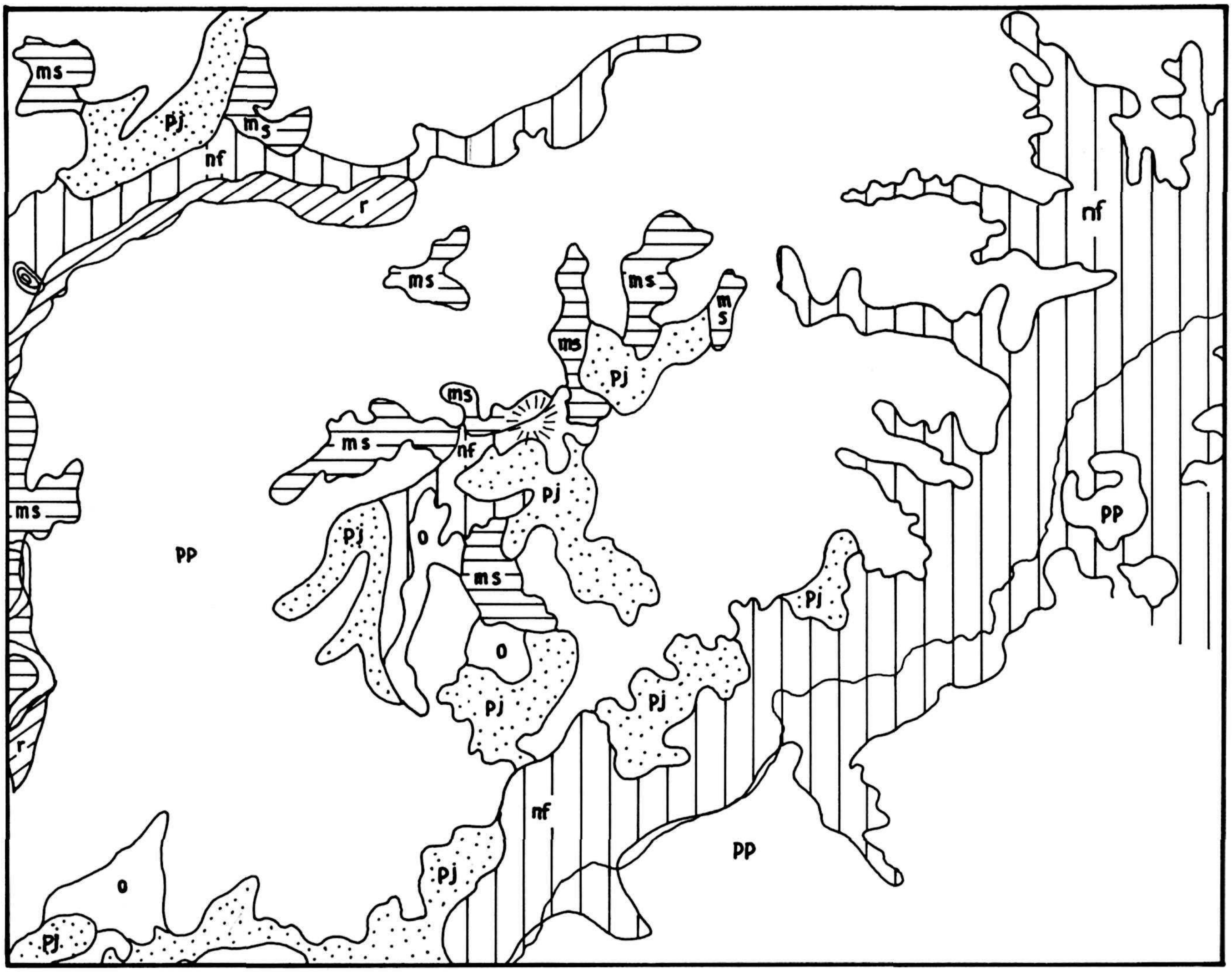


FIGURE 32. Vegetational map of the Chimney Rock District. Abbreviations are: MS, mountain shrub; PJ, pinyon-juniper; PP, Ponderosa pine, Douglas fir; NF (non-forest), grass, rock, cultivated land; R, riparian; and O, other. Adapted from a map by the Forest Service, U.S. Department of Agriculture (Harris, 1971).

TABLE 27
Six Modern Pollen Surface Samples and the Vegetation Habitat of Their Collection Stations
(Buge and Schoenwetter, Appendix B)

Sample No.	Percent Adjusted AP	Vegetation habitat	Collection location	Remarks
Station 1	86.0	Pinyon-juniper	Near head of lower mesa; lower end of site 5AA92	
Station 2	79.5	Grass with sparse pinyon-juniper	Xeric east-facing talus slope just below mesa rim facing into the Stollsteimer Valley	Most prehistoric samples like Station 2
Station 3	87.5	Douglas fir	Northwest facing talus slope below mesa rim and causeway; facing into Devils and Piedra Valleys	Most mesic conditions
Station 4	77.0	Mountain shrub (oak dominant)	Farther down talus slope below Station 3	During moist intervals, prehistoric samples look like Station 4, oak shrub
Station 5	85.5	Ponderosa pine	High terrace above Devils Creek Northwest of Chimney Rock Mesa	
5AA86-25-12	75.5	Sparse pinyon-juniper with Douglas fir nearby	Mound 2 surface, 5AA86, near base of causeway at head of lower mesa	Quite similar to Station 2 in pollen distribution

not been completed and therefore the original estimates have since been somewhat revised. The proposed pollen dates developed by Buge and Schoenwetter are shown in column six of Table 28 while the revised archaeological dates are listed in column eight of the same chart. In general, there is quite close agreement with the exceptions of samples 5AA83-2-37, 5AA92-9-6 and 9-7. In all three cases, tree-ring dates obtained since the work of Buge and Schoenwetter have led to chronological revisions.

Despite the minor changes, the general picture of the vegetation landscape and its history has not been seriously altered. Buge and Schoenwetter (Appendix B) believe that "in general, all of the fossil samples indicate conditions to have been drier during the Chimney Rock Phase. . . ." This conclusion is based on the general prehistoric reduction in tree pollen frequencies (38.5 to 65.0 percent) compared to the modern surface samples (75.5 to 87.5 percent). Thus, all the habitats were much less dense than they are today and probably the more mesic habitats were smaller. Furthermore, there is a general trend of reduction of tree pollen percentages through time with the mesic samples dating around A.D. 950 and the xeric about A.D. 1100. As the tree pollen declined, it was replaced by an increase in grass pollen. The earliest tree cover immediately around sites 5AA92 and 86 was dominated by oak shrubbery like modern collection Station 4, and these conditions were reintroduced only once at 5AA86 around A.D. 1050-1090. Otherwise, there is far more grass in the record than is found today, yielding a floral composition which looks most like xeric modern collecting Station 2 (Table 33).

Harris (personal communication) has suggested a somewhat different interpretation for the episodic oak increases. He believes the extent of oak-dominated mountain shrub habitat, which today favors the more mesic north-facing talus slopes, to be largely controlled by forest fires. In this interpretation, the oak is an early stage of a successional sequence which climaxes in the ponderosa pine-Douglas fir cover. If true, then the infrequent oak intervals appearing in the pollen records of the High Mesa settlement reflect periodic burning of the ground cover in the vicinity of the prehistoric sites.

But whether the oak shrubbery is principally controlled by climate, fires, or even clearing by man, the net effect, according to Harris, is to increase the forage and cover for the aboriginally important elk, deer, and rabbit.

Fossil pollen types of potential economic importance to the Chimney Rock Indians are shown to the right of the double line of Figure 33. These identifications, among which are maize, beeweed, prickly pear cactus, cattail, a member of the *Leguminosae* family, and a member of the parsley family, reflect both maize agriculture and gathering of wild plant products from several vegetation zones.

1974 Pollen Study

The modern pollen rain was monitored by Short (in Truell 1975) as a comparative baseline by which to interpret the prehistoric vegetation. However, instead of using surface pinch samples of soil, she employed 18 pollen traps dispersed according to the different plant associations defined by Schmoll (1932). The homemade traps consisted of a pot scraper set in a plastic cup one-third full of antifreeze. Each of nine stations were equipped with two such collecting devices wired to a metal rod, one near ground level and a second three feet off the ground. In general the results were useful in that the trapped pollen rain did reflect the immediately surrounding vegetation with the exception of the riparian (cottonwood-willow) station (Short 1975: Table 4). However, the adjusted arboreal pollen frequencies, calculated after the procedures of Buge and Schoenwetter, did not exhibit uniformly high tree pollen values comparable to the pinch sample results shown in Table 33, but instead varied erratically within range of 15.2 to 73.0 percent of the

TABLE 28

Ten Prehistoric Pollen Samples Showing Their Indicated Vegetation Habitats and Climatic Implications. The Samples are Chronologically Ordered From Early to Late (Bottom to Top of Page Respectively) (Buge and Schoenwetter, Appendix B)

Sample No.	Report Provenience	Percent Adjusted AP Frequency	Vegetation Dominant	Climate	Proposed Pollen Dates	Remarks	Revised Archaeo. Dates
5AA86-7-161	Fill of upper Fire Basin 1, Room 2	38.5	—	dry	A.D. 1090-1100	Tree-ring dated late 1000s	ca 1100
5AA86-22-45	Top of exterior trash, EU 16	41.0	—	dry	—	—	ca 1100
5AA83-2-37	Fill between upper and lower floors, East Kiva	42.0	—	dry	—	Tree-ring dated A.D. 1093	1093
5AA86-22-44	Middle of exterior trash, EU 16	46.5	oak, Sta. 4	?	—	Stratigraphically underlies spec. 22-45	ca 1090
5AA92-9-6	Roof fall at floor contact, Room 3	51.5	grass, Sta. 2	dry	A.D. 950-1000	Tree-ring dated 1050s.	1050s +?
5AA92-9-7	Floor plaster, Room 3	46.0	grass, Sta. 2	dry	—	Tree-ring dated 1050s	1050s +?
5AA86-4-47	Interior trash lying just above floor, Room 6	60.0	—	moist	A.D. 1050-70	Later than Rooms 6 and 5	ca 1050
5AA86-12-13	Fill between upper and middle floors, Room 5	49.5	—	dry	—	Stratigraphically earlier than Room 6	ca 950
5AA86-11-62	Exterior trash from under Room 4	63.5	oak, Sta. 4	moist	A.D. 1050-70	Better dated A.D. 940-950	940-50
5AA92-6-27	Floor plaster, Room 4	65.0	oak, Sta. 4	moist	A.D. 940-50	Stratigraphically earlier than Room 3.	925

TABLE 29
Distribution of Tree Wood Identifications by Site*

Tree species	5AA83 No.	5AA83 Percent	5AA86 No.	5AA86 Percent	5AA88 No	5AA88 Percent	5AA92 No.	5AA92 Percent	Total No.	Total Percent
Ponderosa pine (P. ponderosa)	49	64.48	26	70.27	24	63.16	14	93.33	113	68.07
Douglas fir (Pseudotsuga)	11	14.47	1	2.70	14	36.84	—	—	26	15.66
True fir (Abies)	7	9.21	1	2.70	—	—	—	—	8	4.82
Juniper (Juniperus spp)	6	7.89	7	18.92	—	—	—	—	13	7.83
Aspen (Populus)	3	3.95	—	—	—	—	—	—	3	1.81
Populus sp.	—	—	—	—	—	—	1	6.67	1	0.60
Non-conifer	—	—	1	2.70	—	—	—	—	1	0.60
Unknown	—	—	1	2.70	—	—	—	—	1	0.60
	76	100.0	37	99.99	38	100.0	15	100.0	166	100.29

*Identifications made on all wood specimens submitted to the University of Arizona Laboratory of Tree-Ring Research.

adjusted pollen sum (Short 1975: Appendix III). Short explains this discrepancy as due to the large amounts of nonarboreal pollen introduced into the traps by insects. Since it is airborne rather than insect-transported pollen which normally is preserved in the soil and in archaeological site matrices, the trap data may not be useful in interpreting the prehistoric samples although it is of value in understanding the total modern pollen rain of the Chimney Rock District.

Thirty-two pollen samples were collected from the Ravine Site at the time of excavation of which just nine had 50 or more grains per slide thereby warranting interpretive consideration (Short 1975: Appendix I). Of these, only two could be related directly to the archaeological deposits and thus dated. One of these was obtained from the Great Kiva, Structure 17, and the other from below the floor of Room 2 at Building 16.

Following Buge and Schoenwetter (Appendix B), I interpret the low percentage of prehistoric tree-pollen frequencies of 24.7 and 34.6 percent as indicating a reduced tree cover compared to the dense pinyon pine woods of today whether measured by means of the pollen traps (67.8, 73.0 percent adjusted AP) or by means of surface soil samples (76.1, 84.7 percent adjusted AP) monitored on site 5AA88 (Short 1975: Appendix III). This lower prehistoric tree density, Buge and Schoenwetter reason, is best explained by a dry climate with less total annual rainfall than occurs at Chimney Rock today. Thus the climatic results of the 5AA88 prehistoric pollen study independently verify the pollen research conducted at sites 5AA83, 5AA86, and 5AA92.

One of the prehistoric samples, 5AA88-13-8, was obtained from the bottom of Cist 1 in the floor of Structure 17, the Great Kiva. Analysis of its pollen content is indicative of cultural practices according to Short (1975:8). In addition to undifferentiated pine pollen, she recovered the highest recorded percentages of ragweed (*Ambrosia*) as well as some sunflower (long-spined Compositae) pollen. One interpretation is that "the high NAP represents use of the cist to store plant material for food or ceremonial use" (Short 1974:8).

Tucson Wood Identifications

One hundred sixty-six wood specimens were submitted to the Tucson laboratories of which all but one was identified as to species (Table 29). Since the bulk of the datable specimens were from the late 1000s, the majority of the wood identifications can be assigned to this interval also.

Inspection of Table 29 shows that most of the trees, which were used as architectural roofing, are ponderosa pine (68.07 percent of the total) with fewer numbers of Douglas fir, true fir, juniper, and a very few non-conifers. Most of the Douglas fir was found at just two sites: the Chimney Rock Pueblo and the Ravine Site. Today a stand of Douglas fir occupies a north-facing talus slope just below 5AA83 and it seems likely that the construction timbers were cut at that spot during the summer (June-July) of A.D. 1093. The high percentage of Douglas fir (36.84 percent of total) at 5AA88 can be accounted for only by positing a somewhat longer journey for timber in A.D. 1077. Today a stand of ponderosa pine with some Douglas fir is found some 0.6 straight-line miles down the Chimney Rock Ravine at a bend in the canyon.

An unusual statistic is the presence of 18.92 percent juniper wood at the Parking Lot Site (5AA86). Today the natural vegetation of site 5AA86 is quite xeric, favoring grass and scattered junipers, and this situation appears to have persisted from the prehistoric past (see surface sample 5AA86-25-12; Table 27).

W. Robinson (personal communication) is not able to help us directly with a climatic interpretation of the dendrospecimens because "most all of the trees are just too young to be reliable climatic recorders." He writes:

> We prefer at least 100-year-old trees if possible, and you can see from the inside dates that they were rare from Chimney Rock. But look at the species. Plenty of (Ponderosa) pine, some Douglas-fir, some real fir (*Abies* sp), a little juniper, and less Aspen. Even assuming some cultural preference for pine, you are faced with a

picture of fairly extensive groves of young pine (Ponderosa since no pinon was identified) with some mature seed trees. This basically sounds more mesic than what you have today (Robinson, personal communication).

Although Robinson does not elaborate, I take his forest reconstruction to mean that the young and rapidly growing Ponderosa Pine forests were colonizing (i.e. seeding and expanding) as a result of ample wintertime precipitation; principally in the form of snow pack (Fritts 1972:96). To reconcile the apparent discrepancies between the pollen and the dendroclimatic conclusions, I suggest that the total annual precipitation during the Chimney Rock Phase was lower than the present-day 17.89 inches (State Turkey Experimental Farm record) but that a relatively large proportion fell during the winter when it is most efficient for use by plants since evapo-transpiration rates are lower at this season. This winter-dominant seasonal pattern is also found today when 58.5 percent of the recorded annual moisture falls between October and March. An even greater increase in the winter seasonality could favor the seeding and rapid growth of the young Ponderosa in the past but still keep the overall tree density low compared to that of today. I admit that I am not wholly satisfied with this reconstruction but I have nothing else to offer at the moment.

Michigan Plant Identifications

While the large construction timbers were sent to the Tree-Ring Laboratory at Tucson for dating and wood identification, the smaller pieces of twig-size charcoal, generally unsuitable for dating, were shipped to the Ethnobotanical Laboratories at the University of Michigan Anthropology Museum for species determination. In addition, cultigens, particularly maize kernels and beans, were analyzed by the Michigan ethnobotanists Minnis and Ford (see Appendix C). Their general conclusions are as follows:

(1) Pinyon (1.53 percent) and Juniper (3.14 percent all specimens) were virtually absent in the 11th century, being replaced by Ponderosa pine (65-70 percent) on the Mesa top. Surprisingly, even the percentage of Douglas fir (4.92 percent) is low although present on shaded north-facing slopes today. This finding could indicate more mesic conditions than today with a general pattern of a higher life zone being depressed. On the other hand, the tree-ring specialists say that ponderosa pine growth is controlled by winter snowpack.

(2) A second conclusion is that mountain shrub association is common, especially on the mesa top. This may mean that many fallow maize fields were undergoing succession. On the other hand, Harris points to this phenomenon as evidence of forest fires. In fact the two conclusions may not be seriously in conflict. In a discussion of this point, Ford and Minnis (personal communication, 1976) state that "Fire would be an excellent field clearing technique. To distinguish between natural and man-initiated causes would be difficult. However, it would seem intuitively correct to assume that field clearing fires would be more localized (that is maintained). Crown fires (which would account for vegetation change) would be more random in extent, assuming that isolated lightning strikes are not important. If this is correct, then one would expect a closer correlation in the amount of charcoal of northfacing slope trees (*Pseudotsuga*) and south-facing slope trees (*Pinus ponderosa*). In reality the difference is great 66%-5%."

(3) The third finding is that archaeological sites of the mesa top, contrary to Harris, are located in the most productive area based on the common presence of six taxa of edible wild plants: choke cherry, yucca, cholla/cactus, snowberry, service berry, and Indian rice-grass. However, if the mesa top were then ponderosa-pine covered, his statement, which pertains to the high terrace sites along the Piedra River, would in fact also apply to the mesa top during the eleventh century.

(4) A fourth conclusion relates to the hypothesis of environmental marginality of the high altitude Chimney Rock location. This hypothesis predicts heterogeneity in the bean and maize populations as expressed phenotypically in kernel measurements and their standard deviations. In fact Minnis and Ford conclude the null hypothesis must be accepted for both cultigens since the variance is quite small, reflecting a homogeneous population of both cultivated plants. So Chimney Rock was an optimum rather than marginal place for eleventh century Pueblo farmers to grow their crops. The general absence of sucker (tiller) stalks and maize nubbin ears is supporting evidence for this conclusion of optimum environment.

(5) A fifth conclusion verifies observations made in the field to the effect that there are very many maize kernels and few cobs. Hence the cobs were shelled at the field location, and kernels only were transported to storage rooms in dwellings.

(6) The final conclusion relates to wood uses. The major construction timbers (uprights and "viga" crosspieces) were generally ponderosa pine, as was the common firewood. Small shrubs, on the other hand, were used for roof matting and firewood tinder.

There is apparently a contradiction between these findings and pollen, tree-ring, and wildlife studies. The low AP/NAP pollen ratio is taken to mean that the ponderosa forest was thinned under the effects of drought (low total annual precipitation compared to today's 17 inches). In contrast, the tree-ring species and small-diameter specimens led Robinson to conclude that the forest was vigorous in colonizing (many young trees, he says), seemingly in opposition to the drought hypothesis of Buge and Schoenwetter. Harris concurs with Robinson, pointing to the presence of a set of four high altitude animals although he admits they could have been carried in by Indian hunters. Nevertheless, he favors (weakly) a winter dominant precipitation pattern which is compatible with the tree-ring data and seemingly out of phase with the drought hypothesis. However, when Harris subsequently analyzed the fauna from the 1/16-inch mesh screening, he found a surprising number of burned kangaroo rats which he used as xeric indicators in the Navajo Reservoir study (Harris 1963 a, b). He seems much less impressed with this data at Chimney Rock, arguing that sheep grazing accounts for the fact that kangaroo rats are now not found farther north than Blanco, New Mexico, which is certainly hot, dry country today. The Minnis-Ford data emphasizing the presence of ponderosa pine forest on the mesa top at the expense of pinyon-juniper again favors the Harris-Robinson hypothesis of more winter snowpack in seeming opposition to Buge-Schoenwetter. In support is a small relict stand of ponderosa found today right up on the mesa surface away from the canyon rims and surrounded by pinyon-juniper.

STUDIES OF THE PREHISTORIC WILDLIFE

More than 3,000 bone specimens were identified from sites 5AA83, 86, 88, and 92 yielding 304 identified individuals ranging over 34 taxa (Table 30). Conclusions drawn from this study cover such topics as hunting strategies, habitats exploited, climatic evidence, resource utilization, and occupational seasonality (Harris, Appendix A). Examination of the faunal lists obtained from each site demonstrates two different hunting patterns. Those animals recovered from site 5AA86 show a preponderance (78.8 percent) of small creatures of which cottontail (13.3 percent) and jack rabbit (6.0 percent) were probably taken by trap or thrown missiles while the high percentage of porcupine (16.1 percent) could be accounted for by simply clubbing the animal to death during the spring mating season. Similarly such slow game as snakes, lizards, and the many rodents were easily captured.

In contrast is the second hunting pattern found at sites 5AA83, 88, and 92 in which the majority (52.8 to 63.3 percent of total) of the animals slain were big game such as mule deer, elk, and to a lesser extent mountain sheep.

Harris (Appendix A) explains these differences as a result of divergent hunting strategies. Occupants of the Parking Lot Site garnered every available animal. Since most of these animals are either slow game or animals of a size suitable for trapping, it is likely that men, women, and children all engaged in their pursuit with much of the meat harvest made near home. Harris concludes that the "smaller game has several advantages over larger, including an amount of meat consumable before spoilage, an ease of capture . . . and, frequently, greater availability" (Harris: Appendix A).

In contrast to this scrounging pattern of exploitation is the less diversified strategy practiced at the other three sites, where most of the animal bones were from big game artiodactyl. Of these, deer and some elk frequent the mesa today and presumably could have been slain in the vicinity of the sites, especially on the north-facing talus slopes where the mountain shrub habitat is most prevalent as a forage area. However, hunting of the mountain sheep, and to a lesser extent elk, must have involved organized hunting trips into the higher San Juan Mountains to the north of Chimney Rock where, particularly during the summer, they would have been much more common. On the basis of ethnographic knowledge of contemporary hunting societies, it is much more likely that these mountain hunting trips away from home were conducted by adult males without participation by women and children.

There are several hypotheses for the different hunting strategies. The pattern of the Parking Lot Site residents which favors rabbits, porcupine, and rodents implies starvation conditions created by some upset in the normal subsistence regime. Economic stress might have been created by a low agricultural income compared to the more affluent economies of sites 5AA83, 88, and 92 where the recovery of stored maize and beans was high, and large game was favored over the smaller creatures to produce a well-rounded, balanced diet.

A second conclusion made by Harris (Appendix A) concerns the range of animal habitats exploited. Although most of the animals in Table 30 thrive today in the mosaic of habitats within a stone's throw of the High Mesa settlement, a few others would have required more extensive journeys. Among these more distant resource locations are the valley streams (fish, beaver, muskrat, and otter), sagebrush terraces bordering the Piedra Valley (jackrabbits), and montane forests (grouse, red squirrel, golden-mantled ground squirrel, and yellow-bellied marmot).

As an alternative hypothesis to the idea that hunting parties journeyed into the mountains to the north for the small montane animals is the explanation advanced by Harris (Appendix A) that there may have been a minor climatic change favoring a southward shift in the normal distribution of these animals. None of these montane animals are of a size to entice the expenditure of much effort in their recovery, a consideration which tips the balance in favor of a climatic hypothesis. Harris envisions a precipitation regime favoring slightly more winter moisture than occurs today. This explanation not only would account for the presence of small montane animals but would, he says, promote an increase in the extent of the sagebrush flats and thereby also account for the high recovery of jackrabbits, which are not common at Chimney Rock today. Although Harris considers this climatic thesis to be weak, it does agree with the tree-species interpretation of Robinson (see Wood Identifications).

The winter-season thesis based on the four small mesic indicators was developed in 1971 from the recovery of bones from the ¼-inch mesh screen. However, in a subsequent report Harris identified still more skeletal material including that recovered from 5AA86 with the 1/16-inch sieve. This work produced evidence of Ord's kangaroo rat (*Dipodomys ordi*), an unexpected xeric indicator.

Harris suggests two alternative explanations for the prehistoric kangaroo rat appearance at Chimney Rock. One possibility is that sheep and goats in modern times have eradicated the grass and forb habitat favored by the kangaroo rat thus artificially forcing its distribution far to the south. His second but less favored hypothesis is that drought conditions sometime after A.D. 1050 forced the withdrawal of the species from the Chimney Rock area. I tend to favor the latter thesis since if grazing were the principal factor affecting the recent kangaroo rat distribution, then the quantity of stock around Blanco should have had an adverse effect equal to that postulated for the Navajo Reservoir and Chimney Rock areas.

The two sets of climatic conclusions, then, can be integrated by postulating a slight increase in winter precipitation and snowfall over today's conditions to account for the southward extension of the mesic montane animals while at the same time that the total annual precipitation was decreased to produce a drought as suggested by the presence of the xeric tolerant kangaroo rat.

Another set of conclusions reached by Harris (Appendix A) deal with the fauna viewed as resources. The long list of carnivores, he believes, were principally sought for their fur rather than as food. Today such furs play an important part in ceremonial costumes and pouches. Other animals such as fish, birds, cottontails, jack rabbits, red squirrel, marmot, beaver, muskrat, porcupine, American elk, mule deer, and mountain sheep were more likely utilized both for food and for fur or hides. Further, he reasons that certain animals are conspicuous for their infrequent use, for instance fish, reptiles, and birds. These animals, which certainly were amply present in the prehistoric environment, are characteristically ignored today and particularly the use of fish is covered by a prohibitive taboo among many southwestern Indians.

A final question which Harris was asked dealt with the evidence which the faunal analysis could bring to bear on the seasonality of site occupation. He reasoned that human occupants of all four sites were in residence on a year-round basis because of the seasonal availability of certain animal resources. For instance, spring occupancy is indicated by the presence in the archaeological deposits of immature deer bones. Support for this interpretation is provided by the presence of ground squirrels and marmots, both of which hibernate and are therefore available only during the spring and summer seasons. Elk remains complete the seasonal cycle, since local hunting of some elk is likely to have taken place during the winter when the snow pack drives these animals down out the high mountains where they spend the summer. For these reasons, the sites of the High Mesa community are known to have been inhabited year-round.

V. Conclusions: A Definition of the Chimney Rock Phase

As a means of drawing together the many different kinds of cultural and natural information discussed here, I will conclude by defining an archaeological culture—the Chimney Rock Phase. This newly formulated scientific unit will be presented as much as possible in terms of peoples' lives with emphasis on the twin problems they were faced with daily: the problem of human organization and the problem of coping with an environment which at times may be bountiful but is frequently unpredictable. The Chimney Rock lifeway will be presented in terms of five topics: settlement, population, community organization, resource exploitation, and cultural ecology.

SETTLEMENT

A prehistoric settlement can be thought of as the patterned manner in which man disposes himself over the landscape (Willey 1953). Its archaeological manifestation is chiefly in the form of architectural remains, that is, (1) types of architectural structures, (2) associations of structures within archaeological sites, and (3) clusters of sites, named here as site groups (Trigger 1968).

Five kinds of architecture were defined from their surface remains as observed on site survey: (1) circular masonry rooms, (2) rectangular masonry rooms, (3) pueblos or multiple room gridded masonry buildings, (4) pit houses, and (5) jacal or rectangular surface rooms made of mud-covered wood framing. Of these, excavation in the High Mesa Site Group has revealed the interior details of only the first three architectural types; study of pit house depressions and the jacal houses must await future investigations. Clearing of house mounds in sites 5AA84, 86, 88, and 92 revealed that the thick-walled circular masonry rooms were domestic residences. These were found either singly (5AA84, 88) or attached in sets of three (5AA86, 92). Upslope and behind these living rooms are lines of two to three rectangular rooms, the interior features of which indicate they were used for food storage and grain milling. Excavations in the Chimney Rock Pueblo cleared an example of another kind of architecture, a large gridded building combining storage, living, and ceremonial rooms.

Most architectural sites are internally organized in an irregular, dispersed pattern along a linear axis dictated by topography. This open, spaced kind of settlement distribution is termed rancheria in the American Southwest. In contrast to the linear settlement organization are a few sites located along the Piedra River where rectangular courtyard subunits of gridded masonry pueblos appear within large villages.

At Chimney Rock, individual archaeological sites tend to be associated as part of seven named aggregates or clusters which form significant localities of prehistoric occupation. It is thought that these site groupings reflect the settlement of eleventh century communities. Each site group community is distinctive in its architectural composition and locational strategy although all members did practice a basically similar cultural pattern termed the Chimney Rock Phase. Taken together, the seven named groups account for 74 sites or about 81.3 percent of the total recorded in the site survey inventory. Eighteen sites were found in isolated positions with no obvious spatial affiliation within any community cluster. Some of the isolated sites are thought to reflect homesteaders who were actively colonizing new terrain, while other isolated sites show no surface evidence of architectural remains and are therefore interpreted as temporary campsites. They were probably occupied by farmers and/or hunters who seasonally dispersed from the formal communities to exploit special natural resources such as floodplain soils for agriculture or some local wild game or plant food resource.

POPULATION

Estimates of the Chimney Rock population size were based on two family-size constants, of three and five persons, multiplied by the number of mounds containing buildings. In the case of multi-roomed pueblos, of which there are 26, a rough estimate of the number of interior rooms was made. These calculations led to a minimum and maximum set of figures of between 1,215 to 2,025 people for the Chimney Rock tribe. In terms of the total research district, this computes to a density of 198.5 to 330.0 people per square mile.

The largest community, the Northern Piedra Group, contained between 624 and 1,040 people, while the smallest, the East Slope settlement, had between 21 and 35. Another comparison is to contrast the population of the upland communities located along the eastern rim of the mesa (354-585) with that in the communities on the high terraces near the lowlands by the Piedra River (705-1,175). This comparison indicates that the Piedra River communities exceeded the mesa-top population by nearly 100 percent. This difference can be explained by the greater agricultural potential of floodwater farming along the Piedra River-Devils Creek confluence compared to the lower potential of akchin farming in the Stollsteimer Valley.

COMMUNITY ORGANIZATION

Social integration of the various settlement clusters was determined by an analysis of the various kinds of habitation units with attention paid to the manner in which they were combined into larger sets. This analysis rests on the premise that the small single room houses were domiciles for individual families. Multi-room buildings held extended families, and structures as large as the Villages contained a lineage or social unit made up of several related extended families. Extending this interpretation of the settlement hierarchy and its residential meaning to still larger units indicates that the site groups would have housed multiple lineages and that community integration was obtained by cross-lineage religious activities conducted in the Great Kivas.

RESOURCE EXPLOITATION AND INDUSTRIAL UTILIZATION

The Chimney Rock Research District consists of six square miles; the habitation sites, however, were concentrated in one square mile. The remaining area was relatively devoid of architectural sites. It is this largely unoccupied area between site group settlements which was exploited for resources to satisfy the biological needs of the Indians. Study of artifacts found on the sites suggests that the land was systematically exploited for a variety of materials and foods. For instance, several kinds of soils probably were utilized for farming: alluvial bottomlands along the perennial streams, deep soils found on Pleistocene terraces, outwash pediment soils at the mouths of ravines, and to a lesser extent, thin, rocky, residual upland soils of the mesa top.

Other resources include water, most of which seems to have been hauled from the valley-bottom streams to the upland sites. Use of clay involved the Lewis Formation shales employed for pottery making and the reddish-brown mesa-top soil for house construction. Vessels manufactured were plain gray necked jars for water storage, open-mouthed corrugated jars for cooking, and decorated black-on-white bowls for food service. Other clay objects found are ritual fetishes and plugs for sealing small-mouthed jars and baskets.

Sandstone was used in the uplands in house construction and tools (metates, manos, slab covers for pots and entryways). Lower elevation sites more frequently employed cobbles in architectural construction.

Stone was also used for knapping materials in the manufacture of various flaked tools. Judging from the cores and debris from this industrial activity, the stone was cobbles collected from the Pleistocene high terraces and/or the modern river channels. Materials obtained in this way were quartzites, chert, basalt, agate, various igneous rocks, jasper, and chalcedony. Minor quantities of flaking stone were also collected from siltstone stringers occurring in the Lewis shale, and, rarely, obsidian was imported from a source on the east side of Wolf Creek pass (Warr, personal communication). Tools produced were arrow tips, knife blades, drill tips, scrapers, axes, choppers, lap anvils, and hammers.

The roster of organic resources includes the various plant and animal products. Timber used in roof construction was mostly ponderosa pine although lesser amounts of Douglas fir, true fir, juniper, and aspen were employed. Interestingly, although the pollen record indicates that pinyon pine and oak were locally available, neither were identified as construction wood. Plants utilized for food and/or medicine include beeweed, prickly pear cactus, cattail, a member of the *Leguminosae* family, a member of the parsley family, chokecherry, service berry, snow berry, cholla cactus, banana yucca, Indian rice grass, and lambsquarter. Other twig-size wood identifications indicate use of hawthorn, mountain mahogany, mountain maple, narrow-leaf cottonwood, and skunkbrush. Vegetal artifacts manufactured include coiled baskets, rope, and plank lids for storage pits. Both the pollen study and identification of the macro-plant remains indicate the use, in addition to wild products, of maize and bean cultigens. Both domesticates were found in charred condition in the rectangular storage rooms where the fall harvest had been stored in a variety of facilities including plugged corrugated jars, coiled baskets, sealed subfloor storage pits, and bags hung from the room rafters.

Analysis of the food refuse bones indicates that a wide range of mammals were obtained for fur, hides, meat, ligaments, bone, and antler. Calculations of the meat yield suggest that the large hooved animals, particularly mule deer, supplied over 90 percent of the harvest, although an important secondary exploitive pattern was recognized at the Parking Lot Site where three-quarters of the game animals were small to medium size creatures rather than big game. Bone and antler were important for the manufacture of flaking tools, polishers, scrapers, beads, and awls.

Most of the diversity in this data can be drawn together into two land use patterns: (1) exploitation of the pinyon-juniper habitat of the mesa top and (2) use of the ponderosa pine habitat at lower elevations between the mesa rim and the Piedra River. Mesa-top settlements were more dispersed, contained fewer people, practiced seasonal movements for farming and big game hunting, hauled water, and infrequently used riparian resources. In contrast, the Piedra River settlements in the ponderosa pine habitat tend to be organized more compactly around plazas and with greater use of Great Kivas; they contained more people, did not have to practice seasonal movement for farming, did not have to haul water any distance from the river, and had greater access to riparian resources. However, their hunting strategies will not be known until one or more sites are excavated.

CULTURAL ECOLOGY

The term "cultural ecology" refers to the study of human-environment interactions. Through this approach to archaeological data, we attempt to understand not only the natural setting of a people but the manner in which they adapted to the special stresses of nature.

Most of the environmental stresses which created a need for adaptive responses at Chimney Rock revolve around seasonal and annual variations in the temperature and precipitation regimes. Such climatic factors are often of an unpredictable nature requiring a massive technical response not only to the mean average values but, more important, to the extreme conditions. Technical response to extremes is evidenced in two fashions: agricultural practices and architectural design (Eddy 1973).

Temperature stresses express themselves as a short growing season, severe winter cold, and cold air drainage and shading. There is no direct evidence of the length of the frostless season extant from the prehistoric past. But information on the present growing season suggests that the prehistoric maize farmer would always have to select field site and seed corn with regard to the first and last killing frost as well as the length of time required to bring the crop to maturity. Schmoll (1932:12) provides modern data on the length of the frostless season obtained from nearby meteorological stations in Pagosa Springs and Ignacio, Colorado, the former showing 75 days and the latter 105 days. My interpretation is that Chimney Rock would be most like the Pagosa Springs record because of the similarity in elevation (7,108 ft.), topography, and proximity (approximately 20 miles). Based on these comparisons, an extrapolated growing season for

Chimney Rock today is probably about 80 days, a period which is just about adequate to mature aboriginal maize in an average year although fluctuations from year to year would cause occasional loss. In order to offset unpredictable frosts, it is likely that early plantings were made on open, southeast-facing slopes which Schmoll (1932:15) describes as being most xeric. In this fashion, the farmer could combat both late spring and early fall freezes and artificially extend the growing season. That such practices were actually followed prehistorically is supported by our finding campsites concentrated in two southeast-facing localities: one in the Stollsteimer Site Group and the other in the lower end of the East Slope Group. Probably these camps were temporary residence for High Mesa farmers who lived by their fields during the summer.

Severe winter cold is another temperature factor to which they must have adapted. A modern (1945-1960) mean temperature record for the Chimney Rock vicinity, available from the State Turkey Experimental Farm (U.S. Department of Agriculture, Weather Bureau), shows an annual average of 44.6°F, with nine months above freezing. The month-to-month values are quite comparable to those Schmoll (1932: Table 1) reproduces from Pagosa Springs, where the minimum extremes were also measured. At Pagosa Springs, the average annual minimum temperature is well below freezing and only the four summer months of June, July, August, and September have minimums above freezing. The lowest subzero temperatures recorded are -35°F in January and -39°F in February, but the temperature may fall below freezing every month of the year. It is these extreme temperature conditions which would have required the selection of especially warm growing sites and well-insulated houses. The architectural design features for the circular living rooms which may be an adaptation to the average and extreme monthly minimums are (1) extra-thick walls greater than three feet, (2) interior fireplace for warming the room, (3) presence of ventilator for escape of smoke, and (4) massed, contiguous rooms in some buildings to increase total insulation (Eddy 1973:17).

A final temperature factor affecting local human adaptation to the environment is cold air drainage and shading. Schmoll (1932:10), from a comparative study of the Pagosa Springs and Ignacio meteorological data, concludes that:

> A study of the curve for the mean monthly maximum of each of these zones shows a temperature inversion in which the temperature is 2 to 3 degrees higher in the yellow pine zone than in the pinyon-juniper zone for the months of January to April, and that the temperatures for April and November coincide. This inversion of temperature, which means that the temperature increases locally with altitude instead of decreases, is explained by Robbins (1917) as follows: "as a result of air drainage, the valleys and canyon bottoms are cooler than the adjacent hillsides." He states that this is a common phenomenon in the mountains and occurs in spring and autumn (Schmoll 1932:10).

Cold air, being heavier than warm, tends to sink or subside into the topographic lows. In order to avoid this cold air lake, the prehistoric settlements were built on upland terrain well above the chilled air mass. This can be demonstrated by the High Mesa Site Group situated some 600 to 1,000 feet above the valley floor. But even the elevation of the two lowest communities shows a decided avoidance of cold-air drainage by being located on high terraces (third through fifth levels) from 141 to 237 feet above the modern floodplain rather than on other terrain options (first and second level) much closer to the river bottom (Eddy 1973:17).

The precipitation pattern to which the prehistoric people had to respond involves a winter-dominant rainfall pattern, a low total annual rainfall, and highly unpredictable year-to-year rainfall. Botanical and, to a lesser extent, faunal studies indicate that the modern-day winter-dominant precipitation pattern was even more prominent during the eleventh century. The incidence of polar frontal storms with associated snow and rain would have been even greater than today. This seasonal aspect of the climate would have provided certain advantages to prehistoric man. For instance, an increase in the snowpack would have supplied ample upland water storage in the spring and fall so that portage of drinking water would have been necessary only in the summer months. Snow lingering on the north-facing slopes could have been used to mix the large quantities of mud mortar necessary for architectural masonry, fully half of which is mortar rather than rock. At the same time, the low evaporation rate of the melting snow, allowing more efficient water storage in the soil, would have favored much more of the mesic vegetation such as Douglas fir and true fir (*Abies* sp) than the one or two trees which Schmoll and Harris have observed at Chimney Rock today. Further, the high soil moisture is advantageous for early spring planting and germination of the maize crop. The ample surface runoff in the spring would have facilitated akchin farming at the mouths of ravines, dry farming of terraces and even of upland mesa-top soils, and agriculture along the banks of perennial streams in the valley bottoms.

Less total annual rainfall, on the other hand, which is strongly suggested by the pollen study, must mean fewer summer thunderstorms, particularly in July and August. This is the season the prehistoric farmers would have needed moisture to mature their crops and fill out the ears. Thus any decline below the August average monthly rainfall value of 2.15 inches would have been a serious threat to the security of the harvest. Perhaps this is why the Chimney Rock farmers employed dry-tolerant beans as a supplement to maize rather than squash which had been coupled with maize during Pueblo I times along the San Juan River.

Another way in which an end-of-summer drought could have been handled is by late planting some fields on north-facing slopes which, although more subject to freezing, do provide greater soil moisture storage throughout the growing season. I would imagine, however, that this kind of field site would be high risk and thus low priority in allocating seed.

The final precipitation stress factor is the highly variable year-to-year rainfall. Although the 16-year State Turkey Experimental Farm record averages 17.89 inches, there are extreme departures from this mean. By coincidence, the maximum and minimum records are from sequent years, an abnormally high 31.67 inches in 1957 and an unusually low 11.14 inches in 1958. To cope with such divergences in the prehistoric past, I have postulated that the farmers practiced a strategy of mixing field locations, taking advantage of the special moisture and temperature potential inherent in a number of slope, exposure, runoff, and soil types. In this fashion, some fields would always produce a crop whether a given year was abnormally above or below the running mean precipitation values.

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APPENDIX A

FAUNAL REMAINS FROM CHIMNEY ROCK MESA

by

ARTHUR H. HARRIS

Some 34 vertebrate taxa have been identified from the Chimney Rock archaeological bones (Table 30). Many of the remains are from occupational levels, but a large proportion is from deposits post-dating occupation. An early problem concerned treatment of the post-occupational-level material. A variety of reasons have led me to include most of this material with that from the occupied levels. Many of the bones, for example, show evidences of association with man (burns, cuts, shaping) and thus definitely are derived from the aboriginal habitation. The sheer numbers of bones also imply this, for the chances of such an accumulation by agencies other than man are nil under the conditions at the sites (absence of archaeological evidence of other prehistoric groups leaves only historic man to worry about). It also is obvious by inspection of frequencies that there is no statistically significant difference between the occupational and post-occupational faunal remains.

All faunal remains, then, have received preliminary interpretation as being man-related with the following exceptions: surface bones; bone specifically noted as intrusive or likely intrusive by the excavators; and the few human remains, which have been excluded from frequency calculations on the basis that such were not utilized in the sense that other faunal elements were and that the sample is highly biased by deliberate removal of most human elements by the excavators.

The minimum possible number of individuals has been calculated by using the feature (excavation unit) as a basic unit. Thus a right and a left humerus from the same feature would be taken as indicative of one individual; however, a right humerus from one feature and a left from a different feature would count as two individuals. The implicit assumption that there is scattering within a feature but not between features obviously is not always correct, but seems to introduce as little bias as any practical interpretation and less than many (for further comments, see Harris, 1963b).

In calculating minimum possible individuals, queried identifications have not been included, but identifications considered probable—but not certain—have.

A minimum of 217 individuals was identified from 5AA86, 36 from 5AA83, 30 from 5AA88, and 21 from 5AA92. As may be seen from Table 30, definite differences occur between 5AA83 and 5AA86. The samples from 5AA88 and 5AA92 are too small to allow much certainty in comparisons, but appear to be most similar to 5AA83.

Major differences between 5AA86 and the remaining sites lie in the frequencies with which the rabbits (*Sylvilagus* and *Lepus*), porcupine (*Erethizon dorsatum*) and artiodactyls (*Cervus canadensis, Odocoileus hemionus,* and *Ovis canadensis*) appear. Other differences seemingly could be explained by differences in sample size and sampling error. The likelihood of bias makes the use of statistical tests somewhat shaky (Harris 1963b), but does give a somewhat more objective basis than opinion along. χ^2 tests between the two groups of sites on the rabbit, porcupine, and artiodactyl data give low probabilities ($p = 0.005$) that identical groups are being sampled. Smaller differences, such as seen between the *Neotoma* samples, are not significant (in the *Neotoma* case, $p => 0.90$).

Several possibilities to account for the differences exist. Possibly the degenerating houses served as denning areas for porcupines and rabbits after abandonment. Although this cannot be entirely ruled out, it does seem improbable since porcupine remains from at least seven features show evidence of association with man by having been burned or by displaying cut marks. Likewise, although cottontail rabbits frequently utilize burrows, jackrabbits seldom do.

Climatic conditions being different at the two sites is ruled out by the sympatry in both time and space. More difficult to rule out is differential preservation and/or recovery. Since artiodactyl bones are relatively large and heavy, they tend to preserve well and are easy to recover. Thus differential loss of smaller bones would artifically inflate the apparent frequency of artiodactyl bones. However, differential preservation is not noticeable in the laboratory; some extremely fragile material has been preserved, and the rather heavy-boned porcupine shows no tendency toward increased numbers in 5AA83.

The most likely cause of most of the displayed differences lies in the cultural attributes. It would appear likely that people of the two contemporaneous sites were utilizing different meat gathering strategies. Nearly 80 percent of the faunal material from 5AA86 is non-artiodactyl and thus represents relatively small animals; less than 45 percent from 5AA83, 5AA88 and 5AA92 falls into this category. It appears that the 5AA86 inhabitants were more opportunistic or that there was some deliberate attempt to gather the (likely) more easily harvested smaller animals.

Both groups utilized areas away from the immediate vicinity to some extent. Since fish, beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and otter (*Lutra canadensis*) are expected only in river and stream valleys, they represent forays to the Piedra, Stollsteimer, or Devils Creek Valleys. Assuming little or no climatic change, *Lepus* remains likely represent hunting along sagebrush terraces bordering the Piedra Valley to the south of Chimney Rock. It is not impossible, however, that black-tailed jackrabbit (*Lepus californicus*) occurred in sparse numbers in the pinyon-juniper woodland on Chimney Rock Mesa or along the flats bordering Stollsteimer Creek to the east of the mesa (there is a recent sight report of its presence in the latter area).

Grouse, red squirrel (*Tamiasciurus hudsonicus*), golden-mantled ground squirrel (*Spermophilus lateralis*), and yellow-bellied marmot (*Marmota flaviventris*) were noted in this study only somewhat farther north. However, the marmot occurs farther south in the drainage, in New Mexico (Harris 1963a), and the ground squirrel would have to shift its range only slightly to reach the Chimney Rock area. Red squirrels in the Southwest are pretty much limited to spruce-fir forest areas; the habitat in the most mesic areas adjacent to the sites seems somewhat too xeric. Past presence of more firs in the area (William Robinson, letter to F. W. Eddy) may indicate conditions sufficiently mesic to entice red squirrels into the area; otherwise, a several-mile trip to the north is indicated.

Data directly bearing on climate are few. As mentioned above, a slightly more mesic habitat may be represented by presence of several animals in the recovered fauna; however,

TABLE 30
Minimum Numbers of Individuals Identified From the Four Chimney Rock Sites and Percentages of the Site Fauna by Taxon

Scientific Name (Common Name)	5AA83	5AA86	5AA88	5AA92	Total
Fish	1 (2.8)	7 (3.2)	-	-	8 (2.6)
Lizard	-	1 (0.5)	-	-	1 (0.3)
Snake	-	3 (1.4)	-	-	3 (1.0)
?Meleagris (Turkey)	1 (2.8)	-	-	-	1 (0.3)
Grouse	-	1 (0.5)	-	-	1 (0.3)
Other Bird	1 (2.8)	5 (2.3)	1 (3.3)	-	7 (2.3)
Sylvilagus (Cottontail)	1 (2.8)	25 (11.5)	-	2 (9.5)	28 (9.2)
Sylvilagus nuttalli (Nuttall's Cottontail)	-	4 (1.8)	-	-	4 (1.3)
Lepus (Jackrabbit)	-	13 (6.0)	-	-	13 (4.3)
Sciurid (Squirrel)	1 (2.8)	1 (0.5)	-	-	2 (0.7)
Tamiasciurus hudsonicus (Red Squirrel)	-	1 (0.5)	-	-	1 (0.3)
Spermophilus cf. lateralis (Golden-Mantled Ground Squirrel)	1 (2.8)	5 (2.3)	-	-	6 (2.0)
Spermophilus variegatus (Rock Squirrel)	2 (5.6)	7 (3.2)	-	-	9 (3.0)
Marmota flaviventris (Yellow-Bellied Marmot)	1 (2.8)	2 (0.9)	-	-	3 (1.0)
Thomomys (Pocket Gopher)	1 (2.8)	6 (2.8)	1 (3.3)	1 (4.8)	9 (3.0)
Thomomys bottae (Southern Pocket Gopher)	-	3 (1.4)	1 (3.3)	-	3 (1.3)
Dipodomys Ordi Ord's Kangaroo Rat	-	6 (2.8)	-	-	6 (2.0)
Castor canadensis (Beaver)	-	2 (0.9)	-	-	2 (0.7)
Peromyscus (White-Footed Mouse)	1 (2.8)	6 (2.8)	-	-	7 (2.3)
Neotoma (Wood Rat)	3 (8.3)	10 (4.6)	-	-	13 (4.3)
Neotoma cf. mexicana	-	-	1 (3.3)	-	1 (0.3)
Microtus (Vole)	-	6 (2.8)	-	1 (4.8)	7 (2.3)
Microtus longicaudus (Long-Tailed Vole)	-	2 (0.9)	1 (3.3)	-	3 (1.0)
Cricetid	1 (2.8)	3 (1.4)	-	-	4 (1.3)
Ondatra zibethicus (Muskrat)	-	1 (0.5)	-	-	1 (0.3)
Erethizon dorsatum (Porcupine)	1 (2.8)	35 (16.1)	-	1 (4.8)	37 (12.2)
Rodent	-	1 (0.5)	-	-	1 (0.3)
Canis cf. familiaris (Domestic Dog)	-	1 (0.5)	-	1 (4.8)	2 (0.7)
Cf. Canis (ca. size of C. latrans)	-	-	2 (6.7)	-	2 (0.7)
Canis cf. latrans (Coyote)	-	2 (0.9)	-	-	2 (0.7)
Canis cf. lupus (Gray Wolf)	-	2 (0.9)	-	-	2 (0.7)
Cf. Vulpes vulpes (Fox)	-	-	1 (3.3)	-	1 (0.3)
Ursus cf. americanus (Black Bear)	-	1 (0.5)	-	-	1 (0.3)
Mustelid (Weasel)	-	1 (0.5)	-	-	1 (0.3)
Mustela frenata (Long-Tailed Weasel)	1 (2.8)	-	-	-	1 (0.3)
Taxidea taxus (Badger)	-	1 (0.5)	-	-	1 (0.3)
Martes americana (Marten)	-	1 (0.5)	-	-	1 (0.3)
Lutra canadensis (River Otter)	-	1 (0.5)	-	-	1 (0.3)
Lynx rufus (Bobcat)	-	1 (0.5)	-	1 (4.8)	2 (0.7)
Felis concolor (Mountain Lion)	-	-	1 (3.3)	-	1 (0.3)
Carnivore	-	1 (0.5)	-	-	1 (0.3)
Cervus canadensis (Wapiti, American Elk)	2 (5.6)	7 (3.2)	4 (13.3)	2 (9.5)	15 (4.9)
Odocoileus hemionus (Mule Deer)	9 (25.0)	29 (13.4)	12 (40.0)	5 (23.8)	55 (18.1)
Ovis canadensis (Mountain Sheep)	-	2 (0.9)	-	-	2 (0.7)
Unidentified Artiodactyl	8 (22.2)	8 (3.7)	3 (10.0)	5 (23.8)	24 (7.9)
All Artiodactyls (Sub-Total)	19 (52.8)	46 (21.2)	19 (63.3)	12 (57.1)	96 (31.6)
Medium or Small Mammals	-	2 (0.9)	1 (3.3)	1 (4.8)	4 (1.3)
Large Mammals	-	1 (0.5)	1 (3.3)	1 (4.8)	3 (1.0)
TOTAL INDIVIDUALS	36 (100.3)	217 (100.5)	30 (99.7)	21 (100.2)	304 (100.0)

short hunting trips (ca. 10 miles) could easily account for their presence. On the other hand, presence of *Lepus* in fair numbers could indicate a slightly drier habitat, decreasing the thickness of pinyon-juniper growth on the southern slopes of Chimney Rock Mesa. Another possibility, fitting both sets of animals, is a precipitation regime favoring slightly more winter precipitation and thus promoting the favorable sagebrush country seemingly preferred by jackrabbits in the Piedra drainage. Such a regime likely would favor presence of true fir on the northwestern face of Chimney Rock Mesa and also allow presence of somewhat more mesic habitat animals (see discussion of precipitation regimes in Harris 1963b, 1970). In any event, the faunal evidence is weak, and appreciable climatic differences seem unlikely.

Presence of Ord's kangaroo rat (*Dipodomys ordi*) does seem to throw some light upon the vegetation at the time of habitation. At least six individuals are represented, and one skull element of this rodent was burned, indicating its presence was contemporaneous with habitation of the site. Presence at the same time as presence of mesic indicators is indicated by recovery of a vole (*Microtus* sp.) from the same feature. Although this particular vole specimen may be intrusive, an individual from another feature is burned, again indicative of contemporaneity with man.

The nearest known approach of kangaroo rats to the area today is some 30 airline miles to the south, at two miles northwest of Blanco, New Mexico (Harris 1963a). The distance involved, the relatively small food value, and the lack of other surely southern forms makes it likely that the presence is natural rather than man-related.

The archaeological record from the Navajo Reservoir District sheds some light on the matter—*Dipodomys ordi* remains were recorded from sites as far north as southern Colorado (Piedra Section) as late as the Arboles Phase, A.D. 950-1050 (Harris 1963b, Eddy 1963). Harris (*op. cit.*) suggested much better development of grass and/or forbs than at present and that possibly introduction of domestic animals in historic times had eradicated *Dipodomys ordi* by destruction of this habitat; an alternative suggestion is eradication by drought damage sometime after A.D. 1050. These possibilities seem as viable today as 10 years ago, with damage from sheep most likely the main cause.

The same factors allowing presence of *Dipodomys ordi* may also have favored presence of *Spermophilus lateralis* at lower elevations than at present.

Assuming better low-growing plant cover, we can expect non-arboreal pollen counts to be relatively higher than at present. There also is the possibility that some arboreal species of plants, particularly of the pinyon-juniper woodland, have increased their density to a degree as competition from grasses decreased; increased sheet erosion following cover reduction may have further reduced the density of forms competitive to tree growth.

An unknown proportion of the recovered fauna may be intrusive. Rock squirrels (*Spermophilus variegatus*), wood rats (*Neotoma* spp.), and pocket gophers (*Thomomys* spp.) frequently utilize rocky areas for protection or are fossorial. Definite evidence of utilization is absent in the area, though all are edible. One gopher element and one *?Neotoma* bone have been burned—the sole suggestion of possible use by man. On the other hand, only 2 of the 13 jackrabbits and 4 or 5 of the 32 cottontails show evidence (cuts or burning) of utilization, though they certainly were used. The evidence indicates smaller animals likely were boiled with a minimum of dismemberment and thus leave little evidence of their utilization.

Other small animals (snakes, *Peromyscus* spp., and *Microtus longicaudus*) live now in ruins on top of Chimney Rock Mesa. Burned *Microtus* and small cricetine elements prove contemporaneity for some, but whether they were utilized for food or died in the burning of the dwellings is conjectural.

The rather long list of carnivores probably indicates use of fur and possibly other parts; use as a food resource is possible.

Animals likely used primarily for food and/or fur or hides include fish, birds, cottontails, jackrabbits, red squirrel, marmot, beaver, muskrat, porcupine, American elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and mountain sheep (*Ovis canadensis*).

Fish preserve poorly, but the scarcity of even fragmentary remains indicates relative unimportance as a staple; birds also make up a minute portion of the fauna. This would seem to be a matter of cultural selection since birds undoubtedly were plentiful at the time of occupation just as they are today.

Estimated weights and frequencies of usable mammal meat are shown in Table 31. As is obvious from the figures in this table, the vast bulk of meat is from the large, hooved mammals. The misleading effect of considering frequencies of individuals rather than usable meat con be dramatically demonstrated. For example, non-artiodactyl sources considered in Table 31 make up 67.6 percent of the individuals of

TABLE 31

Estimated Poundage of Usable Meat and Percentage of the Total Represented by Several Categories in Each Site*

Scientific Name	5AA83	5AA86	5AA88	5AA92
Sylvilagus	2 (0.08)	51 (0.74)	-	4 (0.23)
Lepus	-	39 (0.57)	-	-
Scivrid	1 (0.04)	1 (0.01)	-	-
Tamiasciurus hudsonicus	-	1 (0.01)	-	-
Spermophilus lateralis	1 (0.04)	5 (0.07)	-	-
Spermophilus variegatus	2 (0.08)	7 (0.10)	-	-
Marmota flaviventris	8 (0.33)	16 (0.23)	-	-
Castor canadensis	-	77 (1.12)	-	-
Ondatra zibethicus	-	2 (0.03)	-	-
Erethizon dorsatum	10 (0.41)	350 (5.07)	-	10 (0.58)
Cervus canadensis	700 (28.88)	2,540 (35.51)	1,400 (48.28)	700 (40.84)
Odocoileus hemionus	900 (37.13)	2,900 (42.04)	1,200 (41.38)	500 (29.17)
Ovis canadensis	-	200 (2.90)	-	-
Unidentified Artiodactyl (calculated on basis of mule deer or mountain sheep)	800 (33.00)	800 (11.60)	300 (10.35)	500 (29.17)
Total Artiodactyl	2,400 (99.01)	6,350 (92.04)	2,900 (100)	1,700 (99.18)
TOTAL USABLE MEAT	2,424	6,899	1,714	2,900

*Average weights of usable meat per animals are based on data of White (1953); mammals smaller than squirrel size are ignored. Figures are rounded to the nearest pound.

5AA86, but only 7.94 percent of the usable meat for that site.

In large part, the differences seen earlier between 5AA83 and 5AA86 maintain themselves when viewed on the basis of meat poundage. At first thought, the non-artiodactyl resources may seem inconsequential. However, smaller animals have several advantages over larger, including the fact that it is an amount of meat that can be consumed before spoilage, that they are easy enough to capture that women and children may take such animals, and, frequently, that they are more available.

Seasonal fluctuations in availability of animal food resources occurred. Ground squirrels and marmots hibernate, and their presence indicates spring and summer hunting. More serious, elk and mountain sheep tend to move into higher country in summer, leaving mule deer as the single dependable large mammal in summer. Remains of fawns indicate spring hunting of deer. Antler remains are usually so fragmented as to allow identification only as cervid. In the case of one elk antler, the base has the appearance of having been shed rather than having been removed from a kill. Since no antlers were found attached to skull parts, no implication of fall-winter hunting is present.

Among mammals absent from the recovered fauna are chipmunks (*Eutamias* spp.), Gunnisons prairie dog (*Cynomys gunnisoni*), and the Abert squirrel (*Sciurus aberti*). The latter may be present but confused with rock squirrel elements. I think this unlikely, however, since most skull elements can be identified. There seems no obvious reason for the absence of these forms even assuming some climatic change, thus we may presume either sampling error or cultural reasons for their absence.

In summary, bird resources were almost entirely neglected. 5AA92 has too small a sample for much confidence in interpretation; perhaps greater similarity to 5AA83 is shown. Differences between 5AA83 and 5AA86 are pronounced and apparently significant; 5AA88 and 5AA92 appear most similar to 5AA83. The differences likely are due to cultural features. Climatic differences between the period of occupation and the present are not shown clearly; if present, the likely form would be in slightly greater winter precipitation.

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APPENDIX B

POLLEN STUDIES AT CHIMNEY ROCK MESA

by

DAVID E. BUGE AND JAMES SCHOENWETTER

Introduction

The 30 pollen samples submitted from sites on Chimney Rock Mesa in southern Colorado were processed and analyzed from September through November 1971. Pollen was extracted from the sediment using standard procedures involving flotation and screening of the samples, solution of the inorganic fraction in HCl, HF, and HNO, and reduction of the organic fraction with lye. With the exception of the surface samples, the pollen density of all of the samples was low. Eight of the samples were given further processing with Erdtman's acetolysis mixture in order to eliminate organic material and concentrate the pollen (lab record of 22/×/71). Only two of the eight reprocessed samples were found to have sufficient pollen for counting, however. In all, 6 surface control samples and 10 samples from archaeological contexts yielded data. In some cases low pollen density necessitated counting two slides in order to achieve a 200 grain sum. Pollen preservation was good in most samples.

The adjusted pollen sum was utilized for counting as this allowed comparison of the Chimney Rock data with other studies on the Colorado Plateau (Schoenwetter and Eddy 1964: 69-72, Schoenwetter 1970: 41). The adjusted pollen sum excludes all riparian species, economic or ethnobotanic taxa, and species dependent upon special edaphic situations (e.g., *Sarcobatus*). This permits the AP percentage to reflect the density of trees at the sampling location and, as a result, the effective moisture. Observations were also made on the size of *Pinus* pollen for comparison with R. Hevley's pollen records from northern Arizona (Hevley 1964, Zubrow 1971).

Surface Pollen Records

In Figure 33, the surface samples are arranged from most mesic at the top of the diagram to most xeric. This ranking is on the basis of the floristic pattern observed by the collector of the samples. The floristic ranking is well represented in the pollen samples in terms of adjusted AP percentages and the frequencies of pollen derived from taxa having distinctive moisture requirements. Sample 3, representing the most mesic local conditions, has the highest AP percentage and is characterized by high *P. ponderosa* values and the occurrence of *Abies* and *Pseudotsuga*. Sample 5 is slightly less mesic as reflected by the lower *Pseudotsuga* percentage and the lack of *Abies*. However, this sample is also characterized by a high *P. ponderosa* value. Sample 1, from a pinyon-juniper woodland, has an AP percentage statistically equal to samples of more mesic vegetation, but the arboreal pollen is differently distributed. *P. ponderosa* occurs in significantly lower frequency and *P. edulis* comprises the majority of the arboreal pollen. It is interesting to note that in the pinyon-juniper zone at Chimney Rock Mesa, *Juniperus* is not a well-represented pollen type. Surface Sample 4, from an oak scrub area, is palynologically represented by a lower AP value than the more mesic zones (not significantly lower in the statistical sense), with *Quercus* the dominant AP type. Sample 2 is floristically the most xeric of the samples. It is characterized by a high Graminae percentage, and the *Juniperus* value of this sample is significantly greater than that of any other surface sample. The surface control sample from Parking Lot Site, 5AA86-25-12, is most closely related to surface Sample 2 on the basis of low AP and high grass percentages. However, its location near mesic woodland is reflected by high *P. ponderosa* values and the occurrence of *Abies* and *Pseudotsuga*. These latter types, along with *Juniperus*, appear to be localized in their distribution. A high percentage of these in the fossil samples would indicate close proximity of the species.

Fossil Pollen Records: Dating

The 10 subsurface samples are arranged in Figure 33 by their proposed chronological position. Sites 5AA86 and 5AA83 were tentatively dated within the Chimney Rock Phase to between A.D. 1000 and A.D. 1100 on the basis of the cultural record. Site 5AA92 was placed earlier, during the A.D. 925 to A.D. 975 or 1000 span. It was within these broad time periods that the samples were to be more precisely placed. Utilizing the published pollen chronology for the Colorado Plateau (Schoenwetter 1970) as a basis, certain samples from the different sites were given a tentative date. This placement was then compared with other forms of evidence in order to find the best fit of the Chimney Rock samples within available chronologies of different sorts.

The Colorado Plateau pollen chronology (Schoenwetter 1970) is established on the basis of fluctuations in the adjusted AP frequency pollen statistic. This figure is presumed to reflect levels of effective moisture occurring regionally on the Colorado Plateau. Through time the effective moisture level is seen as increasing or decreasing relative to a theoretical modern standard. Comparison of the adjusted AP pollen statistic derived from samples of unknown or roughly known time periods (as those from Chimney Rock Mesa) with similar adjusted AP values for samples of known age in the chronology should allow cross-dating. In the case of the Chimney Rock series there are three samples in which the adjusted AP frequency exceeds 56.0 percent. These are crucial since they may be expected to correlate to horizons of time represented by the greater-than-present level of effective moisture in the Colorado Plateau chronology.

The earliest of these occurs at site 5AA92, tentatively dated between A.D. 925 and 1000. The Colorado Plateau pollen chronology reveals no moist intervals within this time span. However, this pollen chronology is recognized as potentially having gaps, and it is specifically established as a conservative chronology. One sample collected from a fossil context in the Chuska Valley (Schoenwetter 1967:86) also reflects a high level of effective moisture during part of this time period. The site from which this sample was removed was dated A.D. 875 to 950, although the date is somewhat suspect. If the sample is correctly dated, it would limit the cross-dating for 5AA92-6-27 to the horizon between A.D. 925 and A.D. 950. Dendroclimatological data (Robinson and Dean n.d.) indicate that a moist period during this span occurred from A.D. 940 to A.D. 950. Therefore sample 5AA92-6-27 is tentatively dated to this period. Samples 5AA92-9-6 and 5AA92-9-7 represent a stratigraphic series of

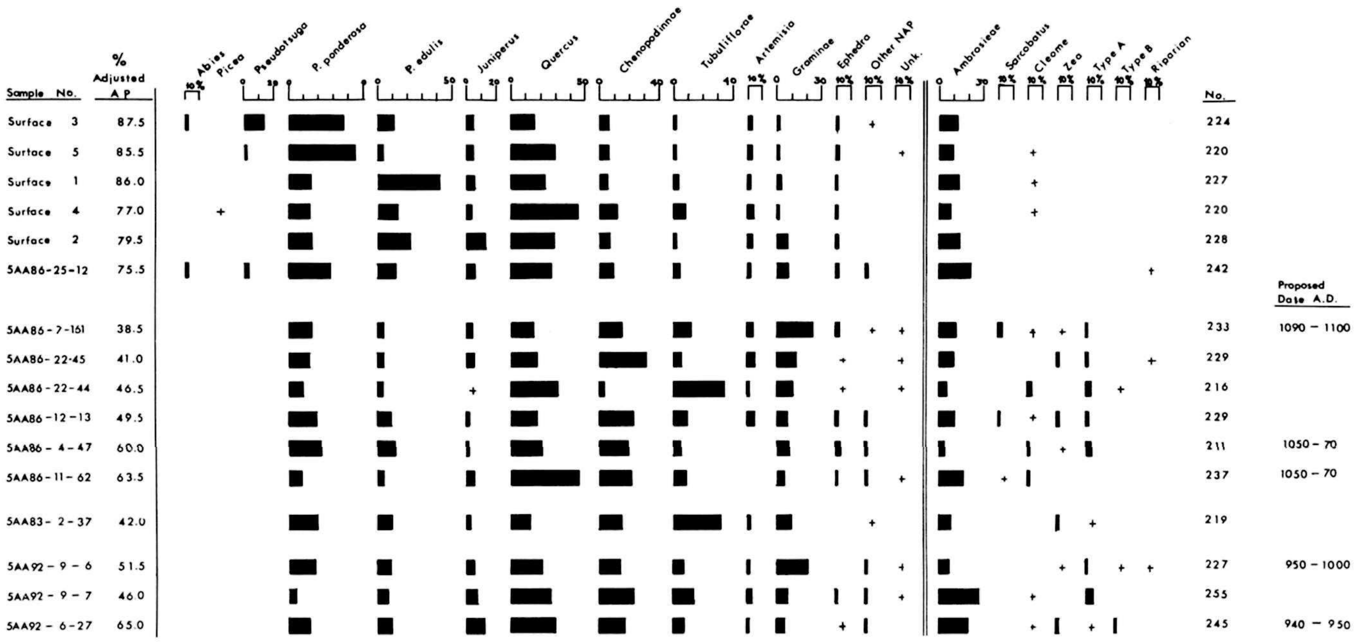

FIGURE 33. Chimney Rock Mesa pollen diagram.

unknown temporal relation to sample 5AA92-6-27. Since the trend of these two samples seems to be from more mesic to more xeric on the basis of increasing grass frequencies, they would seem to fit better after the more moist sample than before it. However, with only three samples, of which one is tentatively dated, the placement of all of the samples within the A.D. 940 to A.D. 1000 horizon is not as secure as we would prefer.

The six samples from site 5AA86 present a better chance for dating. In comparison to the Colorado Plateau chronology, four of the samples fall into the 23 percent to 56 percent range, while two have higher AP values representing more moist conditions. In the time period from A.D. 1000 to A.D. 1100, a moist period is postulated during the mid-1000s (Schoenwetter 1970:42). This period can be dated at 1050 to 1060 A.D. on the basis of palynological correlation with generalized dendroclimatic data for the Colorado Plateau (Robinson and Dean n.d.). However published dendroclimatological maps place a moist period at the Mesa Verde and Chama River stations from A.D. 1060 to A.D. 1070 (Robinson and Dean 1969). Therefore samples 5AA86-11-62 and 5AA86-4-47 can be placed in the A.D. 1050 to 1070 time period with relative security. The remaining samples are somewhat more difficult to date as they lack the internal stratigraphic relationships necessary for secure chronological placement. The only two samples which have a known relationship are 5AA86-22-44 and 5AA86-22-45, from the middle and top (respectively) of a trash deposit. Assuming trash deposition throughout site occupancy, these samples indicate a reduction in AP values toward the end of the occupation of the site. If this is correct, the remaining samples would seem to fit a pattern of reduced effective moisture from a maximum in A.D. 1050-1070 to a minimum in A.D. 1090-1100. This date is selected for the sample indicative of greatest xericity by virtue of low AP value. Robinson and Dean (1969) indicate that the horizon of greatest xericity in the eleventh century occurred within this decade. The series of samples has been ordered in Figure 33 by percent of AP from the more xeric (late) at the top to the most mesic (early) at the bottom. This arrangement produces a consistent pattern of decreasing Graminae values as more moist conditions are encountered earlier in time.

While samples 5AA86-12-13 and 5AA86-7-161 may have come from the period preceding A.D. 1050, they seem to fit well into a pattern of decreasing AP and increasing Graminae during the A.D. 1070 to 1100 period. Thus a date of 1070-1090 is provisionally assigned to these samples as well as samples 5AA86-22-44 and -45.

Sample 5AA83-2-37 was the only sample from Chimney Rock Pueblo to produce sufficient pollen for counting. The sample appears to match most closely those samples from 5AA86 which fall in the A.D. 1070-1090 range. It appears that the kiva from which the sample was taken was refloored at this time, and approximately at the time of the deposition of sample 5AA86-22-44. This latter sample and that from Chimney Rock Pueblo are the only ones which contain significantly greater quantities of Tubuliflorae pollen.

The dating offered above rests on correlation with Colorado Plateau palynological records of adjusted AP values and, to a lesser extent, with dendroclimatic records. Dating by virtue of correlation of pine/juniper pollen ratios and pinyon/ponderosa pollen ratios in the Chimney Rock records with those of known antiquity elsewhere in the Southwest is also possible.

According to Hevly (n.d.), pollen records of the last half of the eleventh century reveal a decreased proportion of pine pollen in the pine/juniper ratio relative to other time horizons investigated at Elden Pueblo. This is simply not the situation reflected at Chimney Rock Mesa (Table 32) unless we assume that the only specimen representing this time horizon is 5AA83-2-37. The possibility cannot be denied, but in the light of the cross-dating achieved through application of both palynological and dendroclimatic records, we simply feel this pollen statistic is not of regional chronological value.

As expressed by the figures in Zubrow (1971:136-7) palynological records of the frequency of pinyon pollen appear to undergo patterned changes through time at Hay Hollow Wash. Higher frequencies are recognized for the A.D. 925-1125 horizon, relative to earlier and later horizons, falling in the 65 to 80 percent range. The raw palynological data upon which these figures are based has not yet been published. Thus we are unable to discern if these pinyon frequencies are percentages of the total pollen observed, percentages of some sort of adjusted pollen sum, or percentage of pinyon pollen in the total pine pollen observed. Our suspicion is that the last alternative is the appropriate figure.

Table 32 expresses the percentage of pinyon pollen in the sum of all pine pollen observed in the Chimney Rock Mesa samples. As is clear, pinyon pollen frequencies at Chimney Rock Mesa are not of the order of those from Hay Hollow Wash. This does not serve as significant evidence against the dating of the Chimney Rock samples, however, for no argument has been presented that pinyon pollen frequency is a chronologically meaningful pollen statistic beyond the confines of the Hay Hollow Wash. Such argument has been presented for dendrological variation, the adjusted AP frequency, and the pine proportion of the pine/juniper ratio.

TABLE 32
Other Pollen Statistics

	Percent Oak in Oak & Pine Value	Percent Pine in Pine & Juniper Value	Percent Pinyon in Total Pine Value
Surface 3	25.4	90.4	22.4
Surface 5	37.8	91.7	8.0
Surface 1	28.8	91.2	73.6
Surface 4	59.0	85.5	47.2
Surface 2	43.6	75.2	58.5
5AA86-25-12	40.2	89.9	30.0
5AA86-7-161	43.5	73.0	21.0
5AA86-22-45	50.7	87.8	22.8
5AA86-22-44	71.0	96.3	30.8
5AA86-12-13	26.2	93.6	32.8
5AA86-4-47	39.8	95.8	35.3
5AA86-11-62	78.5	71.4	32.1
5AA83-2-37	31.3	32.2	30.9
5AA92-9-6	43.6	85.5	32.1
5AA92-9-7	69.2	64.8	58.5
5AA92-6-27	57.1	65.2	37.8

Paleoecology

With the limited number of surface samples to act as control data, reconstructions of the vegetational pattern during the prehistoric period must be considered as tentative. In general, all of the fossil samples indicate conditions to have been drier during the Chimney Rock Phase occupations of the sites. Judging by comparison of AP percentages between the fossil and modern records, arboreal density patterns would most closely match modern conditions at Station 2 (grassland with sparse pinyon and juniper in the vicinity) during the dry periods and Station 4 during the more moist periods (savanna or shrub oak cover). The climatic events occurring at ca. A.D. 950 and A.D. 1050 seem to have had the effect of increasing the *Quercus* density in the site areas.

Hill and Hevly (1968) have argued that the proportion of pine pollen in the pine/juniper ratio reflects a paleovegetational index. Specifically, conditions favoring the growth of pine relative to that of juniper in Colorado Plateau savannas and woodlands are indicated by increasing values in this pollen statistic. They back this contention through an analysis of the correlation of the statistic with records of tree growth. If this hypothesis is accepted, an interpretation of the patterning shown through time in this statistic at Chimney Rock Mesa is appropriate.

The samples from 5AA92 thought to be oldest have lower pine frequencies in this regard than occur in Surface Sample 1. This would indicate a vegetation pattern at the site with less pine, relative to juniper, than occurs today. The high proportion of oak pollen relative to pine pollen in these samples (see Table 32) would indicate that oak was more common than it is today, however, though somewhat less than its modern density at Surface Station 4. The relatively low pinyon proportion in the pinyon/pine ratio (compare 5AA92-6-27 with Surface Sample 1) would indicate that the pine involved was pinderosa rather than pinyon. Vegetation patterns reflected by these standards for this site during the deposition period of sample 5AA92-9-6 would very closely resemble the modern situation at site 5AA86.

The samples from 5AA86 appear to reflect different patterns of vegetation than those of 5AA92. The earliest sample in the series reflects a time when trees increased in density as a response to moister climate. Though the pine involved was ponderosa rather than pinyon, the proportions of pine to juniper seem to have been much as they are today. The increase in arboreal density at the site was essentially an increase in the frequency of oak. If we are correct in our interpretation that sample 5AA86-4-47 follows sample 5AA86-11-62 in time, it would appear that the density of oak at the site was drastically reduced within a short time. It was apparently replaced by ponderosa pine rather than by juniper or pinyon. This succession seems quite unlikely under the climatic conditions postulated. It would appear that the pollen record is here reflecting a systematic clearance of oak brush in the site area by man. With the advent of somewhat drier conditions after A.D. 1070, the total density of arboreal flora on the site was reduced. This continued to the end of the period of occupation represented by the pollen samples. The proportion of juniper to pine near 5AA86 remained much the same as it is today, but the amount of pinyon pine was reduced in the last part of the occupation. At the time of the deposition of samples 5AA86-22-44 and -45, oak clearance practices seem to have ceased.

Economy

The constellation of economic pollen types is fairly typical of Pueblo sites. The distribution of Unknown Type A, a tricolporate, reticulate type, possibly in the Leguminosae family, implies that it is an economic type. Unknown Type B was first noted in trash deposits at Picuris and was felt to have been an economic type there (Schoenwetter 1965). Unknown B apparently represents some member of the taxon Umbelliferae (parsley family). *Cleome* (beeweed) pollen was prevalent in the fossil samples, but was also found in the surface samples, something unusual for this insect-pollinated type. *Opuntia* is reported to occur in the site areas, but was rare in both surface and subsurface samples. *Zea* was fairly typical throughout the fossil samples. The grains of *Typha* may indicate that a nearby riparian environment was being exploited. One grain of *Typha* was found in a sample of roof fall (5AA92-9-6) indicating use of the plant as a building material. In sum, the economic pollen recovered would indicate both maize agriculture and wild plant gathering for subsistence, and it is evident that several vegetational zones were exploited.

The AP frequencies of the fossil samples are uniformly lower than those of the modern surface samples. This indicates that present effective moisture values are higher than those which occurred during the Chimney Rock Phase. Supposedly, climatic conditions affecting agricultural potential during the A.D. 925-1100 period would have created greater economic problems than they might today. The frequent occurrence of maize pollen in the fossil record, however, argues that this was more an apparent than a real concern.

TABLE 33
Pollen Observed

	Abies	Picea	Pinus edulis	Pinus ponderosa	Juniperus	Quercus	Pseudotsuga	Chenopodinnae	Artemesia	Ambrosieae	Tubuliflorae	Liguliflorae	Graminae	Ephedra N	Ephedra T	Sarcobatus	Euphorbia	Lillaceae	Opuntia	Yucca	Typha	Juglans	Onagraceae	Malvaceae	Zea	Cleome	Unk-A	Unk-B	Unk-Other	Total
Surface 1	-	-	84	30	11	46	1	10	4	25	6	-	6	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	227
Surface 2	-	-	44	31	26	58	-	13	6	28	4	-	15		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	228
Surface 3	4	-	21	73	10	32	35	12	5	24	2	-	2	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	224
Surface 4	-	1	25	28	9	91	-	24	8	16	9	-	3	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	220
Surface 5	-	-	8	91	9	60	3	12	5	19	4	-	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-	1	220
5AA86-25-12	2	-	24	56	9	54	5	19	3	41	8	-	15	2	-	-	-	3	-	-	-	1	-	-	-	-	-	-	-	242
5AA83-2-37			17	38	4	25	-	29	2	16	63	-	20	-	-	-	-	1	-	-	-	-	-	-	3	-	1	-	-	219
5AA86-11-62			8	17	10	92	-	43	-	33	16	-	9	1	1	1	2	-		-	-	-	-	-	-	3	-	-	1	237
5AA86-7-161			8	31	8	30	-	31	7	21	24	2	51	3	1	5	-	-	-	-	-	-	1	-	1	1	2	-	1	233
5AA86-12-13			19	39	4	36	-	47	10	22	18	-	15	4	-	2	1	2	-	-	-	-	-	-	4	1	4	-	-	229
5AA86-4-47			24	44	3	43	-	40	-	8	10	-	17	4	1	-	-	1	-	-	1	-	-	-	1	2	6	-	-	211
5AA86-22-44			8	18	1	64	-	6	2	11	69	-	22	1	-	-	-	-	-	-	-	-	-	-	5	-	5	1	1	216
5AA86-22-45			8	27	10	36	-	64	10	20	12	-	27	1	-	-	-	1	-	-	-	1	-	-	3	-	2	-	1	224
5AA92-6-27			17	28	24	60	1	35	3	40	13	-	11	1	-	-	-	2	1	-	-	-	-	1	4	1	1	2	-	245
5AA92-9-6			17	36	9	41	-	28	8	13	13	-	42	-	-	-	-	2	-	-	-	1	-	-	1	-	2	1	1	227
5AA92-9-7			14	10	13	54	1	47	5	54	28	1	14	1	1	-	-	2	-	-	-	-	-	-	-	1	9	-	-	255

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APPENDIX C

ANALYSIS OF PLANT REMAINS FROM CHIMNEY ROCK MESA*

by

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Introduction

Ethnobotany, the study of the direct relationships between human cultures and plant populations, is more than the interest in the plants utilized by primitive man. Traditional investigations usually consist of little more than compiling a list of plant usages and some linguistic data. A more modern concept of ethnobotany treats holistically the relationships between plants and people as two way interactions within larger cultural and biotic systems. While the effects of various biological properties of plant populations, i.e., distribution, quantity, and physical attributes, on human groups is of major interest, the effects of human occupations on plant populations and communities, i.e., alteration of environment, distribution of plants, and encouragement of genetic change, are also relevant.

The most obvious interest has been to what extent plants are utilized by human groups. What people use for sustenance and material culture is very important, of course; however, other aspects of the relationships are vital to understanding man's relationship to an environment. First, plants are important in the flow of information. They are "keys" to the environment and utilization of it, particularly in timing seasonal activities. For example, the first leaves on the cottonwood trees may be the sign that it is safe to plant corn. Second, as elements in mythology and in ceremonial contexts, they define symbolically and metaphorically man's place in nature. Third, folk biological classification reveals the differential knowledge possessed by various members of a society which affect utilization patterns. Unfortunately, most of these valuable data are unavailable to archaeobotanists.

The task of the paleoethnobotanist then is complicated not only by the loss of much physical evidence but also by the absence of direct knowledge of the informational aspects of the plant-man relationships. Compensating for this, however, is the diachronic dimension. By having hundreds of years of evidence at hand, environmental alterations and cultural changes can be discovered.

Specifically, the ethnobotanical analysis of the Chimney Rock Project was undertaken with several problems in mind. Environmentally the Chimney Rock area has a high elevation (up to 7,800 feet). As a potentially marginal region for traditional Puebloan subsistence, an analysis of the utilized species will help us to understand prehistoric strategies for coping with environmental stress. Two specific orientations are involved.

First is the possible change in cultigen populations. Archaeologically, this would be most observable in diminutive size and other phenotypic modification particularly in reproductive structures.

The second is change in subsistence strategies. This is observable in differential quantities of different species utilized. An example of this is Dobyns' (1974) hypothesis that high altitude populations depended upon chenopods and amaranth.

The Chimney Rock region, particularly as a working definition by Harris (this volume), is primarily mesa country with deeply dissected river valleys. Chimney Rock Mesa, 7,800 feet at the northernmost pinnacle, tilts toward the south. The dominant vegetation is pinyon/juniper woodlands with more localized stands of ponderosa pine and Douglas fir in steep ravines and on north-facing slopes. With modern disturbance and the steep environmental gradient, there tends to be great diversity in the distribution of plant communities. Further detail will be found in Harris and in the discussion in the charcoal section of this report.

The Chimney Rock Phase, as defined by Eddy (this volume), consists of seven aggregates of Anasazi archaeological sites of the eleventh century. Total population estimates range from 1,215 to 2,025 with a range in site population estimates from 624 to 1,040 for the largest to 21 to 35 for the smallest. The distribution of the population in relation to topography forms two major divisions. There is a dispersed settlement pattern in the pinyon/juniper habitat of the mesa tops in contrast to a more concentrated population in the Piedra River settlements. The sites included in this report are today found within the pinyon/juniper woodlands.

The ethnobotanical material is treated as two major categories segregated by method of recovery, macroscopic charcoal and flotation. Because of the small sample size and the differential sampling strategy, with most material derived from one particular type of site, inter-site comparison is not possible. The comparative discussion will draw upon ethnographic information and data from other prehistoric provinces in the Southwest.

Charcoal

The most prevalent botanical remains recovered from these excavations are wood charcoal. In addition to wood, this category incorporates bark and needles from coniferous trees.

Two main factors involving prehistoric use and availability determine the occurrence of each species within an archaeological site. Obviously, the first is the environment and its climatic, edaphic and hydrological regimes. These set the minimal, maximal, and optimal parameters for the phytogeography of each species. Within the Chimney Rock area, the floristic diversity reflects the steep gradations of these variables.

The second factor, and anthropologically the more interesting, concerns the selection and utilization of local forest products by the human inhabitants. The strategy of selection can be species specific; that is, the physical properties of a specific plant may warrant its selection for a specific task. For example, a particular tree will be preferred for bows because of its hardness and elasticity. Ceremonial prescriptions, as well as strictly physical attributes, may influence the pattern of utilization of the flora.

The relative availability of a plant is an important factor in its selection. Assuming a search for maximum return for minimum effort, the collection of fireweed, for example,

*Ethnobotanical Laboratory, Museum of Anthropology, University of Michigan, Report No. 460

would begin in the vicinity of the habitation and work outward as the supply diminished. Changes in this pattern during the occupation of a site may be reflected archaeologically by changing relative frequencies of wood species as identified from hearths.

The human population, particularly if it is agricultural, will affect the structure of the local vegetation as well as selecting from it. The same example of the change through time in the frequencies of woods within hearths may indicate changes in the plant communities themselves. Cutting fields out of the forest and the subsequent successional changes of vegetation in old fields may be reflected in the charcoal samples.

The charcoal specimens analyzed by the authors consist of pieces retrieved by the primary excavation (as opposed to a secondary method such as a flotation procedure) at the Chimney Rock Site. These sample pieces are relatively large. Identification to generic level was obtained by viewing a cross-section under a 7-30X binocular microscope. Further identification, to species level, or, in some cases, to verify the initial identification, was made from radial and tangential sections as viewed under a 80-400X research microscope. Wood reference material was collected in the area by Joel Elias, and, when compared with the large size of the archaeological specimens, it enabled the identification of all pieces.

When possible, 20 pieces from each provenience were identified. Previous work has shown that this sample size adequately reflects the total frequencies of charcoal within a sample.

In the Chimney Rock vicinity (a circle of approximately four-mile radius centered on the Chimney Rock ruins), Harris (this volume) has delimited five major biotic assemblages: top of mesa, mesa, mountain shrub, ponderosa pine-Douglas fir stands, and riparian vegetation. His associations will be used in this report.

Top of mesa is the highest zone (7,900 feet) of the Chimney Rock formation. Away from areas of disturbance, i.e., excavations, the general vegetation is pinyon and juniper (*J. scopulorum*) woodland. On the more rocky areas a shrub-like vegetation, *Symphoricarpos* sp. and *Quercus gambellii*, predominates.

The mesa region is directly south of the previous zone and is characterized by a more gentle slope and deeper soils. Dominant vegetation includes pinyon and Rocky Mountain juniper, and the ground cover consists of shrubs, grasses, and herbs.

On the eroded mesa slopes ponderosa pine and Douglas fir appear in small stands. The degree of disturbance is less here than in the previous zone, but on the ruins themselves there is a shift to vegetation such as sagebrush (*Artemisia tridentata*).

The mountain shrub association is similar to the ponderosa pine-Douglas fir assemblage but lacks the arboreal overstory. The most conspicuous life form is shrubs, but a diverse group of herbs and grasses is also present. Harris suggests that much of this zone is the result of fire or lumbering and subsequent succession. Its natural distribution is confined to exposed ridges and other open areas.

The ponderosa pine-Douglas fir forests occupy the steep slopes of Chimney Rock Mesa. The dense shade produced by these trees results in a less diverse assemblage of nonarboreal species. The ponderosa pine tends to dominate the drier, warmer, south-facing slopes and the Douglas fir the moister, cooler, north-facing slopes.

The riparian vegetation is quite diverse. It incorporates aquatic vegetation and stream-side thickets. The arboreal component includes white fir, Douglas fir, narrow leaf cottonwood, and mountain maple. Skunkbush and hawthorn are two of the shrubs growing along these permanent streams.

Eleven categories of taxa are represented in the charcoal samples. Where a specimen was identified to genus, and only one species of that genus is represented in the area, then the specimen was assigned to that species. Using this criterion, 9 of the 11 taxa could be defined to the species level and 2 to genus. Table 41 lists these categories and gives a brief description of their present-day distribution in the Chimney Rock region.

Three hundred seventy-nine specimens were identified. Table 34 shows the number and percentage by site and the percentage of each taxon within the entire assemblage of charcoal. In addition to the identifications by the Ethnobotany Laboratory, University of Michigan, 128 identifications were obtained from material sent to the Dendrochronology Laboratory, University of Arizona.

Table 34 compares percentiles between the two sets of identifications. The differences in the number of identified taxa are striking. Seven taxa were identified at Arizona and 11 at Michigan. The differences occur within one identification set (pinyon, shrub oak, mountain maple, skunkbush, mountain mahogany, and hawthorn). These are all shrubs or small tree growth forms. This discrepancy is a result of the laboratory sorting process. Size is an important criterion for selecting charcoal to be sent to the Dendrochronology Laboratory; the larger, the better. Within the sample submitted to the Ethnobotanical Laboratory we generally found a distinct bimodal size distribution. The large pieces were of the larger arboreal species (ponderosa pine, Douglas fir, and white fir), while the smaller mode consisted of shrub twigs (mountain maple, skunkbush, mountain mahogany, and hawthorn). The one exception to this pattern was juniper. While its growth form today is that of a shrub or small tree, its charcoal was found within the larger-sized, tree group. The above size-specific distribution of charcoal specimens clearly illustrates a common archaeological problem. With the sampling of charcoal stratified by size, samples from a limited size range invariably lead to incomplete data and erroneous conclusions.

While we do not have firm chronological control between samples to make definitive statements concerning vegetational change, the charcoal percentages (Table 34) present some interesting patterns.

Quite obvious is the dominance of ponderosa pine. In both identification sets, this species accounts for 65 to 70 percent of the specimens. Ponderosa pine is much more desirable than the more shrubby species for primary supports, e.g., vigas, in construction. This does not explain the discrepancy between ponderosa (66.06 percent) and Douglas fir (4.92 percent), however. Even in the larger samples submitted to the Dendrochronology Laboratory, the ratio is 7:1. We feel that utilization patterns alone cannot account for such a large difference, suggesting a difference in availability.

Likewise, the very low frequencies of pinyon and juniper (1.53 and 3.14 percent respectively) are hard to explain in terms of usage preferences alone since both of these plants are adequate for firewood. This changed availability may reflect climatic change, but more probably it reflects the

TABLE 34
Number and Percentage of Charcoal Specimens Identified by Site

Site	TOTAL IDENTIFIED	%/N	Pinus ponderosa	Pinus edulis	Pseudotsuga menziesii	Abies concolor	Juniperus sp.	Quercus gambelii	Acer glabrum	Rhus trilobata	Cercocarpus montanus	Crataegus sp.	Populus angustifolia	Non-coniferous	Unknown
		%	64.5	0	14.5	9.2	7.9	0	0	0	0	0	3.9	0	0
5AA 83[1]	76	N	49	0	11	7	6	0	0	0	0	0	3	0	0
		%	33.5	0	0	12.5	7.5	15.0	0	0	27.5	2.5	2.5	0	0
5AA 86[2]	40	N	13	0	0	5	3	6	0	0	11	1	1	0	0
		%	70.3	0	2.7	2.7	18.9	0	0	0	0	0	0	2.7	2.7
86[1]	37	N	26	0	1	1	7	0	0	0	0	0	0	1	1
		%	76.4	0	2.6	1.0	0	2.3	1.6	2.0	7.9	2.6	3.6	0	0
5AA 88[2]	305	N	233	0	8	3	0	7	5	6	24	8	11	0	0
		%	0	20.6	14.7	0	0	0	0	0	58.8	0	5.9	0	0
5AA 92[2]	34	N	0	7	5	0	0	0	0	0	20	0	2	0	0
		%	93.0	0	0	0	0	0	0	0	0	0	7.0	0	0
92[1]	15	N	14	0	0	0	0	0	0	0	0	0	1	0	0
		%	66.1	1.4	4.9	3.2	3.2	2.6	.9	1.2	10.8	1.8	3.5	.2	.2
TOTAL	507	N	335	7	25	16	16	13	5	6	55	9	18	1	1

[1]Identified at the Dendrochronology Laboratory, University of Arizona.
[2]Identified at the Ethnobotany Laboratory, University of Michigan.

different vegetation patterns caused by the process of clearing fields.

While the vegetational succession pattern is not well known, Harris alludes to it by suggesting that the mountain shrub association is usually a successional stage to a ponderosa pine-Douglas fir climax. The wood species of this zone (*Cercocarpus*, *Acer*, *Rhus*) are well represented in the specimens identified. Table 35 indicates the presence or absence of those species found in the charcoal identifications within the vegetational associations outlined by Harris. The strong representation of shrubs may reflect vegetation of cleared forests and fields left fallow. The numerous remains of cultigen populations described in the next section argue for a dependence on field crops. Because of the limited nature of the material, the model of field systems as related to environmental reconstruction should be viewed as very tentative.

The altitude at Chimney Rock is high and consequently the frost-free period is short. In order to maximize available solar radiation, an appropriate conservation strategy should be followed. Locating fields with a southern exposure would maximize the available heat and light. Likewise, mid-slope locations would minimize the effects of cold air drainage. If this model is appropriate, then the high percentage of ponderosa pine relative to Douglas fir reflects the clearing of south-facing exposures for fields and the utilization of the cleared debris. Following Harris, fallow succession would be characterized by a shrub-type vegetation. The high incidence of shrub growth species in the charcoal would represent utilization of these fallow or abandoned fields.

TABLE 35
Modern Community[1] Affiliation of Charcoal Taxa Recovered Archaeologically

Taxon	Top of Mesa	Mesa	Mountain Shrub	Pondersoa Pine/ Douglas fir	Riparian
Pinus ponderosa	-	X	X	X	X
Pinus edulis	X	X	X	-	-
Abies concolor	-	-	-	X	-
Pseudotsuga menziesii	-	X	X	X	X
Juniperus spp.	X	X	X	X	X
Crateagus spp.	-	-	-	X	X
Cercocarpus montanus	-	-	X	X	X
Acer glabrum	-	-	X	X	-
Quercus gambellii	X	X	X	X	X
Populus angustifolia	-	-	-	X	X
Rhus trilobata	X	-	X	X	X

[1]From Harris (this volume)

This Chimney Rock specific model fits into Eddy's (1973 and this volume) general model of adaptation in the Upper San Juan Basin. Here the pueblo populations adjusted to climatic disequilibrium by locational shifts into highland areas. There topographic regions compromise agricultural requirements by offering less soil moisture but a greater frost-free period than the drainage bottoms.

This model does not explain the low frequency of pinyon and juniper. If Buge and Schoenwetter's (this volume) paleoenvironmental reconstruction is correct, the Chimney Rock area was more xeric than today, which would tend to favor the growth of pinyon and juniper. Climatic conditions, therefore, cannot account for the low percentage of pinyon and juniper. While it is possible that this reflects a bias against pinyon and juniper by the inhabitants and a sampling bias in favor of larger trees for firewood, it is possible that at the time of its initial occupation the mesa vegetation was dominated by ponderosa pine, and after clearance by the human population, pinyon and juniper replaced it and remained to the present.

Not surprisingly, there is evidence of exploitation of the riparian association. Eight of the 11 taxa are found in this zone, and 1, *Populus angustifolia*, is common only in this community type.

Subsistence

Following a common convention, plants utilized for sustenance are grouped into two categories: wild and domesticated. What this actually reflects are two extremes on a continuum of the degree of human manipulation of a plant population's life cycle.

At one end are plants which are unaffected by humans except in factors related to accidental dispersal during their harvest. On the other extreme are plants, such as maize, for which virtually constant human intervention is required for successful completion of the life cycle and propagation of the next generation. In between are a variety of plants whose growth depends on a variety of human behavioral patterns which fit neither category.

TABLE 36
Archaeological Seeds

																Recent Contamination				
Sample No.	Percent Size Examined	*Prunus virginiana*	*Amelanchier* sp.	*Symphoricarpos* sp.	*Yucca baccata*	*Opuntia imbricata*	*Orizopsis hymenoides*	*Chenopodium*	*Euphorbiaceae*	*Compositae*	*Cactaceae*	Unknown	*Zea Mays*	*Phaseolus vulgaris* *	Nodules	Shell	*Polygonum*	*Chenopodium*	*Phytolacca*	Unknown
5AA83-10-77	100	—	—	—	—	—	—	—	—	—	—	1	5	—	—	5	—	1	—	—
-10-77	100	—	—	—	—	—	—	—	—	—	—	—	3	—	1	8	—	—	—	—
-10-79	100	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—
-10-79	100	—	—	—	—	—	—	—	—	—	—	—	7	—	—	1	—	—	—	—
-10-82	100	—	—	—	—	—	—	—	—	—	—	—	57	—	—	1	—	—	—	—
-10-94	25	—	—	—	—	—	—	—	—	—	—	—	24	—	—	—	—	—	—	—
-40-4	25	—	—	—	—	—	—	—	—	—	—	—	20	—	—	—	—	—	—	—
5AA86- 4-24	100	—	—	—	1	—	—	—	—	1	—	—	18	—	—	1	—	—	—	1
- 4-27	100	—	—	—	—	—	—	3	—	—	—	—	3	—	—	1	—	—	—	—
- 4-27	25	—	—	—	—	—	—	—	—	—	—	—	4	—	—	4	—	—	—	—
- 4-37	25	—	—	—	—	—	—	—	—	—	—	—	68	—	—	—	—	—	—	—
- 7-158bw	25	8	—	—	8							8	28	—	—	—	—	—	—	4
- 7-158w	25	4	—	—	76	—	—	8	—	—	—	—	48	—	—	8	—	—	—	4
- 7-163	25	8	4	—	—	—	4	—	—	—	—	—	54	—	—	—	—	104	—	—
- 9-65	12.5	120	—	—	240	—	—	—	—	—	—	—	8	—	—	—	—	—	—	—
-11-89	12.5	—	—	—	—	—	—	72	—	—	—	—	64	—	—	32	—	—	—	—
-11-95	100	—	—	—	—	—	—	—	—	—	—	—	7	—	—	6	—	—	—	—
-11-112	25	—	—	—	—	—	4	4	—	—	4	—		—	—	—	—	—	—	—
-22-28	50	—	—	—	—	—	—	—	—	—	—	—	36	—	—	—	—	—	—	—
-22-50	12.5	—	—	—	—	—	—	—	—	—	—	—	376	—	—	—	—	—	—	—
-22-15	100	—	—	—	—	—	—	—	—	—	—	—	2	—	—	6	—	—	—	—
-29-17	25	—	—	—	—	—	—	—	—	—	—	—	8	—	—	4	—	—	—	—
-34-107	50	4	—	4	—	—	2	8	2	—	—	2	24	—	2	2	2	—	1	—
TOTAL		144	4	4	325	—	10	95	2	1	4	11	868	—	3	79	2	105	1	9

*Although no bean was found in any flotation remains, many hand-sorted and screened beans were recovered., Site 86-1, Site 88-1, Site 92-292.

This partial manipulation can include a deliberate, culturally recognized direct action on a plant as well as an indirect or secondary result from altering a plant community for other purposes. The first is exemplified by the selective retention of a useful weed in a field. This practice is a form of cultivation. The second is primarily the modification or creation of new habitats with land clearance for domesticated plants and the simultaneous invasion of the land by volunteer plants.

While the degree of interaction is a continuum, for the purposes of this report it will be considered in three parts based upon the occurrence of a plant population in a particular location: plants that are not dependent on human populations, plants that are partly dependent, and plants which are totally dependent.

The evidence for subsistence plants comes from two recovery procedures: direct observation and flotation. The macroplant remains were recovered manually either in the process of excavation or screening. This method misses most carbonized seeds and other botanical fragments. Furthermore, the recovered remains will vary markedly if different screen sizes are used. Obviously, this technique produces a highly biased sample which favors charcoal and corn cobs at the expense of other food plants in particular.

The other source of botanical artifacts, flotation, is much more random and does recover small seeds. During the Chimney Rock excavations buckets of soil were collected from all features and subjected to water separation. By this practical field method the soil was dumped in a container with a screen, 0.9 mm mesh opening, at the bottom. This was submerged in stream water to within a few inches of its top. The soil was washed away leaving the charred remains behind. Since many calcium carbonate impregnated carbonized plants do not float, this was a practical method. Using this process the whole botanical assemblage for a sample was recovered for analysis.

Twenty-three flotation samples were analyzed. If the sample was very large (greater than 500 g.), it was split into equal fractions until an efficient sorting size was obtained (range 100 to 500 g.). Of course, weights were recorded for each subsample so that statistical reconstruction of the whole sample could be obtained. Once a subsample was obtained, a trained technician separated roots, pebbles, soil debris, and other contaminants from the carbonized residue. Identification was aided by several seed identification manuals and an extensive reference collection at the Ethnobotanical Laboratory.

As a general rule, charred material was considered prehistoric, whether culturally or biologically deposited, and non-carbonized material represents more modern contamination. The fresh assemblage is important for two reasons. First it gives an indication of background contamination, purity of the samples, and in a gross sense, an understanding of the degree of subsurface biological disturbance. Secondly, problems in the flotation procedure can be recognized and corrected.

Within our 23 flotation samples, 1,582 reproductive structures are presented (average of 59 per sample). Of this number, 117 were non-carbonized. This represents an 8.0 percent contamination. From previous work it is clear that this is a low percentage. Even more encouraging is the fact that 104 of the 117 contaminants are from one sample (5AA86-7-163). Therefore, the level of modern contamination is low and the efficiency of the flotation procedure seems excellent.

Thirteen different taxa are represented in the sample: six identified to species, three to genus, three to family, and one unknown. The two clear plant domesticates, maize and beans, will be discussed separately. Table 42 gives pertinent botanical, phytogeographic, and ethnobotanical considerations of the remaining 11 taxa.

The two species which fall within the category of highly manipulated plants are maize (*Zea mays*) and common bean (*Phaseolus vulgaris*). One genus (*Chenopodium*) represents the intermediate stage and six taxa are in the slightly manipulated category (*Prunus virginiana, Yucca baccata, Opuntia imbricata, Symphoricarpos* sp., *Amelanchier* sp., and *Oryzopsis hymenoides*). Four taxa are not identified specifically enough to determine their place in a subsistence cycle.

Table 37 lists the presence/absence of these taxa in relation to Harris's modern vegetation associations. Contrary to his view that the sites were located in the least productive zone, the evidence present suggests otherwise. The utilized species are clustered in the pinyon/juniper and mountain shrub associations. Those found in the other zones are ubiquitous in the study area. No species restricted in its distribution to the riparian or ponderosa pine/Douglas fir association is represented.

TABLE 37

Modern Community[1] Affiliation of Seed Taxa Recovered Archaeologically

	Top of Mesa	Mesa	Mountain Shrub	Ponderosa Pine/ Douglas fir	Riparian
Prunus virginiana	X	X	X	X	X
Yucca baccata	-	X	X	-	-
Opuntia imbricata	-	X	X	-	-
Symphoricarpos spp.	X	X	X	X	X
Amelanchier spp.	X	X	X	X	X
Oryzopsis hymenoides	X	X	X	-	X
Chenopodium sp.	X	X	X	-	-

[1]From Harris (this volume)

Possibly more interesting than the species present is the conspicuous absence of several potentially important economic plants. The three species mentioned by Harris are pinyon nuts, juniper berries, and acorns. None is present in the archaeological record save for one pinyon nut fragment. Their absence cannot be explained by differential properties as they are commonly found in archaeological contexts. The best explanation, as suggested by the charcoal as well, is that these species were not available.

All the species present suggest the utilization of fruits and seeds. Four are woody shrubs producing fleshy fruits, one is a large-seeded grass, one is a large multi-seeded fruit, one is a small herbaceous plant producing many small seeds, and one is a cactus with many-seeded fruit. The degree of human manipulation of most of these species is minimal except for the probable creation of suitable habitats on south-facing slopes and for the casual or accidental dispersal of discarded seeds.

The one possible exception is lambs-quarters (*Chenopodium* sp.). This genus, while found in pristine areas, is adapted to disturbed sun-drenched habitats. Because of this weedy behavior it has a close locational relationship with human populations. Ethnographic examples of the protection of this genus in fields among the modern pueblos are widespread. While we are not suggesting any specific relationship between the Chimney Rock population and *Chenopodium,* the intensive manipulation of *Chenopodium* has been recorded. When the young leaves first appear they are pinched off and prepared as a cooked spinach. With new growth the plant is permitted to reach full maturity, when the seeds are collected for food.

Little can be said about the seasonal dimension of the specimens. While all are collected during the summer or early fall, all represent storable commodities which could be used in dried form throughout the year.

The two domesticated species, maize and beans, are represented in quantity. This is particularly interesting as it relates to a recent article by Dobyns (1974). He suggests segregation of ethnic group along an altitudinal gradient. This is partly due to the adaptability of certain cultigens. More specifically he hypothesizes that high altitude occupation from "A.D. 1000 and for some time after depended upon amaranth and perhaps chenopodium cultivation" (45). In addition he suggests "that downstream migration of Puebloan populations after A.D. 1150 stemmed from cultural change in economic patterns . . . that these gardeners moved to lower elevations to grow more maize, beans, squash, and cotton and less chenopodium and amaranth" (45).

There are several problems with this hypothesis. Implicit is the view of altitude as a static variable. Eddy's hypothesis (this volume), as well as our own, suggests that prehistoric populations can minimize the deleterious effects of higher elevations by selecting strategies maximizing other factors such as planting on south-facing slopes and controlling runoff. Indeed, the apparent upstream movement by the prehistoric populations in the upper San Juan basin recorded by Eddy is a specific example of a complex field-selecting strategy.

While we are not disputing the high altitude adaptability of chenopods and amaranth, the evidence of cultivated amaranth and chenopods in the American Southwest is anything but supportive of Dobyn's hypothesis. The only documented archaeological occurrence of a cultivated amaranth is from Tonto (Bohrer 1962). In addition to amaranths, there is a large assemblage of cultigens including maize and squash, and many legumes including *Phaseolus*.

There are many reports of chenopodium and amaranth seeds in North America. Of the reported finds in the southwest cited by Dobyne (San Cayetano del Tumacacori, Snaketown, Tonto, and on the San Xavier Reservation) all are low altitude sites in the Sonoran Desert. The highest is Tonto at 3,150 feet, hardly a high altitude area. Even in these sites other clearly non-domesticates are found in large quantity (i.e., 890 ml. of tansy mustard [*Descurana*] as compared with only 572 ml. of maize from Arizona BB: 13:50). Therefore, there is no ecological basis or archaeological evidence from high elevation sites, of which Chimney Rock is an outstanding example, to support Dobyne's thesis.

As previously stated, the Chimney Rock populations inhabited an area approximately 7,800 feet in elevation. Despite what would superficially seem to be a poor area for cultivation, maize and beans are found in quantity.

Twenty-two of the 23 flotation samples and 47 macroplant lots contained maize. These are from sites 5AA83, 5AA86, 5AA88, and 5AA92. Beans were identified from all sites except 5AA83 and not in any quantity.

The bean fragments recovered are of the common bean (*Phaseolus vulgaris*), by far the most important legume in prehistoric North America. Approximately 32 g. (70 ml.) were recovered.

Complete charred cotyledons (one-half a bean without the seed coat) were measured for length, width, and thickness. Table 38 gives the statistical summary of the largest three lots of bean cotyledons. The three are similar and can be considered as a single population. This phenotypic similarity is due to similar environmental conditions and a narrow genotype. If localized environmental conditions were indeed

TABLE 38
Statistical Summary of Three Archaeological Bean Populations, 5AA92

	Length			Width			Thickness		
	92-3-1	92-9-3	92-8-1	92-3-1	92-9-3	92-8-1	92-3-1	92-9-3	92-8-1
N	48	100	55	78	131	75	151	133	92
$\overline{X}$	1.04	1.04	1.03	.74	.62	.63	.23	.25	.25
SD	.10	.10	.10	.24	.06	.06	.04	.05	.04

quite marginal for this cultigen, then a less uniform population as characterized by a greater standard deviation would be expected.

While this bean population is uniform by comparison with other populations, it is distinctive. Data from Arroyo Hondo pueblo (Wetterstrom, n.d.), using the same measurements, statistically are different. A test with analysis of variance was used. The length measurement was significant to the 0.005 percent level, width to the 0.01 percent level, and thickness to the 0.02 percent level. This is of interest because both are high altitude sites and each shows internal similarity. With more comparative data, population studies can give a testable data base for comparing various phenotype modifiers of field crops.

Maize was found in many proveniences in the Chimney Rock excavation. All was charred. The material recovered was primarily kernels. Of the 868 maize fragments recovered from flotation, 712 (82.03 percent) were grains or grain fragments, 154 (17.74 percent) were cob fragments (rachis flaps or cupules), and 2 (0.23 percent) were shank pieces. The composition of the macroplant remains mirrors this component breakdown.

The low percentage of cob remains and the abundance of kernels suggest that these remains were from material stored after shelling. The absence of cob or cob impressions in several large aggregates of charred maize supports this interpretation. This is not to hypothesize that maize was imported from lower elevations. If this were true, assuming maximum transportation efficiency, virtually no cobs or cob fragments would be found.

Several lots of maize have a "metallic" sheen on the surface. This uncommon appearance has been noted on several archaeological collections from the Rio Grande Valley (Volney H. Jones, personal communication). This condition may be attributed to a genetic variability or simply to charring.

Maize is a highly variable and economically important grass, and as such there have been many typological schemes proposed for describing populational variation. The classic approach has been the concept of race. Here sets of morphological variation are qualitatively used. While this has proven effective for modern situations and desiccated maize from archaeological sites, many of the characteristics used for identification are obliterated in the charring process. In addition, these designations do not account for specific variables which operate on the genotype.

The second approach is in essence quantitative. Here measurable characteristics are used much as numerical systematics to locate aggregates of individuals with similar characteristics. Consequently, environmental influence can be mapped on a comparative basis.

Ideally, the best approach is an integration of both, in which quantitative data are used without sacrificing the advantages of the use of qualitative characteristics.

For the Chimney Rock specimens there is a problem concerning what to measure. Since most of the remains are grains, it would be logical to use the largest data base. However, charred kernels have proven unreliable for such purposes. This study confirms this. Table 39 gives a rudimentary statistical summary for three large samples of maize. Using a t-test we found that different measurement (length, width, and thickness) between the same samples indicated opposite judgments concerning the relatedness of the samples. Some showed that they had a strong probability of being from different populations (i.e., width between 92-8-1 and 83-10-37); others (i.e., length between 92-8-1 and 83-10-37) suggest that they are from the same population.

This distortion is due to carbonization. Using cob studies (Brugge 1965, Cutler and Blake 1973), shrinkage and distortion has been shown to be a function of moisture content with a shrinkage factor of 15 to 25 percent. This problem has been recognized for other plant remains as well (Renfrew 1972, Ford and Brose 1975, Yarnell 1972).

Eighteen cobs or cob fragments were recovered from the excavations. The number of rows is an important attribute for

TABLE 39
Statistical Summary of Three Archaeological Populations of Maize Grains

	Height			Width			Thickness		
	92-9-14	92-8-1	83-10-37	92-9-14	92-8-1	83-10-37	92-9-14	92-8-1	83-10-37
N	154	85	68	149	83	71	138	.77	.71
$\bar{X}$	.53	.60	.60	.79	.89	.43	.78	.70	.57
SD	.08	.34	.05	.11	.13	.04	.36	.11	.06
%	.0064	.1156	.0025	.0121	.0169	.0016	.1296	.0121	.0036

archaeological maize remains because it is not affected by carbonization. Table 40 gives the percentages of each row number with comparative percentages with other Southwestern populations. The majority of cobs (78 percent) have either ten or twelve rows; a minority have 4 rows (5.5 percent) and 8 rows (16.8 percent). This compares quite favorably with other maize populations. The row percentage for Arroyo Hondo, which is located at approximately 7,000 feet, is particularly similar.

TABLE 40
Percentage of Row Number in Selected Archaeological Maize Populations in the American Southwest

Provenience	N	8	10	12	14	16
Chimney Rock	18	16.7	22.2	55.5	5.5	
Arroyo Hondo[1]	488	5.6	22.2	49.4	19.0	3.8
Cochiti[2]	35	8.5	60.0	28.5	3.5	-
Antelope Cave[3]	1022	12.0	34.0	37.0	14.0	3.0
Paiute Mesa[3]	127	16.0	49.0	29.0	2.0	4.0
Benchmark Cave[3]	90	36.0	3.60	29.0	4.0	1.0
Chaco Canyon[3]	15	7.0	20.0	46.0	37.0	-

(Sources: [1]Wetterstrom n.d.; [2]Ford 1968; [3]Cutler and Meyer 1965)

In the Mesa Verde area (Cutler and Meyer 1965) the earlier BM II-P II maize tends toward a moderate row size (10-12-14). There seems to be a shift at P III to a higher percentage of 8-row ears and the consequent lower percentages of 12 and 14 row.

While there are shifts in maize through time, we do not wish to characterize synchronic maize populations as monotypic. Rather "the races of corn are not sharply differentiated entities, but are rather peaks which rise from greatly varied populations. Almost certainly the corns reaching the Southwest already had some heterogeneity, and it is not necessary or wise to postulate a separate aseptic arrival of each influence" (Jones and Fonner 1954:115).

Not only does the row number correlate with other contemporary maize populations in the southwest, but it fits into the chronological scheme of Cutler and Meyer (1965) and Winter (1975). It is interesting to note that the cobs are not nubbins. It has been noted that corn grown under adverse conditions are smaller and have fewer rows of grains. Further, sucker or tiller stalks often produce diminutive cobs if permitted to mature. The 18 cobs from the Chimney Rock excavations are not particularly small or distorted, and the row numbers seem not to be diminished. This reinforces our view that the Chimney Rock was not climatically marginal for maize.

The other measurement of importance is cupule width (Table 39). Here again, little statistical information concerning cupule width is published. In comparing it to Arroyo Hondo we find that the means are statistically significant to the .001 percent level and represent different populations. While Chimney Rock is at a higher elevation, its mean cupule width is larger.

Based on the evidence from all the Chimney Rock sites, there are no differences in the populations of corn or beans. This suggests that considerable care was exercised to assure planting in favorable localities and that care was taken to protect the ripening crops. The absence of nubbins suggests that tillers were not growing or permitted to grow, and the uniformity of the cobs argues that fields must have been well cleared and free of most competitors. The presence of chenopodium seeds suggests that useful volunteer plants were permitted to grow within the fields but the absence of other field weeds may indicate their physical absence or culturally recognized undesirability.

Material Culture

The most important usages of the native vegetation for the Chimney Rock populations were firewood and construction materials. All were locally available and were secured primarily from the mesa top or the nearby steep mesa slopes.

Ponderosa pine was the predominant roofing material and the most frequently used firewood. The other woods served as savinos and ceiling fill as well as faggots. In contrast to other sites in the Anasazi and northern Rio Grande area where pinyon pine and juniper were employed for these purposes, the general availability of the ponderosa pine is the best explanation for its overall importance.

An extremely fragile portion of a charred coiled basket and some of its possible contents were uncovered in Room 8 at 5AA83. The basket has a two-rod and bundle triangular foundation held together with an uninterlocked stitch to form a close-coil container. The individual stitches are one mm. wide (not corrected for shrinkage) and the material is a carefully split monocotyledenous leaf. There are seven stitches per 10 mm. of coil. The rods are formed from one- and two-year-old three-leaf sumac (*Rhus trilobata*) twigs, and the bundles consist of grass culms apparently of more than one species. Unfortunately the very small fragment precludes further identification without destroying the specimen. The construction employed in this basket was the most common one used in the upper San Juan region starting with the Basket Maker occupation.

The contents of the basket may be more fortuitous than purposeful. They consist of five pieces of ponderosa pine charcoal, two charred pinyon pine twigs, and one 12-row carbonized corncob fragment. Its cupule width of 6 mm. and general appearance is typical of the other cobs found in the Chimney Rock sites (Table 39).

No other artifacts of vegetable origin were submitted to the Ethnobotanical Laboratory.

Summary and Conclusions

The prehistoric occupation of spectacular Chimney Rock and its recent excavation afford archaeologists an opportunity to investigate pre-Columbian cultural adaptations to a high altitude. Elevation by itself is not necessarily a problem but its concomitant climatic variables—short growing seasons and unpredictable precipitation patterns—can stress a sedentary, farming population. Similarly, the number of alternative edible plants and their products are fewer than those available to human communities residing at lower elevations.

The plant remains from the Chimney Rock sites support the conclusion that the mesa top and its gentler south-facing slopes were dominated by ponderosa pine when prehistoric farmers first cleared them for their fields. This wood was used in the construction of the pueblos and for firewood. Additional firewood came from the steeper slopes, riparian communities at the foot of the mesa, and from the shrubs which grew in long-abandoned fields.

There is no evidence that any plants other than maize and beans were important in the subsistence pattern of these people. Several wild plants and even a few that may have been encouraged in the fields were supplemental to the diet and gave periodic relief to the daily fare. None was present in any quantity, and, surprisingly, pinyon nuts and acorns appeared so infrequently that one must assume they were virtually unavailable to these people.

Basically the high altitude botanical subsistence activity of the Anasazi populations of the Chimney Rock region of Colorado closely resembled the adaptation of puebloan peoples in other areas of the Southwest. The difference was of course that these farmers sought arable land at the very margin of successful corn agriculture. At these elevations they did not change their way of life but they undoubtedly changed the landscape to accommodate their predetermined subsistence activities. Their initial success was their eventual undoing.

TABLE 41
Plant Taxa Identified From Charcoal Samples

Pseudotsuga menziesii (Mirb.) Franco — Pinaceae
"Douglas fir"
large trees up to 200′
4,000-11,000′ on porous soil with northern exposure
Pinyon/juniper, mountain shrub, ponderosa/Douglas fir and riparian

Abies concolor (G&G) Lindl. — Pinaceae
"White fir"
large trees up to 250′
3,000-11,000′ on sandy loam or gravelly soil, usually with a northern exposure
Ponderosa/Douglas fir

Pinus ponderosa Laws. var. scopulorum Engelm. — Pinaceae
"ponderosa pine," "Western yellow pine"
large trees up to 230′
2,000-10,000′ tolerant of many soils, usually with a southern exposure
pinyon/juniper, mountain shrub, ponderosa/Douglas fir and riparian

Pinus edulis Engelm. — Pinaceae
"pinyon"
short tree to shrub-like growth
4,000-7,000′
Top of mesa, pinyon/juniper, mountain shrub

Juniperus spp. — Cupressaceae
"juniper"

J. virginiana L. var. scopulorum Lemmon.
"red cedar"
large shrub to small tree
0-9,000′ on gravelly or rocky soils, dry ridges or bluffs
Top of mesa, pinyon/juniper, mountain shrub, ponderosa/Douglas fir, and riparian

J. Osteosperma (Torr.) Little
"Utah juniper"
usually a many stemmed shrub
3,000-8,000′ on arid slopes or valleys
pinyon/juniper

Crateagus sp. — Rosaceae
"Hawthorn"
small shrub
3,000-8,500′, thickets on rocky ground along streams
Ponderosa/Pseudotsuga, riparian (C. rivularis)

Cercocarpus montanus Raf. — Rosaceae
"mountain mahogany"
3,500-9,000′ on dry rocky bluffs or mountain sides
Top of mesa, pinyon/juniper, mountain shrub, ponderosa/Douglas fir and riparian

Acer glabrum Torr. — Acerceae
"mountain maple"
shrub or tree
4,000-9,000′ in poor, well-drained soil with sunny exposure
Ponderosa/Douglas fir

Quercus gambellii Nutt. — Fagaceae
"scrub oak"
shrub or small tree
4,000-8,000′ widespread species
Top of mesa, pinyon/juniper, mountain shrub, ponderosa/Douglas fir and riparian

Populus angustifolia James — Salicaceae
"narrow-leaf cottonwood"
tree up to 60′
2,000-7,000′, along stream sides in mountainous areas
Ponderosa/Douglas fir, riparian

Rhus trilobata Nutt. — Anacaudiaceae
"skunkbrush"
2,500-7,500′ on open slopes
Top of mesa, pinyon/juniper, mountain shrub, ponderosa/Douglas fir and riparian

TABLE 42
Plant Taxa Identified From Seeds

Prunus virginiana L. Rosaceae
"Choke Cherry"
Usually shrub but can form a tree form up to 25', very common throughout the Southwest.
fruits mature July-September, good crop are borne almost yearly
Top of mesa, mesa, mtn. shrub, ponderosa pine/Douglas-fr, riparian
The ethnographic record of its use is extensive. While it has been used as a source of wood, as a medicine, and in ceremonial contexts, its most important use is eating of the succulent fruit, either fresh or dried. Document use in the Southwest is present for the Navajo, Eastern Pueblos, Western Pueblos, and Apache.

Amelanchier sp. Rosaceae
"Service berry"
Shrub, fruit matures July-August
A. alnifolia Nott along streams or in canyons
A. utahensis Koehne dry canyons, rocky slopes, and mountain sides 4,000-8,000
A. alnifolia Top of mesa, mesa, mtn. shrub
A. utahensis Top of mesa, mesa, mtn. shrub, ponderosa pine/Douglas fir
While its prime use is its fruit, fresh or dried, its wood is utilized for construction and as a medicine. Documents ethnographic use includes Navajo, Apache, and Eastern Pueblos

Yucca baccata Torr. Agavaceae
"Lilliaceae"
short semi-succulent with basally arranged leaves with prominent flower stalk
on dry plains and mesas-2,000'-8,000'
Mesa and mtn. shrub
The Banana Yucca is an important economic plant in the Southwest. Uses include fruit as food, roots for soap, leaves for basketry and brushes, as medicine, young fruit (?) stalk eaten, and juice for dye base. Groups using it include Yumans, Eastern Pueblos, Western Pueblos, Pima, Papago, Apache, and Navajo.
for further references see Bell and Castetter

Orizopsis hymenoides (R+S) Ricker Gramineae
"Indian Rice-grass"
perennial bunch grass 1-2' tall
on sand, soil, plains and mesas 3,500'-6,500' seeds ripen in late June
Top of mesa, mesa, shrub, and riparian
The seeds are an important food source. Groups using it include Western Pueblos, Navajo, and Apache
for further references see Jones 1938

Chenopodium sp. Chenopodiaceae
"Lambsquarter"
herbaceous annuals and perennials
common in disturbed ground through the Southwest

Symphoricarpos spp. Caprifoliaceae
"Snow berry"
small shrubs

S. Rotundifolius	slender straggling shrub 4,000-10,000 in mtn. canyons and rock slopes fruit matures July-September
S. Oreophilus	deciduous shrub 5,000-9,000' fruit matures August-September
S. spp.	Top of mesa, mesa, mtn. shrub, P/P, riparian
S. rotundifolius	Top of mesa
S. Oreophilus	Top of mesa, mesa, mtn. shrub, P/D, riparian

Symphoricarpos is primarily used in medicinal preparations, primarily for stomach problems. Groups using it include Navajo.

Opuntia imbricata (Haw.) D.C. Cactaceae
"Cholla"
Spiny shrub or small tree
on gravelly or sandy soils, 4,000'-6,000'
Mesa, mtn. shrub
Uses include as a medicine, ceremonial use, seeds eaten, buds eaten, and spines as needles. Groups include Pima, Western Pueblos, Eastern Pueblos, Navajo, and the Papago
for further references see Castetter and Bell, 1935

C. Album Top of mesa, mesa and mtn. shrub
Chenopods are a well-known source of greens (young plants) and for seed (mature plants). Also it is used in ceremonial contexts. Groups in the Southwest using it include Navajo, Apache, Western Pueblo, Eastern Pueblo, Pima and Papago.

Euphorbiaceae
"Surge family"
A large family (approximately 5,000 species), primarily tropical and sub-tropical, often with milky sap. Not an important economic family in the southwest but many species are adapted to disturbed micro-habitats.

Cactaceae
"Cactus family"
A family of stem succulents with about 200 species. Adapted to xeric conditions. Mammalaria and Echinocactus, in addition to Opunta, are found in the study area. The one specimen does not fit either of these genera.

Compositae
"Sunflower family"
One of the largest family (approximately 13,000 species). In temperate regions these plants are usually small herbaceous, many being adapted to disturbed micro-habitats. A generic identification could not be obtained for this specimen.

Appendix C Bibliography

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ADDENDUM

After the manuscript had been sent to the printer, Robert L. DuBois, Director of the Earth Sciences Observatory, University of Oklahoma, Norman, Oklahoma, reported on the archaeo-magnetic analysis of burned floor plaster removed from the southeast quadrant of Room 2 (Feature 11) in Building 16, 5AA88. The samples were taken by student assistants Jeff and Kathy Amy on July 10, 1972. DuBois reports a date of AD 1190 $\pm$ 31 years derived by averaging eight laboratory assays. The construction of Room 2 is well dated by tree-ring cutting dates of AD 1077 while this archaeo-magnetic date provides time control on destruction of the room by fire; an event which must have occurred at, or soon after, abandonment. Comparison of the central dates indicates use of the room for 113 years, a not unreasonable length of time. However, two lines of reasoning indicate that the archaeo-magnetic central date should not be accepted at face value: (1) the absence of pottery types expectable in the 12th century (Truell 1975: Table 2) and (2) the fact that in general, other lines of evidence do not support dating the Chimney Rock Phase later than AD 1125. To meet these criteria, it would be necessary to employ the two sigma age range of AD 1128 to 1252 providing confidence for the archaeo-magnetic date at the 95 per cent level. Appreciation is extended to the Earth Sciences Observatory staff for service in providing this assay.