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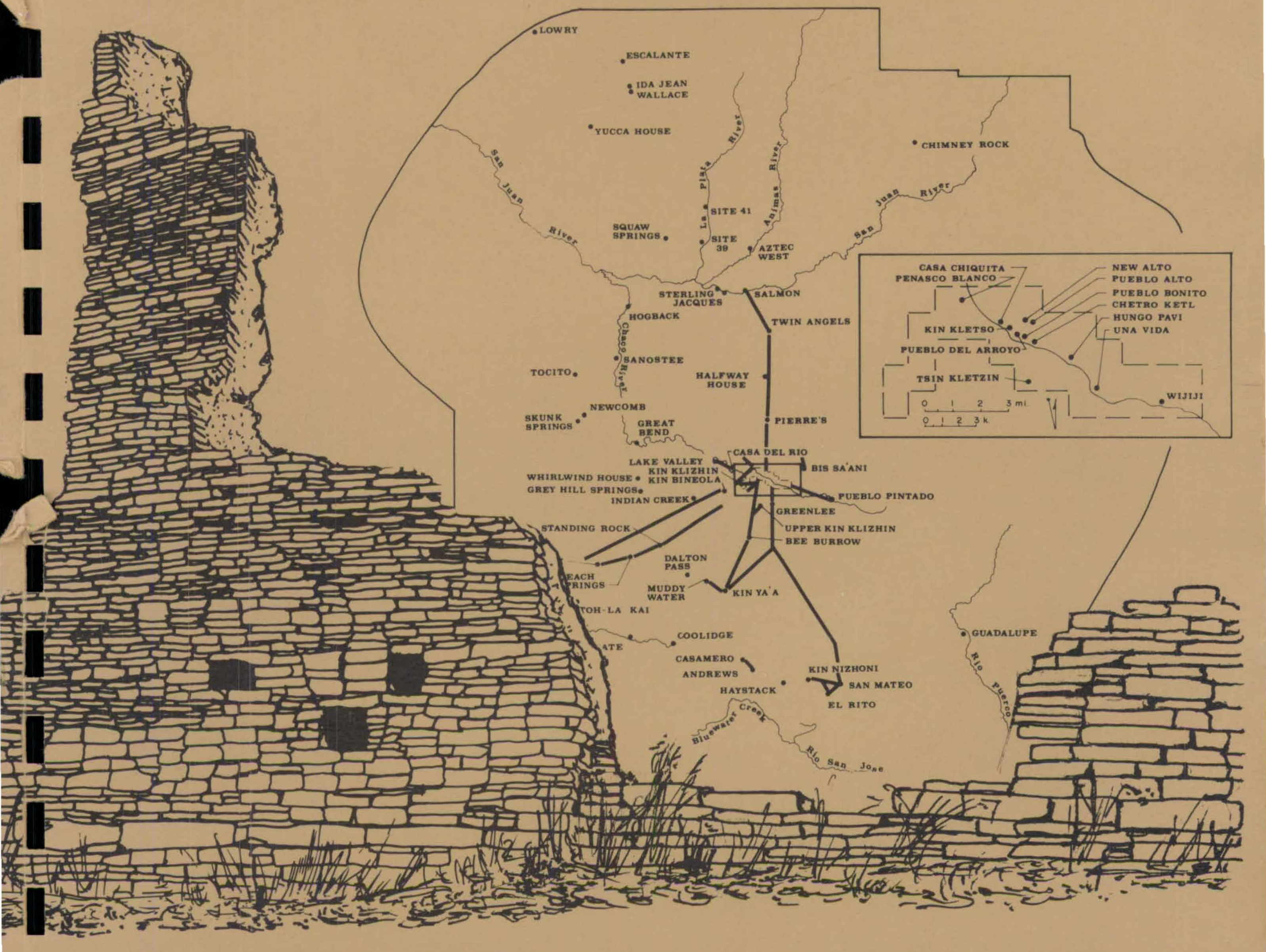
REPORTS OF THE CHACO CENTER
Number Three



THE OUTLIER SURVEY

A REGIONAL VIEW OF SETTLEMENT IN THE SAN JUAN BASIN

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by

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DIVISION OF CULTURAL RESEARCH

National Park Service
U. S. Department of the Interior

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REPORTS OF THE CHACO CENTER

W. James Judge
General Editor

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1. LYONS, THOMAS R., ED.
   1976 Remote Sensing Experiments in Cultural Resource Studies: Non-destructive Methods of Archeological Exploration, Survey and Analysis. Reports of the Chaco Center, No. 1. National Park Service and the University of New Mexico, Albuquerque.

2. LYONS, THOMAS R., AND R. K. HITCHCOCK, EDS.
   1977 Aerial Remote Sensing Techniques in Archeology. Reports of the Chaco Center, No. 2. National Park Service and the University of New Mexico, Albuquerque.

3. POWERS, ROBERT P., WILLIAM B. GILLESPIE, AND STEPHEN H. LEKSON
   1982 The Outlier Survey: A Regional View of Settlement in the San Juan Basin. Reports of the Chaco Center, No. 3. Division of Cultural Research, National Park Service, Albuquerque.

4. BRUGGE, DAVID M.
   1979 A History of the Chaco Navajos. Reports of the Chaco Center, No. 4. Division of Chaco Research, National Park Service, Albuquerque.

5. WINDES, THOMAS C.
   1978 Stone Circles of Chaco Canyon, Northwestern New Mexico. Reports of the Chaco Center, No. 5. Division of Chaco Research, National Park Service, Albuquerque.

Correspondence regarding the reports of the Chaco Center should be addressed to the Archival Assistant, Division of Cultural Research, National Park Service, P.O. Box 26176, Albuquerque, New Mexico, 87125.

EDITOR'S NOTE

The Chaco Center, a joint National Park Service/University of New Mexico facility, was established in 1971 to conduct multidisciplinary research in and about Chaco Canyon National Monument, New Mexico. One of the Center's missions is to disseminate information resulting from its various programs to those individuals and institutions involved in similar or related types of research. Most monographs concerning major projects of the Center will be issued as numbers of the National Park Service Publications in Archeology series.

Other reports, prepared by staff members of the Chaco Center or individuals collaborating with the Center, may be relatively short or may deal with more specific research problems, and thus may not warrant the widespread distribution of the major monographs. Nevertheless, they are significant contributions to knowledge, and need to be made available to those concerned. With this goal in mind, Dr. Robert Lister established the Reports of the Chaco Center series in 1976 as a mechanism to provide limited distribution of copies of these papers in an economical and timely fashion. I assumed the editorship of the series in 1978, when Dr. Lister retired.

The Reports of the Chaco Center include papers based on research in the Chaco Canyon area proper, or on Chaco-related phenomena in the larger San Juan Basin. Most archeological reports will be prepared by staff members of the Division of Cultural Research, while studies in other fields will be written by collaborating scholors.

The Chaco Center maintains an up-to-date list of all published papers, reports and monographs dealing with Chacoan or Chaco-related research sponsored by or carried out in collaboration with the Center, regardless of where they might be published. This list, entitled "Contributions of the Chaco Center," is available on request from the Division of Cultural Research, at the address given on the opposite page.

This is Report Number 3. The first two Reports dealt primarily with remote-sensing techniques and expériments. Reports 4 and 5 have been published. The sixth Report, dealing with the architecture and dating of Chetro Ketl, one of the large sites in Chaco Canyon, is presently being edited.

FOREWARD

The National Park Service's Division of Cultural Research, also known as the Chaco Center, completed the majority of its planned field investigations in the Chaco Canyon area in the late 1970's, and began to focus its efforts on the analysis and interpretation of the data recovered. Even before finishing our field work, however, it became apparent that answers to the archaeological problems of Chaco could not be determined from analyses of data derived solely from the Canyon area itself. We began to realize that we were dealing with the tip of the iceberg--much of Chaco lay far outside the Canyon. Chaco influence elsewhere in the San Juan Basin had, of course, long been known to archaeologists, but its extent and degree of refinement was only just beginning to be appreciated.

Realizing that we were dealing with a refined, complex, socioeconomic and political system, we felt it imperative to broaden our investigations to include survey and reconnaissance of Chaco-related sites elsewhere, and most importantly, to extend this effort to the village sites which comprised the prehistoric communities surrounding the outlying Chacoan structures. Initially, three sites were chosen for investigation: Bis sa'ani, Peach Springs, and Pierre's, and the three Chaco Center archaeologists assigned to the project have reported the findings of their intensive survey here. However, they have also taken the opportunity to go beyond the data from those three sites to compile an assessment and evaluation of most of the known Chacoan outliers in the San Juan Basin. This effort was taken in cooperation with another study carried out by Mike Marshall, John Stein, and Richard Loose, and, I feel, is very successful in complementing their work.

As witnessed by Chapter 5 of this report, the authors have compiled a plethora of new data on the outlier phenomenon from a combination of extensive reconnaissance and literature review. The following synthesis and interpretation of these and other data, presented in Chapters 6 and 7 from the standpoint of a prehistoric regional system, will, I feel, be of lasting benefit to researchers interested in approaching the complex Chaco phenomenon which dominated the San Juan Basin in the eleventh and twelfth centuries, A.D. Further, the report most certainly will be very effective in assisting land managers to carry out their responsiblity of protecting and preserving the Chaocoan outliers.

W. James Judge
December, 1982

ACKNOWLEDGEMENTS

A large number of people have contributed to the completion of this report, and it is a pleasure to acknowledge their contributions here. For unfailing support and constant patience, from the inception of the outlier survey, through an endless succession of drafts and revisions, W. James Judge deserves a large measure of credit and my most sincere thanks. Second, but no less, William B. Gillespie and Stephen H. Lekson as co-authors have provided much needed realistic advice and criticism.

Another round of thanks is extended to the entire Chaco Center staff, including Nancy Jo Akins, Catherine M. Cameron, Peter J. McKenna, John D. Schelberg, H. Wolcott Toll III, Marcia L. Truell, and Thomas C. Windes. All provided helpful criticism and reviewed numerous manuscript drafts. A special measure of gratitude is extended to Rosemary Ames, Rosarita Archuleta, and Angelle Bratcher, secretaries; Catherine Ross, archivist; Jerry Livingston, illustrator; and to Carol Condie, Joan Mathien, and Paula Sabloff who edited or reviewed portions of the manuscript. The photographic work is the result of the collaborative efforts of Jerry Livingston and Bruce Moore.

Without the assistance, criticism and advice of many San Juan Basin archaeologists our knowledge of Chacoan outliers could not have been brought to its present state. Mike Marshall, John Stein and Richard Loose, who were conducting their own outlier research project during the preparation stages of this report, provided much stimulus, enthusiasum and lively discussion. The free interchange of information between two studies contributed to each.

In addition to data contributed by Marshall and Stein, many other colleagues entrusted us with their original field notes, maps, manuscripts and photographs. Deserving of special mention are: John Beal, Bruce Bradley, Cory Breternitz, Joel and Charlotte Brisbin, Robin Farwell, Hayward Franklin, Rory Gauthier, Cynthia Irwin-Williams and the San Juan Valley Archaeological Project staff, Lou Ann Jacobson, Anthony Lutonsky, Gretchen Obenauf, Thomas O'Laughlin, Lonnie Pippin, and Cheryl Wase.

More than any other, R. Gwinn Vivian deserves recognition for realizing that outliers and a Chacoan system existed. Not only did he envision such a system long before others, but he convinced us that we should go out and archaeologically document it.

Robert P. Powers

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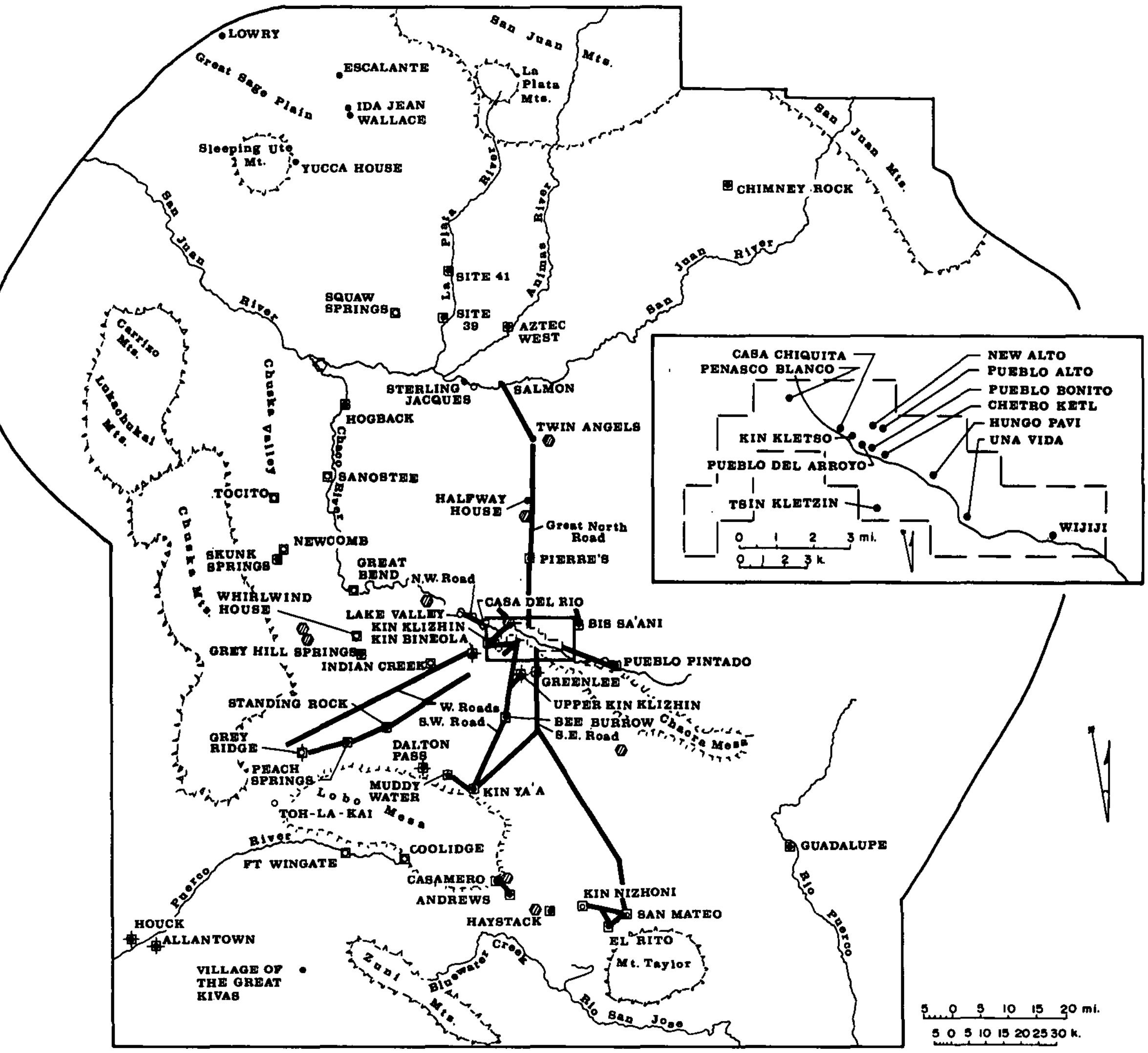
OBJECTIVES AND MEANS OF THE SURVEY

Introduction to the Problem

Within northwestern New Mexico, the Chaco Basin of approximately 11,500 km^2 is drained by an ephemeral watercourse known commonly as the Chaco Wash, or, more wishfully, the Chaco River. Although the meaning and origin of the word Chaco are unclear, the term is historically associated with the section of the wash enclosed by a shallow sandstone canyon, famous for its Anasazi ruins. The dense concentration of sites in Chaco Canyon, including some of the largest structures within the Chaco and San Juan Basins, has long suggested its prehistoric importance. The recent documentation of prehistoric Anasazi roadways that converge on the canyon from surrounding areas has only served to strengthen this belief. Chaco Canyon appears to have been the most important center of prehistoric settlement within the San Juan Basin during the eleventh and early twelfth centuries A.D. Given the prominence of the canyon archaeologically, the term Chacoan is also applied to descriptions of Basketmaker III to Pueblo III Anasazi archaeology of much of the San Juan Basin (Figure 1). (The key to symbols used in several figures in this report is shown in Figure 2.)

The San Juan Basin (ca. 40,000 km^2), which embraces the Chaco Basin within its south-central expanse, is a structural feature formed by surrounding monoclines, uplifts, platforms, and slopes (Fassett and Hinds 1971). Topographically, the San Juan Basin is bounded on the north by the San Juan and La Plata Mountains, Mesa Verde, and Sleeping Ute Mountain. On the west, Carrizo Mountain, the Chuska Mountains, and the Defiance Plateau rim the basin, while to the south less severe limits are formed by the Zuni Mountains. On the east the Nacimiento Mountains and the Jemez Caldera are the major features, lying just east of the Hogback Monocline, which structurally forms the east basin edge. Natural corridors into the basin are present to the northwest and southwest where the boundary mountains and plateaus give way to gradually sloping plains. Along the east and south perimeters, shallow valleys and low plateaus provide easy access as well.

Outside Chaco Canyon, in the expansive San Juan Basin, Chacoan students have long noted the presence of sites exhibiting architecture and ceramics characteristic of the major Chaco Canyon sites. Chacoan architecture also occurs at sites with assemblages dominated by San Juan and Chuskan series ceramics. More recently, it has become apparent that many of these outlying sites occur within major Anasazi site aggregations or communities and are linked to Chaco Canyon via prehistoric roads. The term outlier has come into popular usage to emphasize the geographic location of these communities relative to Chaco Canyon.



Outlying Chacoan structure or major Chaco Canyon structure (treated in this study)

Outlying Chacoan structure (not treated in this study)

Outlying Chacoan structure and associated community (inner circle or dot keys treatment or non-treatment)

Outlying Chacoan structure and probable associated community (inner circle or dot keys treatment or non-treatment)

Other reconnaissance area

Schematic interpretation of probable prehistoric road. With the exception of the Great North Road and the Southwest Road, road identifications are tentative, subject to future confirmation through ground survey.

Intensive survey areas include the Bis sa'ani, Peach Springs, and Pierre's communities. Reconnaissance areas include the Twin Angels, Halfway House, Hogback, Great Bend, Grey Hill Springs, Standing Rock, Dalton Pass, Muddy Water, and Casamero outlying structures or communities.

Figure 1. The Chacoan system. Early Pueblo III (1050-1175).

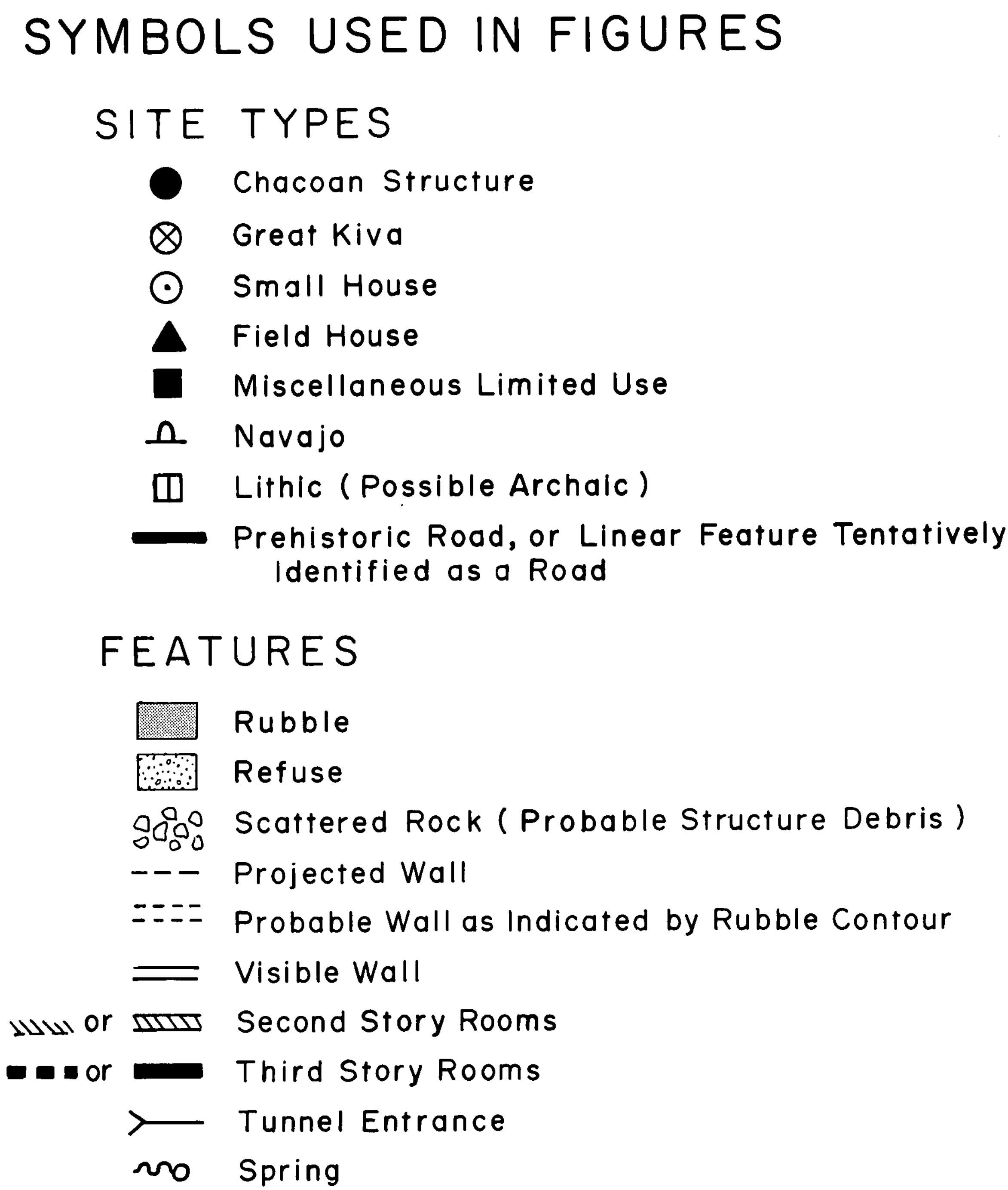


Figure 2. Symbols used in Figures.

Examples of widely recognized outlier sites with Chacoan architectural features and, in some instances, Chacoan (Cibolan) ceramics are Aztec Ruin (Morris 1928), Chimney Rock Pueblo, (Eddy 1977; Jeancon and Roberts 1924), Lowry Ruin (Martin 1936), Kin Ya'a (Bannister 1965; Holsinger 1901), Village of the Great Kivas (Roberts 1932), Allantown (Roberts 1939), and Salmon Ruin (Irwin-Williams 1972, 1975). A number of these sites are known to have associated smaller sites, and at a few, prehistoric roads have been documented.

While archaeologists have not doubted the "Chacoan" affinities of architectural features at these sites, debate continues concerning why sites up to 130 km distant from Chaco Canyon should display such striking morphological similarity. Early explanations included migration and resettlement of Chacoan groups or diffusion of Chacoan culture (Gladwin 1945:144-45; Martin 1936:103,205; Morris 1939:53,205; Roberts 1932:157). The great number of contemporaneous Chacoan outliers documented in recent years, however, has eliminated migration as a valid explanation, while diffusion in its traditional sense has been abandoned by many anthropologists because of its lack of explanatory value (Martin and Plog 1973:256-60).

The theoretical reorientations of the last 15 years, as well as substantial gains in empirical knowledge of Chacoan prehistory, have generated a great number of papers that have focused on the problem of outlier sites (Allan and Broster 1978; Altschul 1978; Cordell and Plog 1979; Drager 1976; Ebert and Hitchcock 1973; Frisbie 1972; Grebinger 1973; Irwin-Williams 1972; Judge 1979 [presented in 1976]; Loose 1976, 1979; Lyons and Hitchcock 1977; Morenon 1977; Powers 1974; Schelberg 1979; Snow 1977; Tainter and Gillio 1980; Toll 1978; Vivian 1970a, 1970b; Winter 1980). While these papers vary substantially, virtually all have viewed Chacoan outliers and the associated roads as material evidence of a large, complex socioeconomic system, or interaction sphere. Consistently postulated elements of the "Chacoan system" are resource redistribution, social ranking, and task specialization, all important aspects of chiefdoms (Earle 1977, 1978; Fried 1967; Peebles and Kus 1977; Sahlins 1958, 1963; Service 1962, 1975). Local development of this social system is argued or implied in a number of instances. Some of the more comprehensive, systemic models stress that local development involved the evolution of a complex level of society that reflected the Anasazi response to the environment of Chaco Canyon or the San Juan Basin (Grebinger 1973; Judge 1979; Toll 1978).

Other researchers, while not denying the importance of local ecological adaptation, propose that the major impetus for the Chacoan florescence was provided by Mexican influence (DiPeso 1968a, 1968b, 1974; Frisbie 1972; Hayes 1981; Kelley and Kelley 1975; Reyman 1971, 1978). They purport that Mexican *pochteca*, through cooperation or coercion, masterminded the Chacoan development. Lister (1978) approaches the problem from a more cautious stance, emphasizing that while the presence of Mexican traits is undeniable, the type or degree of culture contact is not yet identifiable.

In 1976, when we initiated the Chaco Center outlier survey and reconnaissance, Chacoan outliers had not received much attention. It is the intent of the present volume to address that need. Archaeological data are presented on a number of outlier communities not previously documented, and conclusions concerning the Chacoan system are made on the basis of original data and analyses from a larger sample of sites (36 outlier sites and communities). The depth of treatment here allows the generation of specific ideas that provide a beginning point for future research. Finally, the utility of archaeological survey analysis on a regional scale is strongly suggested.

The only other recent archaeological survey that has exploited the potential of the San Juan Basin data base is Anasazi Communities of the San Juan Basin (Marshall et al. 1979). Although it is oriented largely toward presentation of data and identification of significant cultural resources of all Anasazi time intervals, the majority of communities identified are believed to have been integrated into the Chacoan system. As such, the book forms a companion volume to this study. Concerted effort to record comparable types of data, using similar techniques, has been made since the inception of both projects in 1976. Data and ideas have been freely traded since that date to the betterment of both studies.

The Problem and Theoretical Considerations

The existence of prehistoric roadways interconnecting outliers and Chaco Canyon sites and the occurrence throughout the San Juan Basin of Anasazi structures exhibiting Chacoan architectural attributes form strong, primary evidence for site interaction on a regional scale from ca. A.D. 900 to 1175. The terms Chacoan phenomenon (Judge 1979), Chacoan interaction sphere (Altschul 1978; Frisbie 1972), or Chacoan system (as used herein) are currently employed to describe this interactive relationship. The nature and intensity of this interaction, and why it evolved and collapsed are essentially unanswered questions. The goal of this volume in general is to suggest possible answers to these problems, although our progress to date is modest. This study in a sense is a winnowing of the data, at the end of which we can hopefully direct better, more specific questions toward the research problems identified above.

As detailed in the preliminary research prospectus (Judge 1976), the primary focus of this investigation was to determine the relationship between outliers and the Chaco Canyon sites. Since interaction is presumably the very basis and reason for the existence of a regional system, it is through examination of outlier site and community interrelationships from the perspectives of time, space, environment, morphology, and artifact remains (lithic and ceramic) that the explication of the Chacoan system can best be attempted.

Because of the preliminary level of this study, our approach to analysis has been primarily inductive, allowing us to arrive expeditiously at hypotheses that seem to best explain the observed phenomena. Although no formal testing of these hypotheses has been carried out, informal elimination and testing takes place throughout the course of the study. The explanations proposed are the ones we believe to be most feasible and supportable with regard to available data. By utilizing these to structure further investigations, emphasizing collection of data to confirm, refute, or revise what is proposed here, the value of our approach can best be effected.

The overall theoretical perspective of this investigation combines elements of systems theory espoused by Flannery (1968), an evolutionary approach to the development of society (Service 1962), and a cultural ecology orientation (Hardesty 1977). Although these theoretical perspectives are more assumed constants and underlying themes than emphasized elements, they are responsible to a great degree for the kinds of explanations and proposals offered.

As a final note, we would like to emphasize that the model proposed here stresses indigenous development of a complex cultural system, development that resulted from Anasazi adaptation to the San Juan Basin environment. We do not acknowledge the possible importance of Mexican influence. Rather, we would suggest that Mexican-Anasazi interaction was more indirect exchange through intermedaries than direct intervention (redistributive exchange or intrusion by pochteca as "prime movers" in the development of the Chacoan system).

Methodology

A planned research program of several phases included intensive archaeological survey and reconnaissance, literature search, analysis, and report preparation. Approximately one month of intensive field survey at three specific outlier locations was carried out initially in the fall of 1976. Its purpose was to provide detailed environmental and archaeological data on a small number of outlier communities. These data were then used to generate hypotheses concerning the interrelationship between less extensively documented outlier communities and the Chaco Canyon sites. Abbreviated documentation of the larger number of outlier communities was implemented through archaeological reconnaissance (one week) and a subsequent period of literature and archival research. While the original objective of the project was to report on all known outlying communities, the staggering number of communities that have been recorded since prevents such comprehensive treatment. We would estimate that perhaps no more than 50-60% of the outlying communities are now documented. Further, the 36 outlier communities reported herein probably do not account for more than 20-30% of the postulated total. Our primary purpose in reporting on this number of site communities is to present a sample of outliers, providing a more solid basis for discussion of the outlier system from a regional perspective.

William Gillespie, Stephen Lekson, and Robert Powers intensively surveyed the three outlier sites between September 27, 1976, and October 29, 1976, spending approximately 600 man-hours. The outlier communities chosen were Bis sa'ani, Pierre's, and Peach Springs. These selections were determined by several factors: (1) prior reconnaissance suggested that all were probably Pueblo II-III outlier communities, as indicated by the presence of one or more structures with Chacoan architectural features; (2) the immediate area of each site was archaeologically unknown; and (3) all were thought to be integral to the Chacoan road-communication network, with one site (Pierre's) situated along a known road. Additionally, differences in geographic location, environment, duration of occupation, and size insured some degree of variability.

The first criterion, the presence of a structure with Chacoan morphological features, is the primary criterion utilized throughout this study as a clue to possible Chaco Canyon-outlier interaction. In addition, it is the factor that determined inclusion of most sites and communities discussed herein.

The size of the area we chose to survey at each community was small, based on the initial observation that a large number of sites occurred within a short distance of the prominent Chacoan structure or outlier. Accordingly, beginning with the Bis sa'ani community, we surveyed the entire area within a 1-mile radius (1.6 km) of the Chacoan structure. Due to the large number of visible sites at the Peach Springs community and the excessive amount of time it would have required to record them, we reduced the survey area to a .5-mile (.8 km) radius surrounding the outlier. The remainder of the 1-mile radius was sampled via a series of radiating transects. The intensive survey was concluded at the Pierre's community where a .5-mile radius around three Chacoan structures was intensively covered, with a sample survey of all topographic zones within the .5 - .75-mile (1.2 km) radius area.

Actual site survey was accomplished by walking linear transects, although in some areas of heavy site density, the entire area was covered by walking from site to site. When linear transects were employed, each individual covered a strip 20-30 m wide, allowing the crew a total transect sweep of 60-90 m that varied according to the terrain and visibility. When a site was located, the crew converged to record it.

The basic categories of information recorded included vegetation, site remains, lithics, and ceramics. While a site recording format was followed, modifications were made in the field as deemed appropriate by the crew. In addition, general notes on geology, topography, soils, and vegetation were made for each survey area as a whole.

Vegetative data include plant species and density. The purpose of recording vegetation data was to provide a rough measure of paleoenvironmental suitability for each survey area, particularly as a source of wild plant foods and materials. The assumption that present vegetation reflects the prehistoric flora is based on a number of recent paleoenvironmental studies that suggest little environmental change over the last 2000 years (Betancourt and Van Devender 1980; Dean and Robinson 1977; Hall 1977; Love 1977b, 1979; Robinson and Rose 1979). If the vegetative environment of the San Juan Basin has changed appreciably in the last 2000 years, the alteration may be more a result of over-use by humans during both Anasazi and recent historic times (Betancourt and Van Devender 1980).

Geological data are included to provide a background for understanding local topography and soils as well as to permit description of potential sources of local lithic materials. The topographical data add a further dimension to the description and analysis of site location patterns.

Soil documentation is limited to field description of soils, assessment of their arability, and means of irrigation. Because annual precipitation is critical to determine whether crops may have been produced by the Anasazi relying solely on rainfall or whether they required supplemental irrigation, mean annual precipitation estimates for each survey area have been calculated. Our purpose in examining soil and precipitation was to provide a means for evaluating the agricultural potential of the community areas.

Precipitation estimates have been derived using the simple linear regression:

$$P \text{ est.} = \text{yr } \bar{x} + \text{or} - .0024 \text{ Elev.}$$

(where P est. is the estimated mean annual precipitation in inches, and yr $\bar{x}$ is the mean annual precipitation for the nearest weather station, and Elev. is the difference in feet above or below the nearest weather station). This formula, adapted from Hodges (1974:17), allows a close approximation (5% error) of mean annual precipitation and is based upon the observation that rainfall values within the San Juan Basin correlate closely with elevation. Present precipitation values and seasonal patterns appear relatively unchanged from prehistoric precipitation patterns as indicated by recent preliminary dendroclimatological reconstructions of annual and seasonal rainfall for A.D. 900-1969 (Robinson and Rose 1979).

Subsequent to the field work, additional soil data were derived from the New Mexico State University Agricultural Experiment Station, Water Resources Research Institute, and Soil Conservation Service (S.C.S.) research reports (Maker et al. 1973; Maker, Bullock, and Anderson 1974; Maker, Hacker, and Anderson 1974). These provide data on a variety of critical soil variables as well as a classification system for determining the relative suitability of soils. This classification system, used throughout the outlier soil discussions, is as follows:

Class 1: Few or no limitations for use as cropland under irrigation. Productive, and well adapted to irrigation. High yields of most climatically adapted crops can be obtained with good management.

Class 2: Well suited to irrigation, but with slight to moderate limitations for sustained use under irrigation. Moderately productive, requiring more than average management to obtain high yields.

Class 3: Moderate to severe limitations for sustained use under irrigation, and generally not as suitable for production of as wide a range of crops as land in Classes 1 and 2. More limited productivity, or requiring a very high level of management to obtain moderate to high yields.

Class 4: Very severe limitations for sustained use under irrigation. Land in this class is usually suited to only a few of the climatically adapted crops. Some of this land may be adapted or used for the production of specialized crops under a very high level of management.

Class 6: Land not suitable for irrigation.

Data on site remains are oriented toward documentation of site architecture and refuse in addition to the relationship of site features. This was recorded to provide the foundations for analyses of site architecture, function, and chronology.

The lithic data are recorded according to the types of materials present, utilizing A. H. Warren's (1967, 1979) lithic classification system. Following this scheme, each material is referenced by a four-digit code. The overall purpose was to distinguish local from nonlocal materials as a means of investigating prehistoric exchange of lithic materials.

Ceramics are classified by ware and design style, with the primary purpose of determining site chronology. Basic criteria upon which classifications were made include design style, paint type, and the presence/absence of polish. While some degree of temporal control is sacrificed by a design style analysis, it was felt that on-site ceramic type analysis would have been excessively time-consuming, and possibly less accurate (see Appendix A for a detailed discussion of ceramic analysis and sampling procedures). No collections of either lithic or ceramic materials were made, except in a few instances where a small sample of surface sherds was made at the request of A. H. Warren for temper analysis.

The recording strategy for artifacts varied with the quantity and density of refuse material exposed on the site surface. Where only small scatters of dispersed material were present, an attempt was made to examine all exposed sherd and lithic specimens in every portion of the site. At sites with large scatters of dispersed material, the area was sampled via 2-3-m-wide transects with all sherds 4-5 cm in diameter or larger examined. All exposed lithics were recorded. At sites with large, dense scatters or major trash mounds, the deposit was sampled via one or more 1 m-wide transects, until a sample of at least 100 or more specimens had been examined. Within the selected transects, all sherds 2 cm or more in diameter were examined, as were all lithics, regardless of size. The remainder of each refuse area was walked in 2-3-m transects to check the general representation of the first transect.

Each member of the survey crew recorded the same categories of information at every site, insuring basic comparability of information and terminology. Gillespie located the site on a 7.5' topographic map and complementary aerial photograph, taking a number of compass azimuths as necessary. Following this, he recorded all vegetation, soil, and lithic data. Lekson sampled the site ceramics and took black-and-white and/or color photographs as deemed necessary. Powers mapped the site and recorded all architectural data. Additional comments and observations were made as warranted. Recording took from 25 minutes to several hours, depending on the size and complexity of the site.

Because the purpose of the project was to investigate Pueblo II-III outlier communities, only those sites received the full recording procedure. Archaic, Basketmaker III, Pueblo I, and Navajo sites were identified and located on the map, and in many instances a few descriptive comments were made. The meager amount of data recorded at the Basketmaker III and Pueblo I sites has since proved helpful and is included in the various discussions. Locations and information collected on both Archaic and Navajo sites are on file at the Division of Cultural Research (formerly the Chaco Center), University of New Mexico, Albuquerque, as are all other site data not included herein.

A fourth outlier, Halfway House, was originally slated for intensive survey treatment. However, subsequent to survey of the three communities, we felt that more general data from a number of outlier localities would be more informative than another in-depth survey of a single community. As such, our final week of field time was spent in reconnaissance at a number of Chaco Basin localities where: (1) an outlier community was known or thought to be present; (2) high peaks and buttes indicated the possibility of shrines or signaling stations; and (3) little or nothing was known archaeologically.

The reconnaissance was carried out primarily by truck, with all crew members scanning the landscape for major sites and potential features. Binoculars were utilized to identify potential sites, saving hours of walking. In this manner, the Dalton Pass, Grey Hill Springs, and Standing Rock communities were discovered and recorded. Also visited were a number of better known outliers documented by others but not previously examined by us. Figure 1 shows the localities examined during the reconnaissance.

Most of the Chacoan structures visited by the reconnaissance team (Hogback, Twin Angels, Halfway House, Great Bend, Grey Hill Springs, Dalton Pass, Muddy Water, Standing Rock, and Casamero) were recorded in the same detail as in the intensive survey areas. But the many small house sites at some of these locations were either not recorded or recording was limited to notation of location and brief summaries of architecture and ceramics.

Following completion of the field work, a search for outliers in both the published and unpublished literature was initiated. Site files, archives, and personnel at the Museum of New Mexico, Laboratory of Anthropology, School of American Research, and University of New Mexico were consulted. An additional source of data was an outlier "questionnaire" mailed to archaeologists who had previously worked in the Chaco area or were intimately acquainted with its archaeology.

Since the purpose of expanding the outlier search was to provide comparable data on a larger sample, we attempted to collect the same environmental and archaeological data derived from the intensive survey. An obvious problem arose where previous investigators had different research interests and did not collect the same types of information. Where archaeological data are missing, this problem can only be remedied by future investigation. In some instances where environmental information was scanty, some recourse was provided by referring to a number of general sources on topography (United States Geological Survey, 7.5' Topographic Maps), geology (Dane and Bachman 1965; New Mexico State Highway Department Geological Quadrangles), vegetation (Camilli 1979), and soils (Maker et al. 1973, Maker, Bullock and Anderson 1974; Maker, Hacker, and Anderson 1974). Numerous subsequent visits by one or more of the authors to all but two of the outliers (Sterling and El Rito) permitted further commentary on the basis of first-hand observation.

Compilation and preliminary interpretation of the mass of data culled from the literature search was divided among the three of us. Gillespie assumed responsibility for the area north of the San Juan River; Lekson, the southern areas (Rio Puerco East, Rio San Jose, Rio Puerco West and the Zuni area); and Powers, the Chaco Basin.

Initially, analysis was divided among us, with each responsible for writing up the data compiled during the survey. As such, the environmental, agricultural, and lithic portions of the chapters on the Bis sa'ani, Peach Springs, and Pierre's surveys have been written by Gillespie, with the ceramic sections penned by Lekson, and the architectural portions by Powers. The remainder of the volume, chapters 5, 6 and 7, has been authored almost exclusively by Powers, with some contributions by Gillespie.

Terms and Definitions

Chronology

Since most of the dates referred to are Anno Domini, calendar dates have not been prefaced with A.D. Temporal classification of sites, material found on them, and discussion of developments over time are made using Pecos Classification (Kidder 1927) instead of the phase systems devised for specific Anasazi areas. Given the assumption that the outliers are part of a Chacoan system, classification according to the Chacoan chronological scale best suits our purposes. The dates assigned to the Pecos Classification follow the modifications introduced by Hayes (1981) that are based on the survey of Chaco Canyon National Monument (Figure 3). Thus, when we refer to Pueblo II or Pueblo III, we are speaking of the period as it is dated in Chaco Canyon.

Temporal placement of sites is based on the presence of ceramics considered chronologically diagnostic by Hayes (1981) and Windes (1977a, 1978a) for the Cibolan series, and by others (Breternitz 1966; Breternitz et al. 1974; Peckham and Wilson 1965) for the San Juan and Chuskan ceramic areas. Considerably less emphasis has been placed on the use of architectural features for temporal classification.

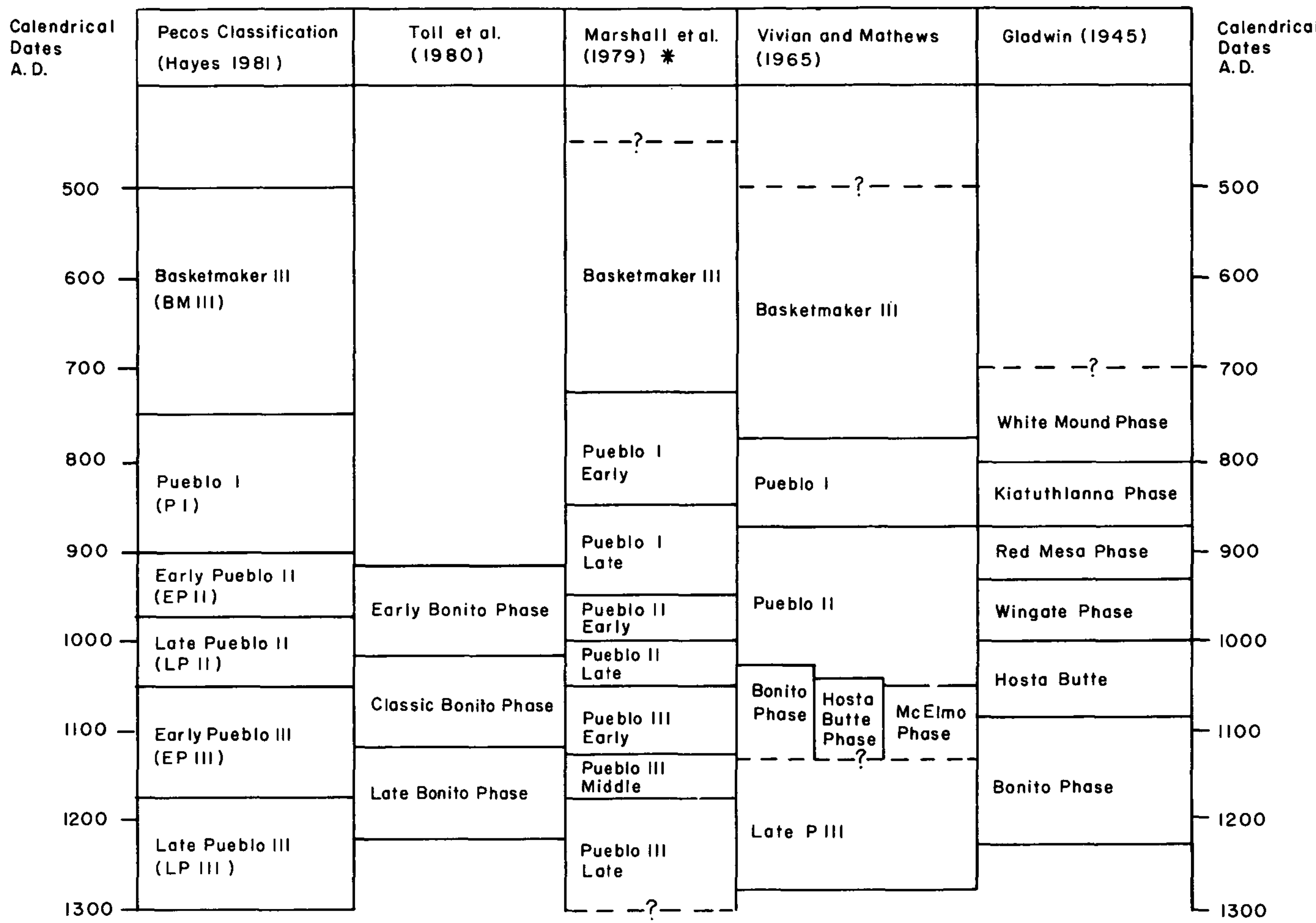
Use of the Pecos Classification in this manner is preferable to either Gladwin's or Vivian and Mathews' phase systems with their definitely local restrictions. Furthermore, resurrection of Gladwin's Chaco Branch phase system, even for use solely within the Chaco Basin would require not only major revisions of dates, diagnostic ceramics, and architecture, but also alteration of his sequential Hosta Butte and Bonito phases to allow contemporaneity. Wendorf and Lehmer (1956: 190-95) and Vivian and Mathews (1965:107-110) particularly, have discussed the problems of the Gladwinian scheme. Vivian and Mathews' reworking of the Pueblo III portion of the Gladwin phase system (allowing contemporary Hosta Butte, Bonito, and McElmo phases) is also out of date and in need of revision.

Subsequent to the writing of much of this volume, Windes (Toll et al. 1980) developed a three-phase division for the Pueblo II-III occupation of Chaco Canyon. Divided into Early (920-1020), Classic (1020-1120), and Late Bonito (1120-1220) phases, Windes' system provides needed chronological control. By including all contemporary structures under a single phase designation, his system eliminates the perplexity of contemporaneous phases. Had Windes' phase sequence been devised earlier, it would have been utilized in this study.

Settlement Units

Several terms are utilized herein to delineate a hierarchy of settlement units. These units not only provide a convenient analytical framework, but also hopefully correspond to prehistoric organization.

Figure 3. Correlation of calendrical dates with Pecos Classification and Phase systems for the Chaco area.



✱ Marshall et al. (1979) follow Vivian and Mathews in recognizing contemporary Bonito, Hosta Butte, and McElmo architectural phases, but with beginning and ending dates for the Bonito and Hosta Butte phases at ca. 950-1200.

The most encompassing of these is the region, the area within which Chacoan outliers occur and are believed to have interacted. The region includes most of the San Juan Basin as well as a few adjacent peripheral areas such as the Great Sage Plain of southwestern Colorado and the historic Zuni area. While the spatial limits of outliers on the east (Highway 44) and west (Chuska Mountains) appear to be well delimited, regional boundaries to the north and south are tentative. This reflects the limited amount of outlier-oriented survey conducted.

The region has been divided into subareas, each defined by a major road system and associated outlying communities. Chaco Canyon, as the central point of all major road systems, has been arbitrarily defined as a separate subarea. Identification of outlying road systems and their associated communities as subareas is logically defendable in that each system occurs in a separate portion of the basin, in most instances without apparent connecting roads. Because few roads have been defined outside the Chaco Basin, assignment of communities in areas peripheral to a road system is not yet possible.

Within the subarea defined by each major road system, the major settlement unit defined is the outlier community. Each community is an aggregation of contemporaneous sites occurring within a small, circumscribed area, with a site density exceeding that of surrounding areas. Site types encountered within the community include Chacoan structures, small houses, great kivas, and a variety of limited-use sites. While many outliers are this type of multisite community, a few outliers appear to include only an isolated Chacoan structure.

Site Types

Of the sites that are present in communities, two types referred to as towns and villages (Grebinger 1973; Vivian 1970a, 1970b, 1972; Vivian, Dodgen, and Hartmann 1978) or Bonito Phase and Hosta Butte Phase sites (Judge 1979; Marshall et al. 1979), respectively, have received the most archaeological attention. While the first pair of terms is widely applied to sites throughout the Southwest (Martin and Plog 1973; Vivian and Mathews 1965), the Old World connotation of town and village is initially confusing, particularly in contrast to the more judiciously applied terms in other regions such as Mesoamerica (cf. Blanton 1972; Flannery 1976:163-65; Parsons 1971; Sanders 1956: 117). The Chacoan sites to which the term town has been applied are single, enclosed buildings rather than aggregations of public, private, and commercial buildings organized by streets or other thoroughfares. Similarly village is usually applied to even smaller single structures that are assumed to have housed only a small, closely related family group (Vivian 1970a, 1970b).

The terms Bonito Phase and Hosta Butte Phase are perhaps even more unfortunate. As originally defined by Gladwin, they designated local architectural and ceramic trait complexes characteristic of sequential time periods. Subsequent research has demonstrated unequivocally that many sites with characteristics of these two phases were actually contemporary and were occupied for much longer temporal intervals. More recently, the terms have been utilized to characterize the contemporary but divergent town and village architectural styles, without necessarily implying that such sites conform to the temporal, ceramic or other identifying features originally recognized in the phase definitions. The association of the term phase with Bonito and Hosta Butte, when they are actually being used as site type names, is at best confusing.

In place of town and Bonito structure, we employ the general term Chacoan structure. It is utilized throughout the descriptive portions of this study prior to an analytical examination of Chacoan structure size, morphology, and locational variability presented in chapter 6. It is through such an analysis that patterns of Chacoan structure variability may be recognized and a more specific Chacoan structure typology proposed.

The specific functions of Chacoan structures are largely conjectural. While portions of some excavated Chacoan structures are clearly residential (e.g., Judd 1954, 1959; Morris 1928), the function of other portions of these and other Chacoan structures are questionable or unknown (Lekson et al. 1982; Marshall et al. 1979; Vivian and Mathews 1965; Windes 1981). In addition to possible functional variability within individual Chacoan structures, the range in size and morphology with respect to location suggests functional differences on an interstructural level.

As utilized here, the term Chacoan structure refers to outlier and Chaco Canyon sites exhibiting the classic style of Chaco architecture, characteristic in its highest form of the large Chaco Canyon sites (i.e., Pueblo Bonito, Chetro Ketl) and McElmo pueblos during the 900-1175 era. Although great kivas of this time period display a number of Chacoan structure attributes, they are clearly a separate site type, and as such are not included within the general classification.

Diagnostic morphological attributes of individual Chacoan structures include some, but not necessarily all, of the following:

1) Size: Although previous discussions have recognized the large size of many Chacoan structures, size has not been recognized as a specific attribute of these structures. This possibility is investigated herein. To delineate the size range of and to discriminate size differences between Chacoan structures, the floor area of each Chacoan structure, was measured. This includes all enclosed plaza and upper story floor areas.

2) Large-scale structure planning: This is indicated by large-scale construction units (i.e., roomblocks) displaying an ordered, compact layout. The large size of Chacoan building units and the level of labor organization required distinguish planning at many Chacoan structures from small-scale planning (single-room to small room clusters) characteristic at other Anasazi site types (Lekson et al. 1982).

3) Core and veneer walls, and Chaco style masonry: Core and veneer walls consist of two exterior wall facings and an interior rubble core. The outside facings display Chaco-style masonry that includes the wide variety of masonry styles documented by Hawley (1934, 1938), Judd (1964), and Vivian and Mathews (1965). The styles are composed of varying patterns of coursed slabs, blocks, and spalls, in varying combinations. Banding, or the alternate layering of stone courses of different thicknesses, is a technique commonly associated with the largest Chacoan structures in Chaco Canyon.

4) Room size, ceiling height, and roofing materials: "Large" rooms and "high" ceilings of Chacoan structures, as compared with other Anasazi structures, have been noted repeatedly (Hayes 1981; Vivian 1970b), although what constitutes large or high has not been fully defined. A solution to this problem is attempted in this study through the quantification of room sizes and ceiling heights and the establishment of large room size and high ceiling parameters. The use of large conifer timbers (ponderosa pine, Douglas fir, white fir) in Chacoan structures has been documented previously, but here the use of these timbers as a characteristic attribute of Chacoan structures is proposed.

5) Chacoan kiva furnishings: Kivas at Chacoan structures often display a distinctive complex of attributes including a subfloor ventilator, six to ten horizontal log pilasters, a shallow southern bench recess, and a western subfloor vault. A sipapu is not present in most instances.

Since no one structure displays the entire complex of attributes, identification of a structure as Chacoan is based on the recognition of a varying constellation, or polythetic, complex of attributes (Clarke 1968). Even if all of the distinguishing attributes did occur consistently, the identification of all features would be impossible at unexcavated sites where presence or absence of diagnostic features could not be determined. Other features commonly found at Chacoan structures, including multistory construction, great kivas, and tower kivas, may have more value for discriminating size and functional differences. Multistory construction and great kivas, for example, occur primarily at larger Chacoan structures.

As used above, the term Chacoan structure excludes a number of remaining community structure types not of the classic architectural style. It does not imply that other site types in the community, particularly within Chaco Canyon and much of the Chaco Basin, are non-Chacoan, although at some outliers sites do display local, non-Chacoan architectural and ceramic affiliations.

The most prominent of the remaining site types is the village or Hosta Butte pueblo, here termed small house site. Minimally, as applied herein, small house sites consist of four or more contiguous rooms with an associated kiva, and refuse -- the latter in sufficient quantities to suggest permanent occupation. The term small house is felt to be appropriate since the majority of these sites are unquestionably residential and relatively small in size compared to Chacoan structures.

Basic architectural features distinguishing the small house sites include the following:

1) Size: These sites are generally considered to be relatively small in comparison to Chacoan structures, as the term small house implies. This assumption is examined herein through quantification of small house sizes.

2) Small-scale structure planning: The scale of planning is small compared to Chacoan structures, involving only single rooms or room clusters. Furthermore, there is little effort to integrate the various units into a symmetrical and regular whole. The result is a structural layout that has been described as "amorphous" or "unplanned" (Vivian 1970a, 1970b). Some Pueblo-III small houses may display more coordinated construction effort, however (Truell 1979).

3) Simple and compound masonry: Small houses are usually constructed of tabular, block, or cobble masonry with a single stone (simple masonry) or two stones (compound masonry) forming the wall breadth. Walls are typically thin (15-30 cm), although thick masonry walls predominate in some areas. As noted by Vivian (1970b), an increase in core and veneer wall construction occurs beginning in Early Pueblo III. Masonry at small houses displays a great deal of variability both within and between sites. Although styles are identifiable, they appear to reflect a higher degree of individual expression than the more standardized masonry styles at Chacoan structures. At least within Chaco Canyon, masonry at small houses is qualitatively inferior to that at Chacoan structures.

4) Room size and ceiling height: The sizes of small house rooms vary substantially, but the size of the average small house room is thought to be smaller than the average Chacoan structure room. In Chaco Canyon, Vivian (1970b:171) noted that living rooms average about 5.0 m^2. Hayes (1981) more recently arrived at a similar figure of 6.2 m^2 for 39 rooms at the small houses of Bc 50 and Bc 51.

Although floor to ceiling heights in small houses are assumed to be less than in Chacoan structures, they are usually impossible to determine from standing architecture as small house walls are frequently represented only by wall stubs and collapsed masonry. Analogy to the architecturally similar but better preserved Mesa Verde cliff ruins suggests that 1.5-1.8-m ceilings may be expected (Hayes 1981).

5) Kiva furnishings: Small house kivas are generally smaller in diameter than Chacoan style kivas at Chacoan structures. As an example, a sample (n = 28) of excavated small house kivas in Chaco Canyon reveals a smaller diameter ($\bar{x}$ = 4.0 m) than the sample of Chaco style kivas (n = 65) where $\bar{x}$ = 7.1 m (Lekson et al. 1982; Truell 1982). Small

house kivas change through time, beginning in Pueblo II as relatively featureless structures with little or no masonry. They develop into structures more commonly graced by masonry walls, high masonry pilasters, a bench, and some type of southern recess. By Early Pueblo III some features of both the late, classic San Juan and Chacoan style kivas are present. These include both subfloor and above-floor ventilators, shallow and deep keyhole recesses, and presence/absence of sipapus (Hayes and Lancaster 1975; Morris 1939; Smith 1964; Truell 1982; Vivian 1970b).

In addition to Chacoan structures and small houses, a variety of limited-use sites with specific secular or religious functions have been recognized. Use of these sites is believed to have been occasional, scheduled, or seasonal, in opposition to more permanent habitation and generalized usage of small houses.

Fieldhouses are defined as sites of 1-3 rooms, without a kiva, and displaying a minor amount of occupational refuse. Use is assumed to have been temporary or seasonal (Reher 1977:84; Rohn 1963:447-48; Skinner 1965:18-21). Although there is no proof that structures classified herein as fieldhouses did in fact function as such (e.g., they could represent very small permanent residences), we have attempted to apply the term judiciously -- primarily to small structures adjacent to arable land. The problems of categorizing sites such as fieldhouses and small houses prior to excavation are particularly apparent in the Bis sa'ani area and will be discussed further in chapter 2.

Great kivas are large, circular subterranean or semisubterranean structures believed to have been used for ceremonial purposes (Lekson et al. 1982; Vivian and Reiter 1965). No rigorous attempt to document great kiva diameters has been made. Therefore, our application of the term great is somewhat subjective. However, all of our structures are within the bounds of the 10-m minimum diameter given by Marshall et al. (1979).

At sites of unclear but apparently limited or specialized usage, general descriptive terms have been applied. Where the occurrence of these sites is quantitatively or spatially limited (i.e., to one community), definition and description of the site type has been left to the relevant discussion.

Alternately, descriptive names have been assigned to sites with some shared characteristics, although they do not necessarily reflect any single site type. Scatter has been applied to sites with surface ceramics or lithics that lack apparent architectural features. Although as scatters these sites are generically similar, uniformity in function is not presumed. Sites designated nonhabitation have some form of architectural remains, but it is doubtful that they served as domestic habitations or fieldhouses. Again, functional similarity is not assumed.

Organization of the Report

In chapters 2, 3, and 4, data and conclusions specific to the Bis sa'ani, Peach Springs, and Pierre's survey areas are presented. While summary and interpretative comments for each community have been included, they are intentionally brief as the bulk of our analytical and interpretive effort has been reserved for discussion from the vantage point of the region. Chapter 5 follows with outlier data collated from the reconnaissance and literature sources. Interpretive statements on the chapter 5 outliers are generally confined to explanations and conclusions entertained by earlier investigators.

In chapter 6, a regional synthesis is attempted from the outlier data presented in the previous chapters. This portion of the paper is both summarial and interpretative, examining outlier chronology, community settlement pattern, regional settlement pattern and site organization, environment and resource variability, outlier site type variability and morphology, and outlier lithics and ceramics from a regional perspective. To the degree possible, change over time is documented or postulated, thereby presenting an evolutionary view of the outlier phenomenon.

Chapter 7 presents a final summary and commentary on the conclusions reached in chapter 6 and briefly addresses the development, florescence, and fall of the Chacoan system.

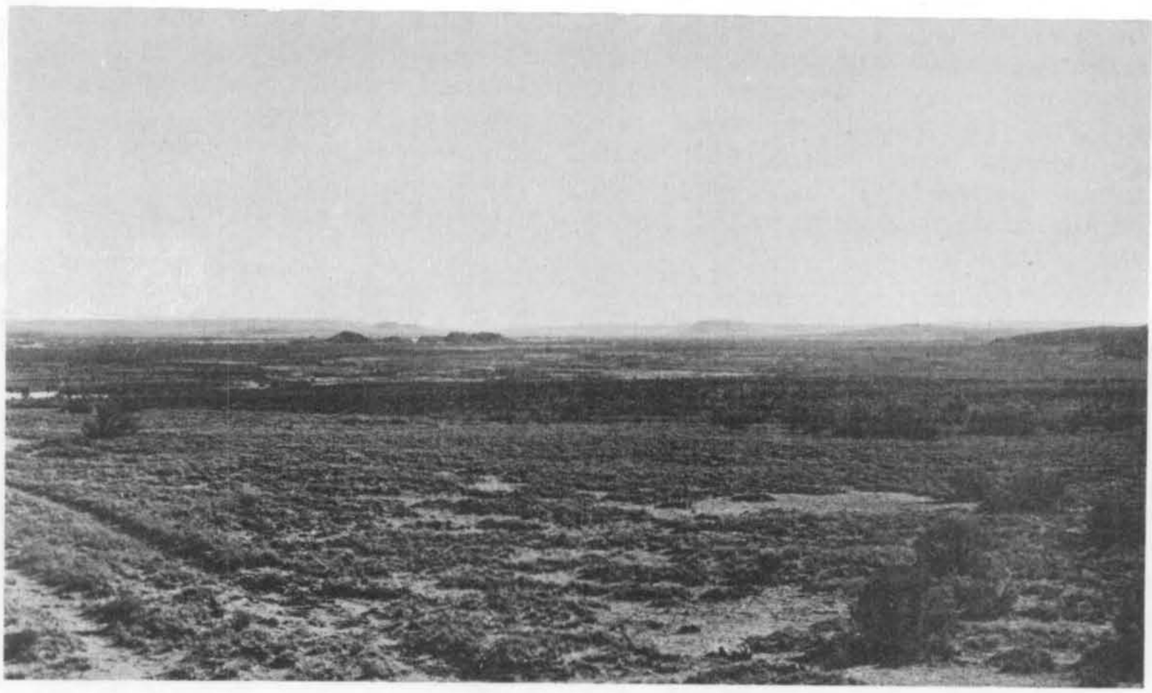


Figure 4. Overview of the Bis sa'ani survey area. The Bis sa'ani Chacoan structure is located on the shale ridge at left center. View to northeast.

THE BIS SA'ANI SURVEY

Introductory Comments

The Navajo words bisghąą' kini and bis sa ani, meaning "house on top of clay" and "clay in place" (Fransted 1979:14) are used by the local Navajo to refer to the Chacoan structure within this survey area. The latter word has been spelled herein as Bis sa'ani in concurrence with present informal use of this word by archaeologists.

The Bis sa'ani survey area is in the Escavada Valley less than a dozen kilometers east-northeast of Chaco Canyon (Figures 1 and 4). Its elevation is 1,960 m above sea level.

Centered at the Chacoan structure, the Bis sa'ani survey area is 3.2 km in diameter, with a total area of 8.1 km. Unlike the subsequent surveys at the Peach Springs and Pierre's communities, the entire 1.6 km-radius was intensively surveyed (Figure 5).

Despite the short distance to Chaco, no prehistoric road segments linking Bis sa'ani to Chaco Canyon have been identified to date. Several segments of a possible roadway extending approximately 3 km north from Bis sa'ani (Figure 5) have been identified by Obenauf (1980), but whether these are prehistoric or historic features is not yet known. Because of the recent alluvial deposits that cover the Escavada Valley floor and the easily eroded Fruitland shales that border the valley, the question of whether the Bis sa'ani community was connected to Chaco by a road may never be satisfactorily answered.

Physical Environment

Topography and Geology

Bedrock is actually exposed on slightly less than 10% of the surface area within a 1.6 km radius of Bis sa'ani. The remainder of the ground surface is covered by alluvial and aeolian deposits of various forms and thicknesses. The exposures of bedrock are in three separate locations -- a row of hills parallel and adjacent to the Escavada Wash and two roughly parallel strips of badland that form the north and south margins of the valley (Figure 5).

Bis sa'ani (the Chacoan structure) is rather precariously situated on the ridge of shale parallel to, and immediately south of, the Escavada Wash. The irregular ridge is approximately 750 m long, 20-50 m wide, and up to 20 m high. The ridge stands in isolation above the relatively flat bottomlands on both banks of the Escavada.

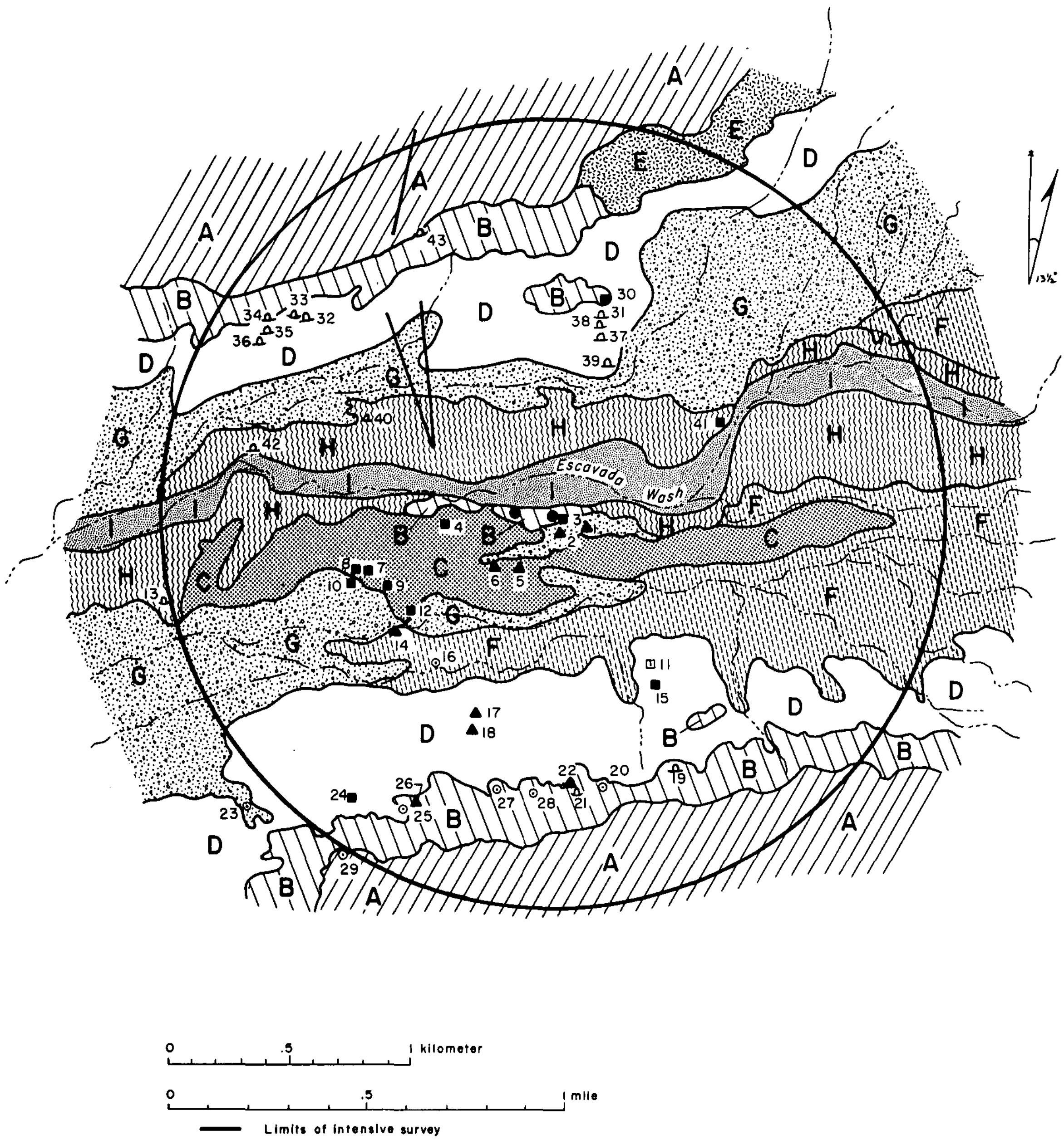


Figure 5. Bis sa'ani site types and microenvironmental zones.

The valley bottom is rather broad at this location -- approximately 2 km between the bands of shale badlands that form the valley limits. These bordering badlands rise 25-35 m above the valley bottom. The southern ones are somewhat thicker, higher, and more continuous -- a result of the northeasterly dip of the strata.

The badlands are exposed portions of the Upper Cretaceous Fruitland Formation. Bands of white, light gray, and purple shale, with frequent lenses of soft sandstone, make up most of the exposed formation. Near the crests of the southern badland are extensive layers of hard, dark brown, and roughly tabular sandstone. This material appears to have been the principal source of building material for all of the sites within the Bis sa'ani survey locality. To construct the Chacoan structure, much of this quarried rock had to be transported 1 km. Outcrops of burned red shale are also present at the west end of the central Bis sa'ani ridge and at the west end of the southern badlands. Associated with a few of the burned shale outcrops is a fine-grained red, purple, and gray chert suitable for flaking (#1042). The nearest source area noted within the survey area was on a small hill 800 m west of the Chacoan structure.

The main drainage in the area is the Escavada Wash, an ephemeral watercourse that flows from east-northeast to west-southwest. The wash here is 75-200 m wide and quite shallow, with no sign of arroyo formation. Since no springs or seeps are known in the area, the Escavada is probably the most reliable water source even though the coarse, sandy alluvium is highly permeable. It seems likely that water could be easily obtained by digging shallow wells in the edge of the Wash. Many Navajo residents of the Escavada Valley obtain virtually all of their domestic water in this fashion. In a similar situation in northeastern Arizona, Hack (1942) has documented the Hopi practice of excavating shallow wells in arroyo beds to obtain water for small-scale irrigation, especially during dry years.

Apart from the wash and badlands, most of the Bis sa'ani valley floor is covered by active aeolian deposits. Along the Escavada, these deposits take the form of large dunes that border the wash. The loose, alluvial sands of the wash serve as an immediate source for the dunes. Other than a small sherd scatter (B-41), no definite Anasazi sites were found in this area. Further away from the wash, dunes are lower, of less distinct form, and are interspersed by numerous small, secondary drainages. The character of these latter deposits displays considerable variability. The major features are summarized and described in the following soil and microenvironmental zone discussions.

Soil Associations and Agricultural Potential

Three major soil associations are present within the survey area. Doak-Shiprock soils are found on the mesa tops; Turley-Badland soils in the valley; separating these two are Badland soil exposures. According to Soil Conservation Service criteria (Maker et al. 1973), the mesa top association (Doak-Shiprock) has the best overall potential for modern irrigation agriculture, with all of its soils falling into Class 2 and 3 (see chapter 1). Highest potential (Class 1) lands are not present in the eastern portions of the Chaco Basin. Although Class 2-3 mesa-top lands are theoretically as good as any other Class 2-3 land within this portion of the basin, it is probable that the mesa top could not be dry farmed with an estimated mean annual rainfall of 234 mm (9.2 in). Although the amount of summer rainfall is the critical factor, the annual mean falls short of Hack's (1942) 305-mm (12 in) minimum required for this type of agriculture. Given the inaccessibility of water, irrigation of these lands with Anasazi agricultural techniques would have been virtually impossible. Accordingly, it is believed that these mesa-top soils supported only a minimal amount of agriculture.

The Turley-Badland association of the valley bottomlands is approximately 45% Class 2, while much of the remainder (52%) is Class 6 land (not suitable for irrigation). Class 4 soils are only minimally represented (3%). In the Bis sa'ani area, most of the bottomland appears to be Class 2 Turley soils -- thick, grayish loams occurring on gently sloping and undulating valley bottoms. Here lies most of the arable land in the Bis sa'ani vicinity. The final soil association, the Badlands, is devoid of agricultural potential.

Within the arable bottomland soils are differences in suitability for farming. Most of the abundant secondary drainages display a very fine-grained alluvium derived from nearby shale outcrops. These clayey soils appear to be poorly suited for agriculture (cf. Bradfield 1971). On the other hand, the sandy aeolian soils are of a texture more appropriate to farming. The best situations appear to be where there is a thin sand cover over the finer clayey alluvium. Bradfield (1971:5ff.) explains that the thin sand layer acts as a mulch that minimizes evaporation from the more retentive underlying clayey soil. The result is sustained soil moisture. In the Bis sa'ani area, this condition is most frequently found in the area just south of the Chacoan structure. Here, numerous small dunes intermix with small drainage and playa areas. By planting at the interfaces of the small dune and drainage areas, prehistoric farmers would have been able to maximize retained soil moisture from the dunes and runoff from the small drainages. Further to the west are fewer dunes, and the majority of the land is clayey alluvium from the badlands. Further east, the dunes are larger and more abundant, but the drainage system is better developed with more discrete and slightly incised stream beds, effectively draining the area.

On the north side of the wash, conditions are less suitable for farming. The low areas where soil moisture exists practically all consist of fine-textured clayey soils nearly devoid of vegetation. Sandier aeolian soils are largely confined to slightly elevated ridges that lack moisture and defy any practical means of irrigation.

In discussing potential agricultural areas, the Escavada itself must also be considered. In general, its alluvium is rather coarse, and the possibilities of crop destruction by flooding are too great for the stream bed to be desirable. On the other hand, the soil moisture must certainly have been attractive. Vivian and Mathews (1965:11) noted that Navajos farmed in the Escavada alluvium further downstream at the confluence with the Chaco Wash, indicating that farming in the sandy wash itself is certainly feasible in some areas.

Given the similarity between modern precipitation trends and prehistoric precipitation calibrated by Robinson and Rose (1979), it does seem possible that agriculture may have been carried out sucessfully by the Bis sa'ani inhabitants during some years. On the other hand, it is probable, again judging from modern precipitation records, that crops failed during dry years. In nearby Chaco Canyon, for example, the years 1950-1956 received an annual mean rainfall of 178 mm (7.0 in), a value below the already meager annual mean of 209 mm (8.2 in) averaged from 1950 to 1978 (U.S. Department of Commerce, Climatological Data for New Mexico). During two of these years less than 100 mm (3.9 in) of precipitation was received, and unless all of this fell during the summer in storms substantial enough to generate runoff and replenish soil moisture, it seems doubtful that any crop could have been produced during these years.

Micro-environmental Zones and Vegetative Associations

In order to present and discuss the relationship of site distribution to environment and vegetation within the Bis sa'ani area, microenvironmental zones and vegetation associations are delineated below.

The entire survey area has been subdivided into nine rather specific microenvironmental zones defined on the basis of geology, land form, soils, and vegetation. The zone within which each site occurs is shown in Appendix B, Table 1, and the spatial distributions of the zones are shown in Figure 5. The microenvironmental zones are as follows:

Zone A (Mesa top): Mostly stable aeolian deposits with dense sage (*Artemisia* sp.) cover, and occasional deflation areas with exposed bedrock. Approximately 12% of the survey area.

Zone B (Badlands): Exposed shale, sandstone colluvium and alluvium in talus and outwash areas. Very little vegetation. Approximately 9% of the survey area.

Zone C (Flat Bottomlands), Zone D (Gentle Slopes), and Zone E (Steeper Slopes): Zones of predominantly low (less than 1 m), irregular, semistable dune deposits with occasional small drainages and deflation areas. Vegetation is variable, with most dune associations having sparse to moderate shrub cover. Approximately 10% of the survey area is flat bottomlands; 22% gentle (ca. 2-5°) slopes, and 1% steeper (ca. 5-15°) slopes.

Zone F (Dunes): Moderately high (ca. 1-2 m) dune deposits separated by prominent secondary drainages and deflation areas. Moderate brush cover, mostly sage (Artemesia sp.) and greasewood (Sarcobatus vermiculatus). Approximately 10% of the survey area.

Zone G (Alluvium): Mostly fine-grained (silt and fine sand) alluvium of secondary washes. Some low, stable dunes are present with deflation areas common. Vegetation sparse or absent. Approximately 18% of the survey area.

Zone H (Large Dunes): Predominantly large (over 2 m), active or semiactive dunes. Along both banks of the Escavada, large greasewoods (often pedestaled) are dominant. Approximately 12% of the survey area.

Zone I (Escavada Wash): Coarse sand alluvium of the Escavada Wash. No vegetation. Approximately 6% of the survey area.

The vegetation in the Bis sa'ani area is quite variable, ranging from barren badlands to concentrations of large greasewood plants along the Escavada banks. In addition to recording the vegetation characteristic of each microenvironmental zone listed above, plant associations in the immediate vicinity of each site were noted (Appendix B, Table 1). While the majority of these associations closely correlates with the range of microenvironmental variability, some of the vegetation associations at sites cross-cut the zones. Each vegetative association is defined below:

Vegetation Association #1 (No vegetation): Badlands and some alluvial flats.

Vegetation Association #2 (Sparse vegetation): Grasses only, mostly sand dropseed (Sporobolus sp.). Both badlands and mixed alluvium as well as aeolian deposits.

Vegetation Association #3 (Shadscale association): Shadscale (Atriplex confertifolia) dominant, with wolfberry (Lycium palladum) occasionally present. Same topographic situations as #2.

Vegetation Association #4 (Sagebrush association): Characteristic of the mesa tops on either side of the Escavada Valley. Various grasses also common.

Vegetation Association #5 (Mixed sparse shrubs): Including sagebrush and saltbush (Atriplex canescens) with overall brush cover sparse. Various grasses are present and occasionally dominant. Small greasewoods and wolfberry also present in small amounts. Found in mixed alluvium and aeolian deposits.

Vegetation Association #6 (Moderately dense mixed shrubs): Greasewood, sage, saltbush, and various grasses and wolfberry present. Sand dune localities.

Vegetation Association #7 (Dense brush cover): Moderately large greasewoods dominate with sagebrush of secondary importance. Found on semiactive sand dunes.

Vegetation Association #8 (Very large greasewoods): Often pedestaled. Characteristic of the active or semiactive dunes lining the Escavada. Soil moisture high.

Site Distributions

Geographically, the most striking pattern at the Bis sa'ani area is the dichotomy in site distribution between the north and south sides of the Escavada Wash. Twenty-six of the 28 identified Anasazi sites are located on the south side of the wash. Also interesting is the absence of Anasazi sites in the southeast quadrant of the survey area (Figure 5).

Reasons for the north-south dichotomy are not certain but may be related to differences in agricultural productivity. As described previously, the bottomland soils south of the wash may have been more suitable for farming than the northern flats. Of the bottomland microenvironmental zones, the only zone whose site percentage (25%) exceeds its land area percentage (10%) is Zone C which has flat bottomlands with low irregular dunes, small secondary drainages, and deflation areas (Table 1). This zone occurs immediately south of the Chacoan structure. Associated sites are limited almost entirely to small house and fieldhouse structures that are frequently situated at the interface of a low dune and a small deflation or drainage area. The dune and drainage locations of many of these sites suggest that proximity to agricultural areas was a primary determinant in their location.

The north-south settlement dichotomy holds not only for the bottomlands, but also for sites in the badlands. If we again consider site distribution with respect to microenvironmental zones (Table 1), a positive correlation with south badland areas is clearly indicated. Nearly one-third of the Anasazi sites are located here on less than 10% of the land. The association of sites with prominent situations and bedrock outcrops is not uncommon and is characteristic of many areas in the Chaco Basin. However, at Bis sa'ani, the association is somewhat unusual in that the prominences are largely shale badlands. Sites in the badlands (especially the Chacoan structure) often occupy remarkably precarious positions. Access is difficult, the shale provides a poor architectural footing, and, in general, the badland topography gives the impression of being rather undesirable. Accordingly, it appears that high visibility, availability of building material and/or defense may have been key considerations in choosing badland locations in general. Specifically, selection of south badland locations may be indicative of the relative proximity of the more productive bottomlands to the south badlands.

Table 1 Microenvironmental zones with vegetative association of Bis sa'ani survey area sites and percentage of relationship of microenvironmental zones to Anasazi sites distributions.

Microenvironmental zone groups		Sites in zone #	Sites in zone %	Zone percentage of survey area	Percent of Anasazi sites in zone	Percent difference[a]		Vegetative Associations 1	2	3	4	5	6	7	8
Mesa Tops	A	2	5	12	4	-8	A[b]	-	-	-	-	-	1	-	-
							O	-	-	-	1	-	-	-	-
Badlands	B	11	25	9	32	+23	A	4	2	3	-	-	-	-	-
							O	1	1	-	-	-	-	-	-
Mostly Dune Deposits	C	7	16	10	25	+15	A	2	-	2	-	2	1	-	-
	D	14	32	22	14	-8	A	1	2	1	-	-	-	-	-
							O	-	-	-	-	10	-	-	-
	E	-	-	1	-	-1	-	-	-	-	-	-	-	-	-
	F	2	5	10	7	-3	A	-	-	2	-	-	-	-	-
	H	4	9	12	4	-8	A	-	-	-	-	-	-	-	1
Alluvium	G	4	9	18	14	-4	A	1	2	-	1	-	-	-	-
	I	-	-	6	-	-6		-	-	-	-	-	-	-	-

a - Difference between percent of survey area and percent of Anasazi sites.
b - A = Anasazi, O= Other (includes Navajo and lithic [possible Archaic] sites).

It is interesting that the distribution of Navajo sites is the opposite; most of the recent sites are on the north side of the wash. Possibly the reason for these divergent locational patterns lies in the different subsistence practices -- herding vs. farming. Alternately, the Navajo preference may only reflect the undesirability of fording the Escavada during the summer thunderstorm season.

More open to question are reasons for the absence of Anasazi sites in the southeast quadrant of the survey area, although again it appears that agricultural suitability could be the determining factor. The dunes in this area cover a much higher percentage of the ground surface than in the southwest quadrant, and are often physically larger. Another possibly significant attribute is the presence of incised and narrow drainage channels. Farther west, these channels open up and flow over a much larger and more level area.

Overall, sites are inversely correlated with the density of vegetation cover. This is largely a reflection of the association with badland areas. The majority of site locations feature sparse, if any, vegetation (Table 1).

Site Remains

The physical remains found at the Anasazi sites recorded in the Bis sa'ani area are summarized below. They are presented in more detail in Table 2. Discussion of the sites is ordered by the site types defined in the first chapter of this study.

Chacoan Structure

Layout

Situated atop a narrow and precipitous, east-west shale ridge, the Chacoan structure has two separate roomblocks, each roughly L-shaped (Figures 6, 7 and 8). Separated by over 105 m, the two house blocks could be considered two different sites. However, it is more likely that the physical restriction of this narrow and sinuous ridge necessitated two separate blocks just as the ridgetop location eliminated substantial outside plaza areas (an enclosed plaza area may be present in the east block). Examination of the ridge indicates that the location of each block was carefully selected. Because of the extensive rubble that obscures many corners and individual room outlines, it is impossible to determine if the structure was built according to a large-scale plan. The orientation of both house blocks is almost due south.

The west roomblock has a total of 12 rooms and a single kiva, while the larger east room complex, covered by more rubble, has an estimated 25 rooms and four kivas. At least two of these rooms, at the southern end of a projecting kiva block, are second-story chambers. Including these second-story rooms, the combined floor area of both

Table 2 Site layout and architectural data

Site Type/ Number	Structure Configuration	No. of Rooms	No. of Kivas	Masonry Type[a]	Trash[b]	Site Size (m)	Estimated Structure Size (m^2)	Comments
Chacoan Structure:								
Bis sa'ani	2 "L" blocks, 2-rm. isol. unit	37[c]	5	c,cv	ts	40 x 30 50 x 50	1040	-
Small houses:								
B-16	Rectangular	5?	1?	-	s	30 x 12	80	Possible room block kiva. Roomblock size/ number of rooms obscured by aeolian and alluvial fill.
B-20	Non-contiguous	5?	1	s,c,cv	ts	24 x 20	35	Two cairns on pinnacle south of site.
B-23	Rectangular	3-5?	?	-	lm	35 x 10	80	Roomblock obscured by aeolian/alluvial fill.
B-25	Non-contiguous	3-5?	?	s;c	ts	25 x 10	25	Uncertain if walls form rooms, possibly series of terraces.
B-27	Non-contiguous	4-6?	?	s,c	ts	25 x 10	30	-
B-28	2 rect. blocks	7	?	s,c	t	40 x 10	65	-
B-29	Arced	5-10 rms, 1-2 pithouses?	?	-	lm,s	30 x 30	?	Excellent long distance visibility to north and west.
Limited Use Sites: Fieldhouses:								
B-1	Rectangular	2-3	-	-	s	14 x 40	-	-
B-2	Non-contiguous	3-4[d]	-	-	s	120 x 120	-	Small cluster of stone with sparse refuse scattered over large deflated area.
B-5	Rectangular	3+	-	s,?	-	33 x 15	-	Little trash visible, possibly buried.
B-6	Small rubble concentration	1	-	-	s	16 x 13	-	-
B-14	Small rubble concentraton	1	-	-	s	10 x 07	-	-
B-17	Small rubble concentration	1+	-	-	s	11 x 06	-	-
B-18	Scattered rubble	1	-	-	s	70 x 20	-	Presence of architecture indicated only by widely scattered slabs.
B-22	Squarish block	1-2	-	-	s	15 x 10	-	-
B-26	Squarish block	3	-	-	s	15 x 12	-	-
Scatters:								
B-4	-	?	-	-	s	05 x 06	-	Concentration of cultural refuse, with burned adobe roof impressions.
B-8	-	-	-	-	s	e	-	Sparse scatter of cultural debris distributed over large deflated area.
Non-habitation:								
B-3	Squarish block	1+	-	-	s	10 x 10	-	Probable non-habitation site of unknown purpose. Proximity to Chacoan structure suggests functional interrelationship.
B-7	Small rubble concentration	1	-	-	s	04 x 03	-	Probable non-habitation site of unknown purpose.
B-9	-	-	-	-	s	80 x 55	-	Sparse scatter of cultural debris over large deflated area.
B-10	-	-	-	-	s	e	-	Concentration of sherds
B-12	-	-	-	-	s	e	-	Sparse scatter of sherds south of B-9.
B-15	-	-	-	-	s	100 x 95	-	Sparse scatter of sherds with two rock concentrations representing possible hearths or other small features.
B-24	-	-	-	-	s	12 x 10	-	Scatter of refuse with occasional slabs. Possibility of 1-2 rooms in vicinity.
B-30	-	-	-	-	s	e	-	Small concentration of chipped and ground stone.
B-41	-	-	-	-	s	05 x 05	-	Concentration of sherds. Possibly a single pot break.

a Masonry type abbreviations are: s = simple, c = compound, cv = core and veneer.
b Trash type abbreviations: ts = talus scatter, lm = low mound, m = mound, s = scatter.
c Room count of 37 does not include 1-2 isolated rooms(s) on pinnacle.
d At least two separate fieldhouse structures are present.
e Site dimensions not recorded.

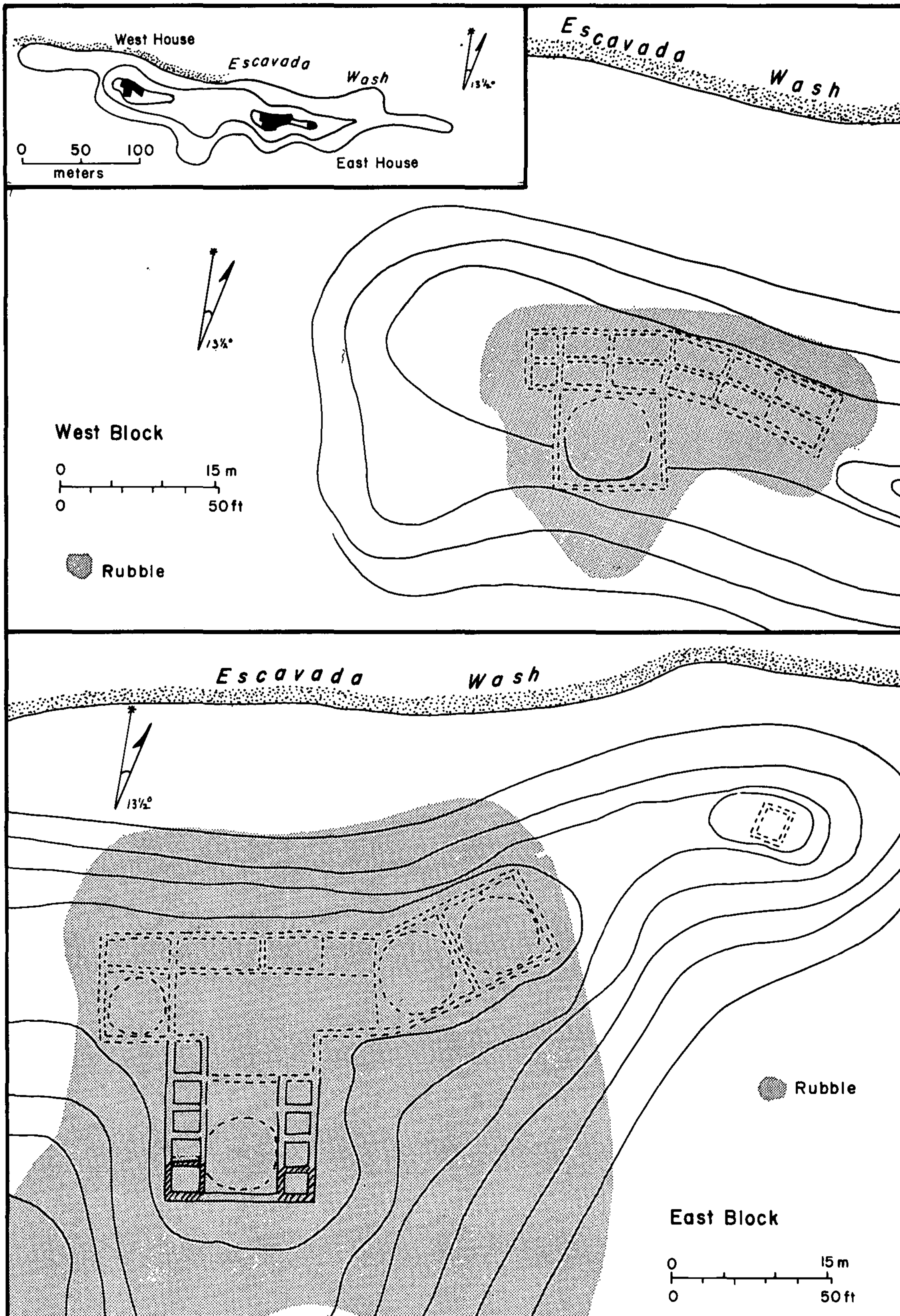


Figure 6. Bis sa'ani Chacoan structure. East and west house blocks.

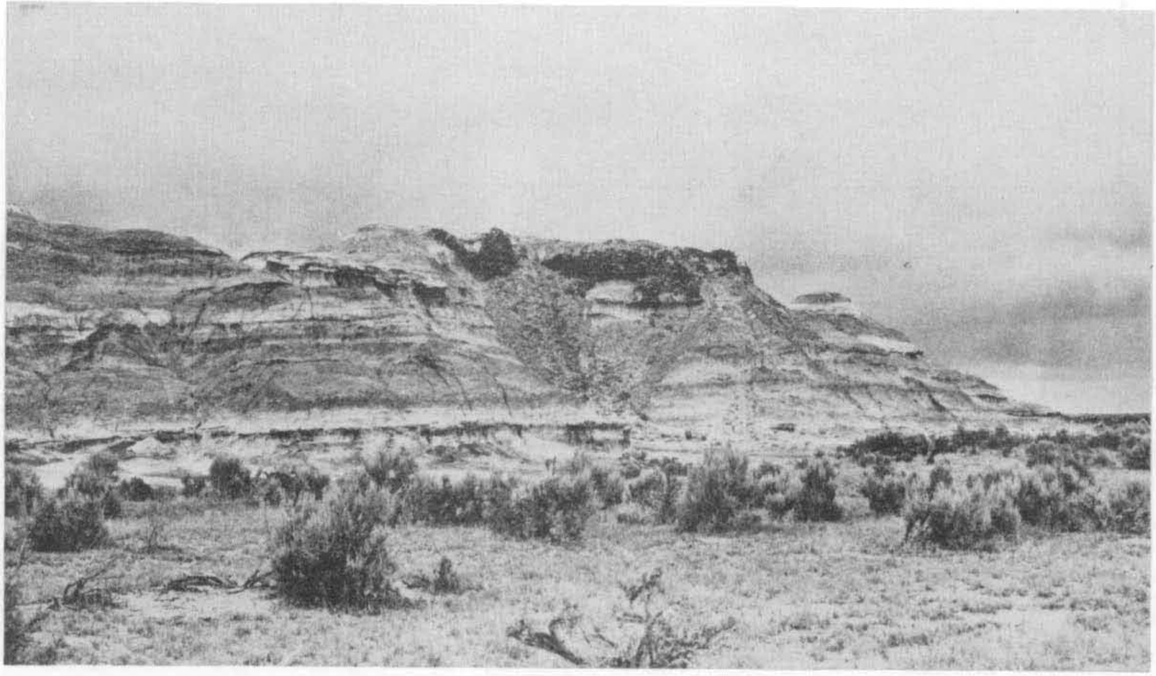


Figure 7. Bis sa'ani Chacoan structure. East house block, looking northeast from alluvial flats.

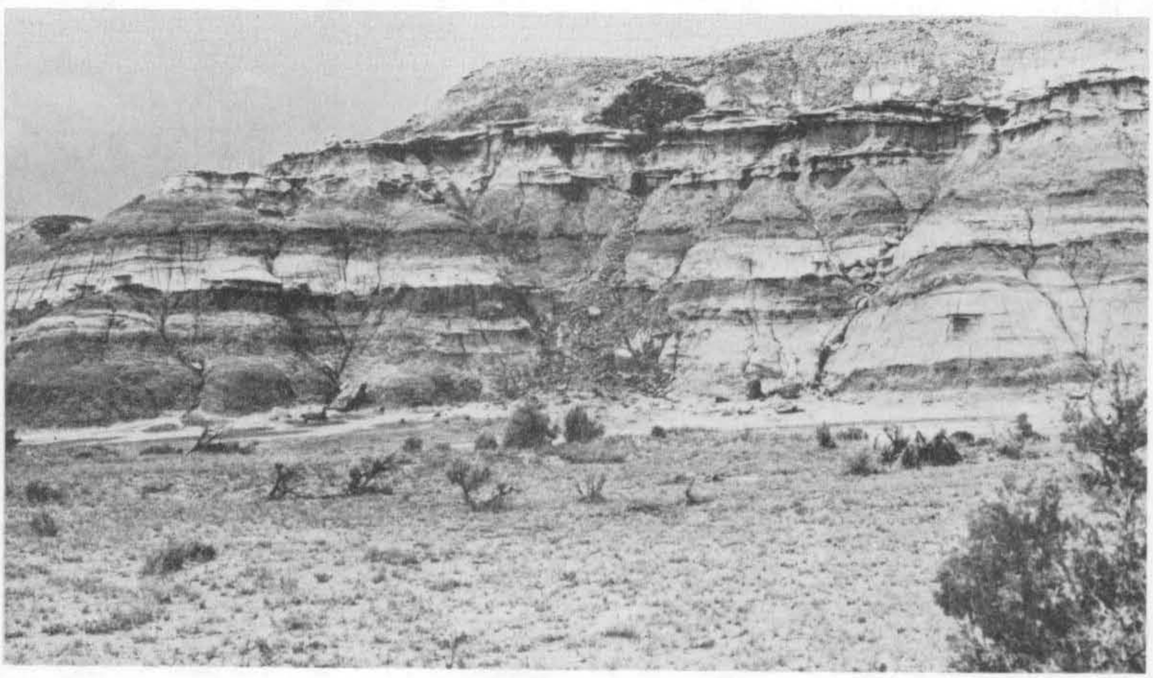


Figure 8. Bis sa'ani Chacoan structure. West house block, looking north from alluvial flats.

blocks totals 1040 m^2. Another one, or possibly two, eroded rooms are present on top of a melting clay knob 20 m east of the east block.

Little trash is present, although a continuous scatter of rubble and debris surrounds both blocks. In general, sites throughout the survey area have little trash, and, in this respect, Bis sa'ani is not unusual. However, it is our guess that some of the Chacoan structure trash was thrown over the precipitous north ridge slope where the first heavy rains sent it down the Escavada Wash.

Trash associated with the west block seems to indicate construction and use in Early Pueblo III, as does the refuse from the east block. Smatterings of earlier pottery are present in both areas but may be misleading. Though the lack of refuse may in part reflect its method of disposal, its sparsity together with a lack of outward evidence of architectural renovation suggest that occupation of the Chacoan structure was brief.

Architecture

In their present condition, the Chacoan structure roomblocks, and particularly the eastern block, appear to contradict the principle of gravity. The thick, outside walls of the latter structure, footed on shale, are now partially to almost completely undermined. Yet they stand unassisted for heights exceeding 3 m, supporting tons of rubble that fill the interior room spaces. The walls are predominantly core and veneer, typical of many Chacoan structures, although some thinner compound walls are present. Exposed wall masonry ranges from veneers of small shaped blocks laid in even courses to wall faces composed of large, unshaped, or only roughly shaped blocks laid in uneven courses (Figure 9). Mixtures of both variants occur in some walls, jumbled together, or in sets of roughly alternating courses to create a banding effect (Figure 10). Along the lower west wall of the east roomblock are the remains of what appears to have been a decorative band of dark sandstone (Figure 11). Whether this band circled the east block is impossible to tell. If so, it is similar to the decorative bands at other Chacoan structures, including the Aztec West Ruin and the Ida Jean Ruin.

The primary masonry stone is a blocky, angular fracturing, chocolate brown sandstone from the southern badland. Although its cleavage characteristics are responsible for the blockiness of masonry throughout the site, the lack of shaping and the crudeness of the coursing appear to reflect the quality of workmanship more than possible limitations of the material. Although wall exposures are limited and severely weathered in many instances, the masonry at this site clearly does not display the craftsmanship or elaborate styles of many of the Chaco Canyon structures.

In part because of this, Bis sa'ani does not closely resemble any of the Chaco Canyon styles in their purer forms as recognized by Hawley

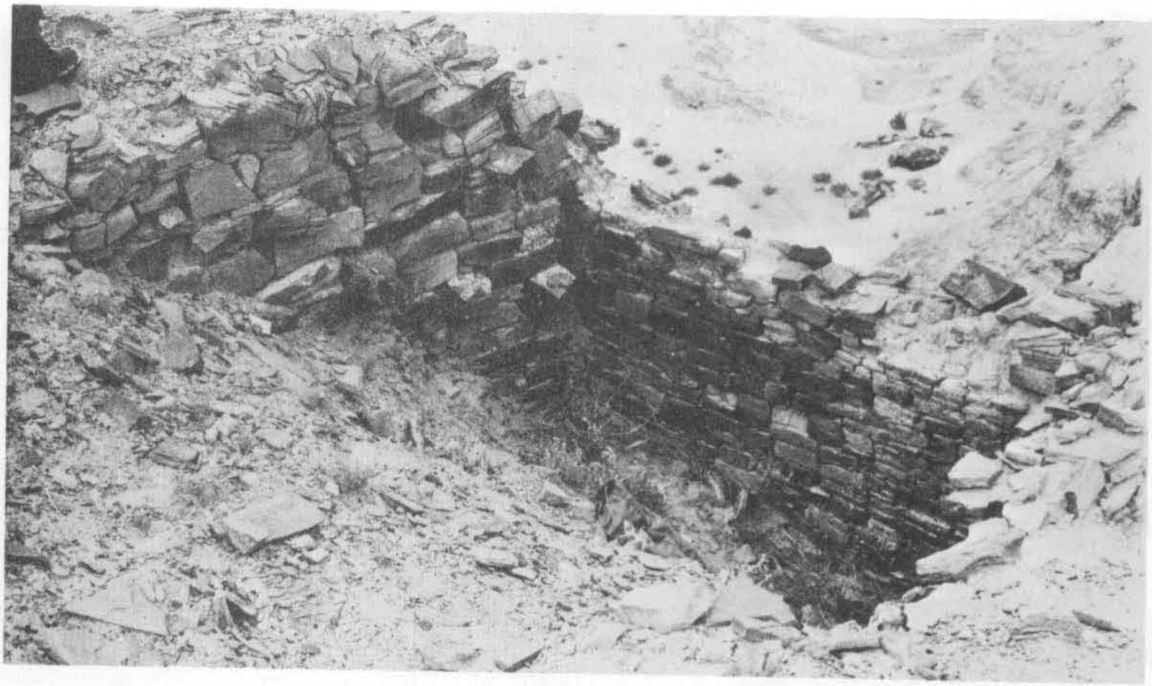


Figure 9. Bis sa'ani Chacoan structure. East house block. Detail of blocky masonry in small room on the west edge of the house.

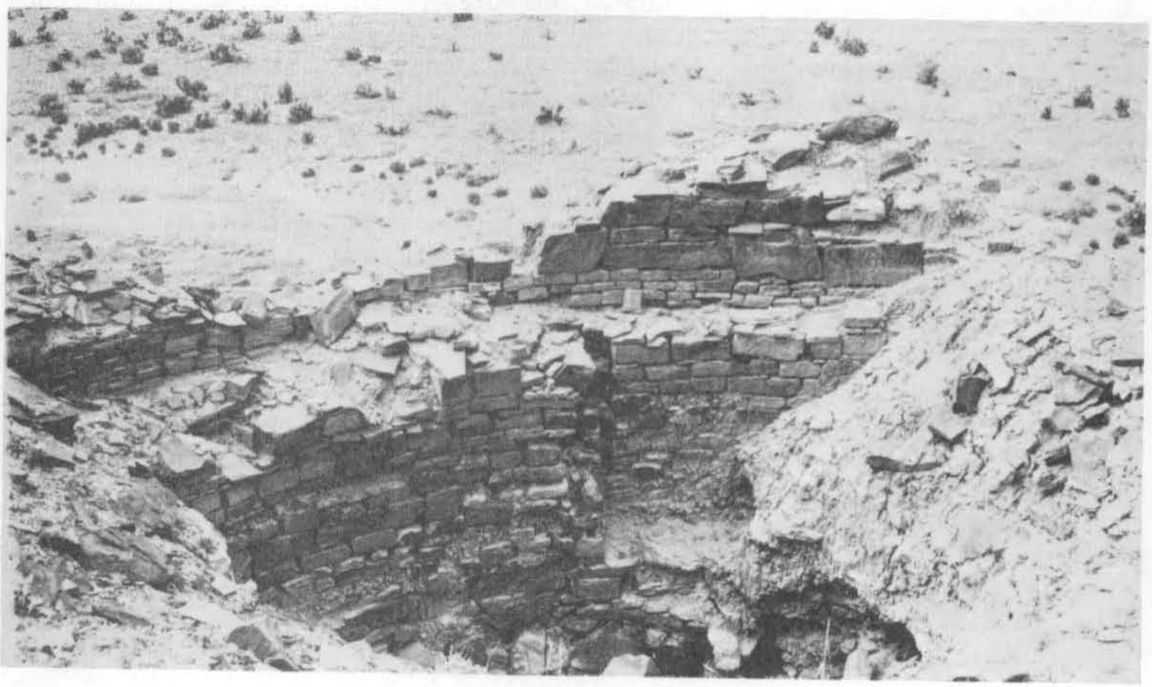


Figure 10. Bis sa'ani Chacoan structure. West house block kiva. Detail of banded small and large blocks near kiva ventilator.

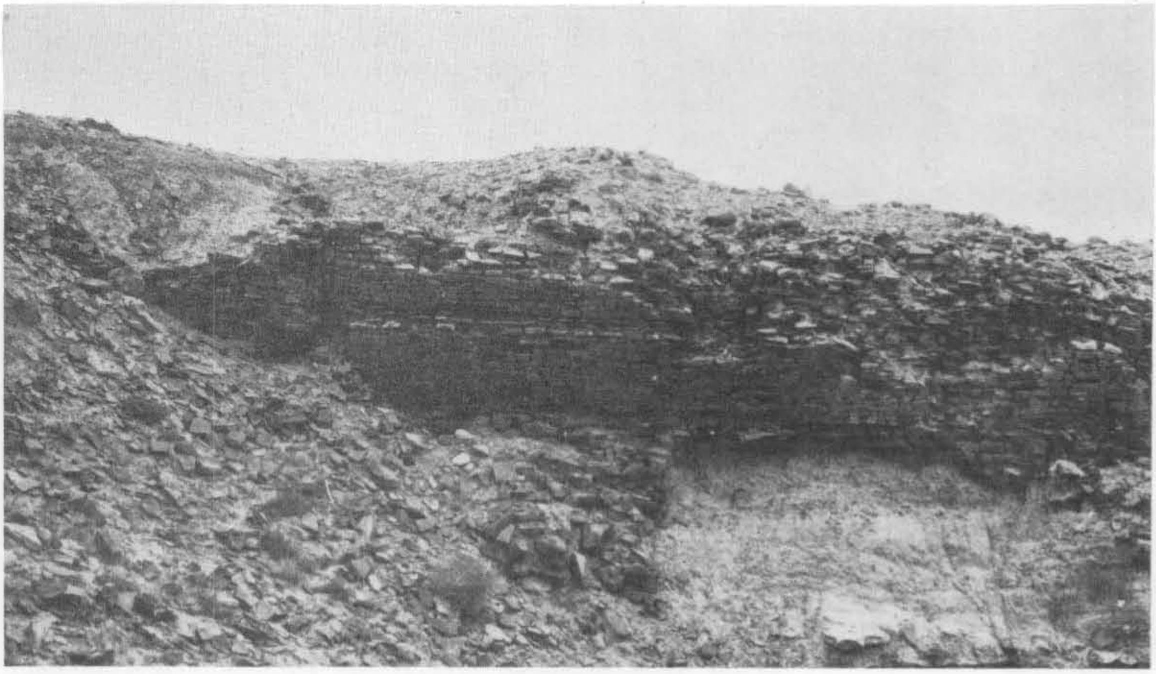


Figure 11. Bis sa'ani Chacoan structure. Badly eroded west wall of east house block. Eroded area in middle of wall face may have held decorative bands.

(1934, 1938) or Judd (1928, 1964). However, elements of Hawley's Types IV, V, and VI are recognizable. Given that the similarity between the Bis sa'ani masonry and Hawley's types is only general and that dendrochronological reexaminations have eliminated, added, or changed dates on which Hawley's temporal placement of styles was based (Lekson et al. 1982), the site can only be assigned a general late date, probably post-1050. The site's ceramic assemblage confirms this conclusion.

Beam holes in one east block room establish a ceiling height of 2.5-2.8 m. The high wall sections in this same room, and possibly those in one other, also appear to preserve the stubs of second-story room walls. Two other rooms adjacent to these are logical candidates for second-story rooms, but no evidence of upper story rooms remains.

At the approximately 27 rooms with visible outlines, size ranges from 5 m^2 to 20 m^2 (Table 3). Four (15%) of the largest rooms (13-20 m^2) are bigger than the "large" rooms (11 m^2) cited by Vivian (1970b:168) from Pueblo del Arroyo.

At all five Chacoan structure kivas, only wall segments are presently exposed. The sole kiva in the western roomblock has a shallow southern recess and traces of what might have been a high, narrow bench (Figure 10). Both this kiva and another one in the east block illustrate the use of small, squared blocks and slabs to achieve a gradual and uniform wall curve. We have observed this construction technique in other Chacoan structure sites. Originally we thought it might be a technique limited to Chacoan structure kivas until small stones used to the same effect were observed at a Bis sa'ani small house kiva in the south badland.

With five kivas, a kiva/room ratio of 1:7 is indicated. This is a substantially higher ratio than the 1:12-15 ratio Hayes (1981) believes is more typical of Anasazi sites in general.

Small Houses

Only seven small house sites were recognized in the survey of the Bis sa'ani locality (Table 2), and, of these, a number are so small ($n = 6$, $\bar{x} = 52.5$ m^2, $sd = 25$) that they could just as readily be identified as fieldhouses depending on the bias of the investigator.

Although both small house and fieldhouse sites have been recognized, the distinction between the two is difficult and may not be entirely valid. This is partly because postoccupational deposition and erosion have obscured sites. Furthermore, proximity of fieldhouses to small houses (less than 1 km) and the minimal size of small houses suggest that some of the units identified as separate fieldhouse and small house sites might better be viewed as spatially separate yet interdependent loci of a single habitation unit. The bottomland sites (Zones C, D, F, and G), half ($n = 9$) of which have been identified as fieldhouses, have obvious advantages with respect to agriculture and are not subject to the severe space limitations inherent at sites located in the badland zone. Alternately, the badland locations offer readily available building stone, better visibility, and defense. The divergent microenvironmental zones strongly imply functional differences and complementarity between sites within the two areas. Although the presence of some substantial small house sites in both major areas suggests that a spatial-functional dichotomy is not all inclusive, the assumption that fieldhouses or small houses may not conform entirely to their idealized roles must remain.

As noted previously, a small house is defined as a site with a minimum of four rooms, a moderate-to-substantial amount of trash, and a kiva. The latter requirement was hedged, since only one site had a visible ceremonial structure. It is presumed that kivas at the remaining sites are present but not visible, hidden by heavy alluviation.

Layout

The spatial layout of sites identified as small houses varied according to the microenvironmental zones in which the sites occurred. The following discussion treats the bottomland sites first, succeeded by badland sites, and a single mesa-top site.

The two small houses in the bottomlands each appear to have a single rectangular roomblock, one tier wide and perhaps five rooms in length. A circular rubble area at B-16, exhibiting a slight central depression, may be a kiva (Figure 12A). No kiva is visible at the other bottomland village, B-23. The trash at B-16 is little more than a scatter, while that at B-23 is more substantial and forms a small, low mound. Estimated rubble mound heights at these small house sites range from .25 - .75 m. At each site, dunes, colluviation, and deflation have obscured the roomblock and surrounding area, making it especially difficult to determine site size and the presence or absence of features. Each site could be significantly larger than it appears.

One of the better preserved and more substantial small house sites (B-28) lies within the badland zone, protected from, and unobscured by bottomland deposits. Situated at the west foot of a small erosional ridge in a small badland canyon, B-28 has two small, double-tiered blocks of five and two rooms, each oriented north-south (Figures 12C, 13 and 14). Trash is scattered to the west of the rooms, and if a kiva is present, it is completely buried in the colluvium to the west of the room blocks. Rubble mound height is .5 m.

Three additional small houses in the south badlands are situated on top and at the northern ends of three separate badland ridges. The layout at each site is best characterized as "dispersed," the result of level ground that is too narrow for more than two small contiguous rooms. The easternmost of the small houses, B-20, bears the remains of two to three small rooms spread along the top and east side of a clay

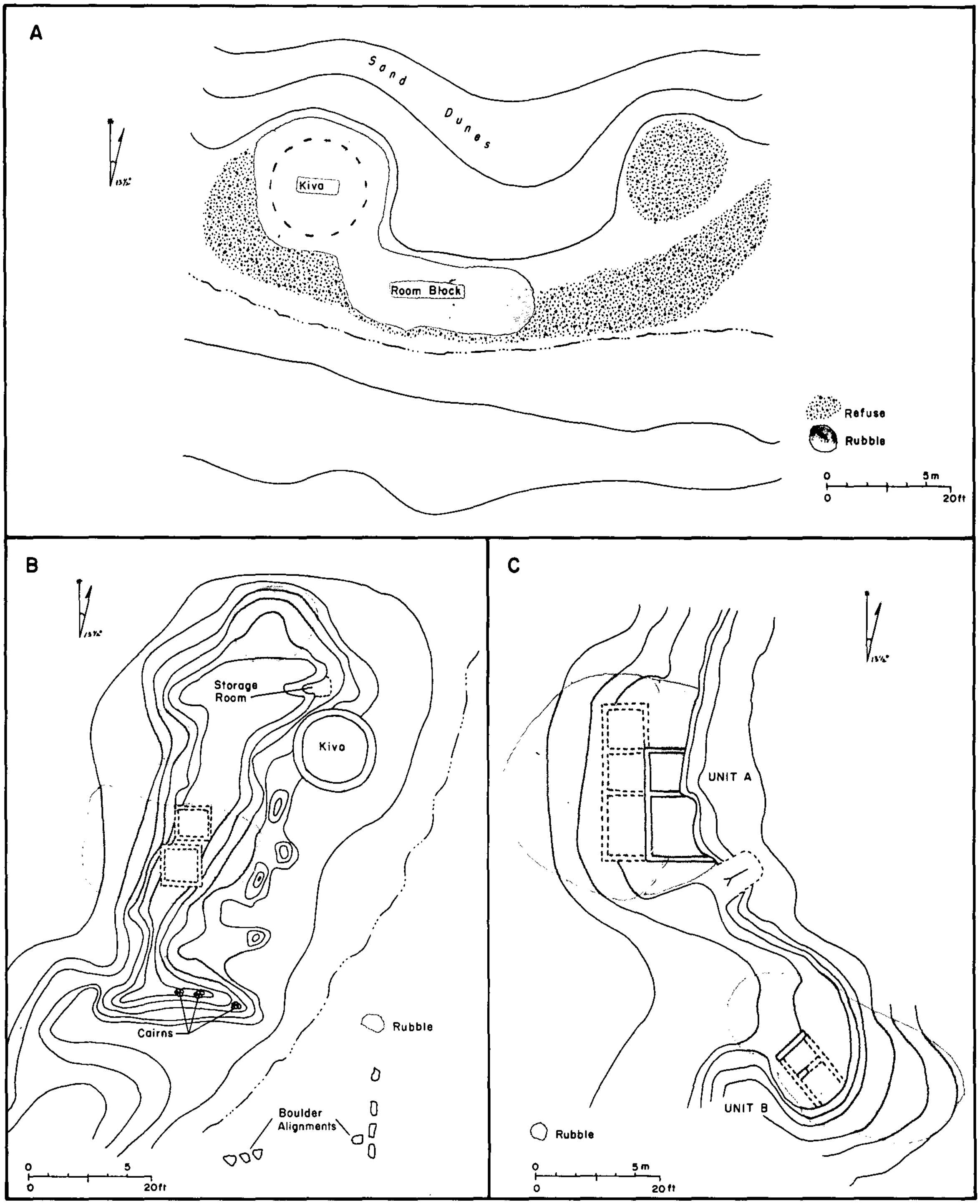


Figure 12. Site plans of selected small houses: A) B-16; B) B-20; C) B-28.

Figure 13. B-28, small house, Unit A, looking north.

Figure 14. B-28, small house, Unit B, looking southeast.

and sandstone-capped ridge (Figure 12B). Masonry rubble indicates that at least two more rooms may once have been present. An exposed kiva lies at the east foot of the ridge in the colluvium (Figure 15). Trash spills down both the east and west sides of the ridge.

A second badland small house (B-27) has four to six scattered rooms with trash littering the north, west, and east slopes of its ridge. A third site classified as a small house (B-25) may have a similar number of rooms, although it is not clear whether the visible walls form rooms or several retaining walls. Rubble mound heights are .25 and .25-.50 m, respectively. Again a light scatter of refuse among the talus and masonry debris is the only cultural material. Kivas are not visible at either of these latter sites, although they could be buried in the colluvium at the foot of the respective ridges. While aeolian deposits and water transport make site identification in the bottomlands difficult, extreme exposure and resulting erosion have virtually destroyed the badland sites. In most places, only one to two courses of masonry remain intact, the substance of the original room being estimable only from the talus debris below.

A final Bis sa'ani small house, located on the mesa top dividing the Gallo Wash drainage from the Escavada, is situated on a high point directly overlooking the southern badland and the Escavada Valley. This site (B-29) has an arcuate rubble mound (.5 m high) reminiscent of earlier Pueblo I and II housemounds -- a clue that is partially substantiated by the Pueblo II and III pottery found concentrated to the southwest of the house. Though five to ten rooms are estimated, no obvious kiva or pithouse depression is visible. The area to the east of this house block could conceal these structures, however.

As with the badland small houses, visibility must have been a major consideration in the location of this site, since the disadvantages with respect to field areas and water would have been substantial.

Architecture

At many Bis sa'ani small house sites, the architecture is almost completely buried; in others, it is visible as collapsed rubble. At the bottomland sites, visible walls are the exception. Therefore, most of the visible architecture is exhibited in the meager remains of the badland sites. Intact masonry is visible at five sites, with walls of simple (one stone wide) and compound (two stones wide) construction exposed. Core and veneer work is exposed in only one structure where it is used to strengthen the downslope side of the sole badland kiva. Two aspects of simple and compound construction that contrast sharply with the Chacoan core and veneer construction are the substantially smaller quantities of masonry required for walls of this type and their relative lack of stability. This latter point is demonstrated by a comparison of the architectural remains of the Chacoan structure and small house sites in the badland microenvironmental zones. The Chacoan walls, although much undermined and endangered by erosion, still reach

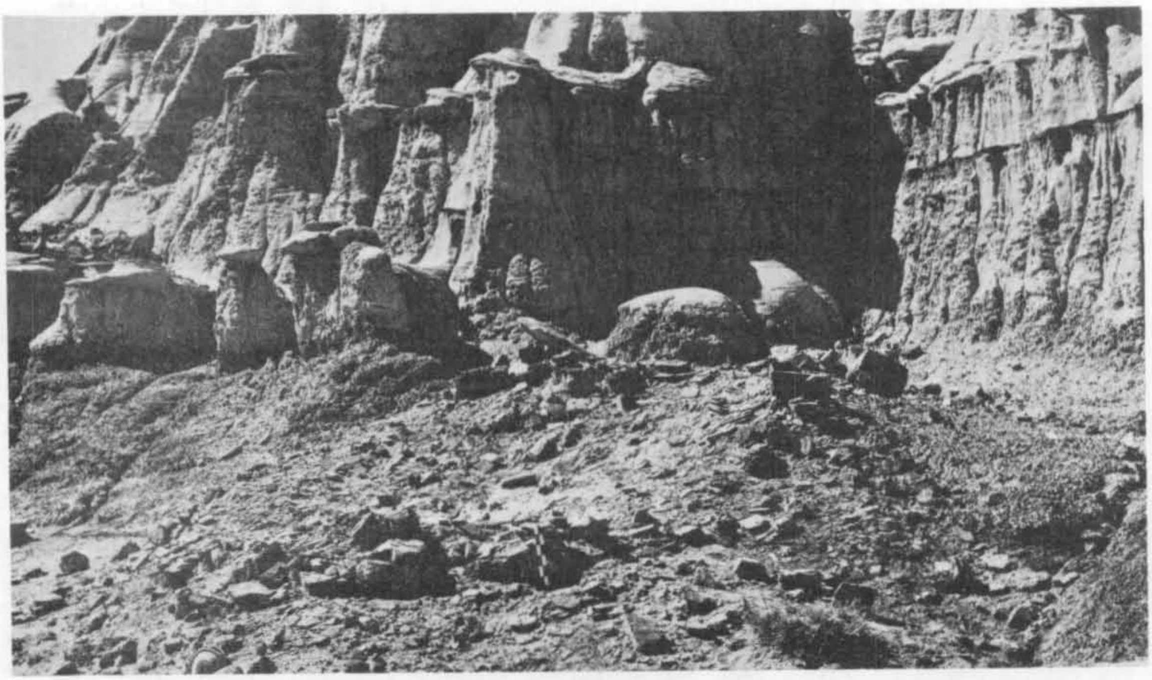


Figure 15. B-20, small house. View of kiva, looking west.

to substantial heights, while the small house walls rarely exceed two to three courses in height.

The masonry stone at the small houses is the same brown, blocky sandstone utilized in the Chacoan structure, although less of the small house masonry appears to have been shaped. This is only a subjective impression, however. At one badland small house (B-20), several walls had bases of upright slabs; while at B-28, exceptionally large blocks were used to foot some walls (Figure 14). Shaped stone is exposed in the upper walls of the kiva at B-20, making the masonry of this structure similar to that exposed in the Chacoan structure kivas (Figure 15). One high, squared masonry pilaster in this kiva, however, suggests San Juan style furnishings. In contrast, pilasters are not exposed in the two Chacoan structure kivas that are partially open to bench level.

The outlines of a small number of individual small house rooms are distinguishable, but only in the badland sites. Here the rooms are small, perhaps necessarily so, because of limited construction area. Table 3 reveals that only 12 rooms are measurable. Of these, ten (83%) are small (4 m^2) while the remaining two are larger (7 m^2) chambers. Our present impression is that excavation in the bottomland sites would reveal larger rooms, and perhaps a wider range of room sizes.

Limited Use Sites

Fieldhouses

Nine sites in the bottomlands (Zones C, D, F, and G), each with one to three rooms and an associated scatter of cultural material, have been identified as fieldhouses. The majority are located at the edge of low dunes and small drainages. Portions of these sites are covered by aeolian sand, while the remainder (usually the southern trash area) is scattered and covered by alluvial sediments. The distinguishing criteria between these sites and small houses are the lesser number of contiguous rooms (three or less), smaller quantities of trash, and presumed absence of a kiva. Where alluviation or duning severely obscures the number of rooms and the presence or absence of a ceremonial structure, type assignment is of necessity partially subjective.

Layout. The structures range from one-room masonry units to rectangular or squarish units of three rooms. At one site (B-2), three separate masonry scatters are believed to represent the remains of four separate rooms. Refuse often surrounds the structure areas in a light sheet scatter or is exposed only in deflated areas.

B-6, representative of the smaller fieldhouse sites, includes a sparse scatter of cultural debris distributed over an area 16 x 3 m in size (Figures 16B and 17). Only one location within this area has

Table 3 Estimated room size by site type

Site type/ Number	Room Size (m^2)						Mean Room Size (m^2)	Standard Deviation (m^2)	Total Rooms Measured	Total Est. Rooms	Percent Rooms Measured
	4	5	7	9	13-16	20					
Chacoan Structure:											
Bis sa'ani		12	1	10	3	1	8.2	4.0	27	37*	73%
Small houses:											
B-16											
B-20	2										
B-23											
B-25											
B-27	5										
B-28	3		2								
B-29											
Sub-totals	10		2				4.5	1.2	12	38	32%
Limited Use Sites:											
Fieldhouses:											
B-1											
B-2											
B-5	3										
B-6											
B-14											
B-17											
B-18											
B-22	1										
B-26											
Sub-totals	4						4.0	-	4	18	22%
Nonhabitation:											
B-3											
B-7											
Sub-totals							-	-	-	2	-
Total	14	12	3	10	3	1					

Note: Room size fractions are not shown (i.e., 15.5 m = 15 m) but were utilized in deriving mean room size and standard deviation.

* Does not include isolated pinnacle room(s).

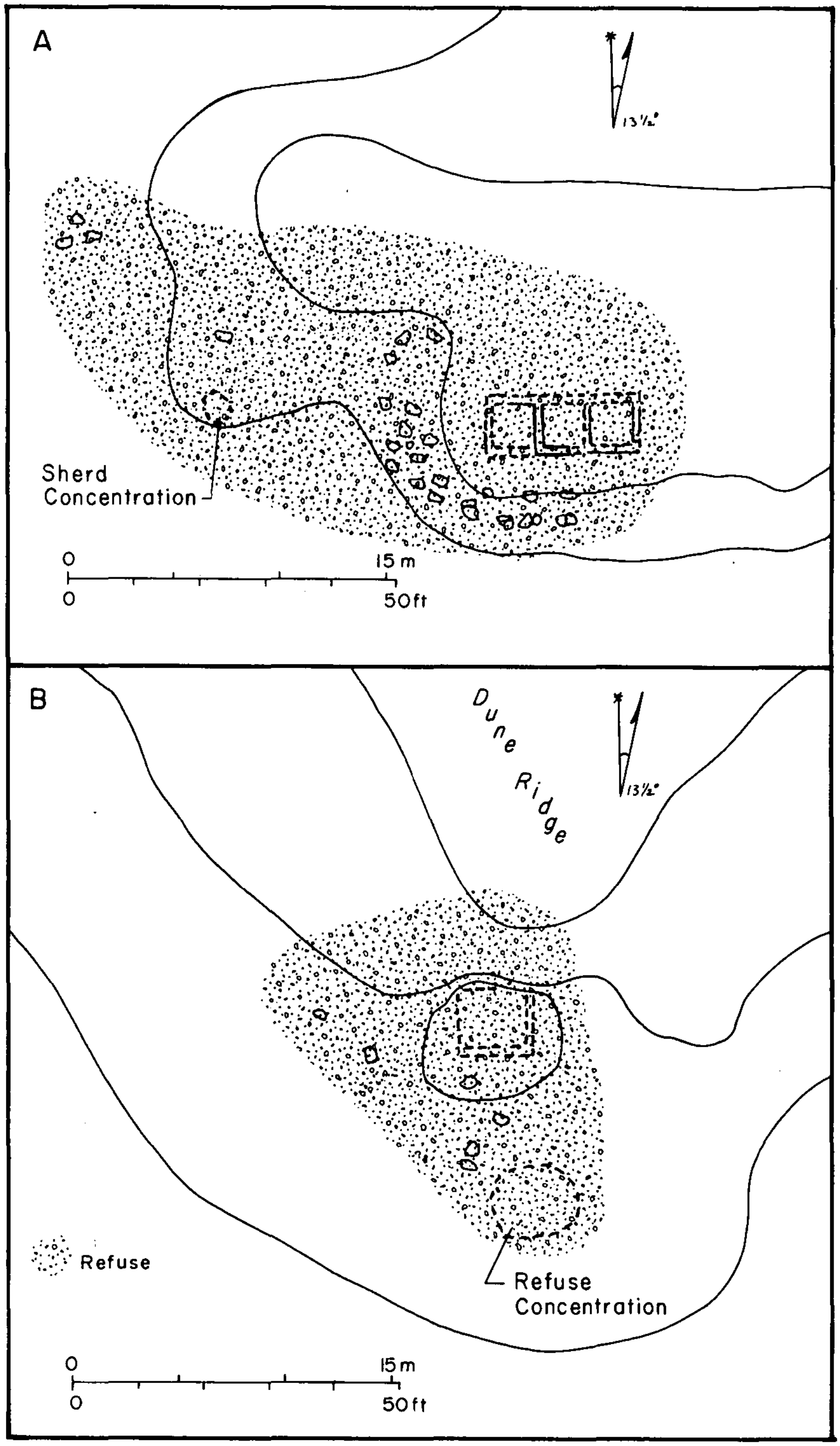


Figure 16. Site plans of selected fieldhouses: A) B-5; B) B-6.

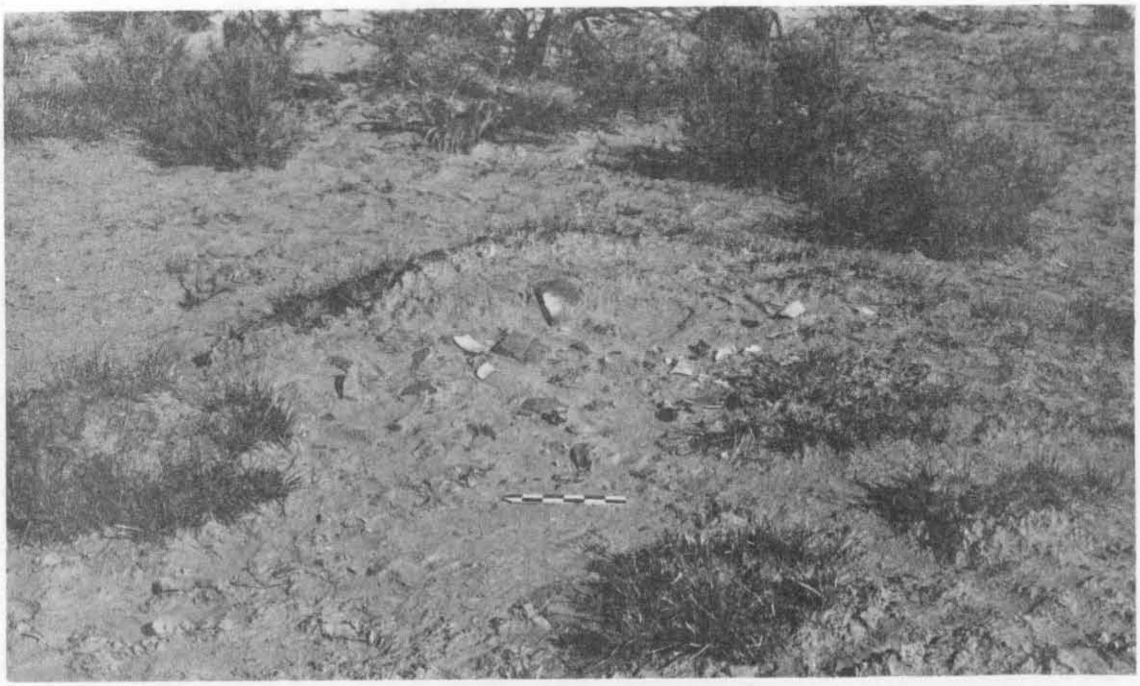


Figure 17. B-6, fieldhouse. Scatter of slabs and cultural material.

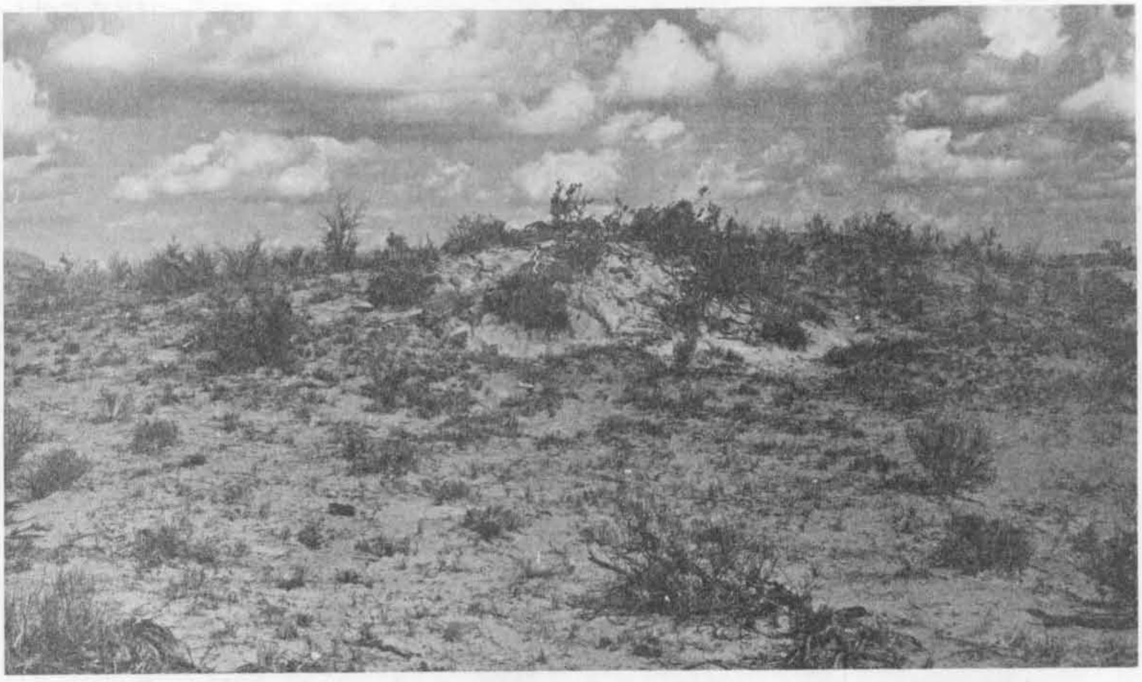


Figure 18. B-5, fieldhouse. View of rubble scatter, looking to northeast.

enough stone to suggest a one-room structure. B-5, a larger fieldhouse, has three contiguous, east-west oriented rooms, and a light scatter of surrounding cultural material (Figures 16A and 18). Dunes to the north and east may hide additional rooms. If so, a small house designation is warranted.

Architecture. The architecture of the fieldhouses is even more rarely exposed than that of the small houses. Given that we seldom saw more than two dozen scattered sandstone slabs, and only rarely an exposed wall alignment, we can only surmise that fieldhouse masonry is similar to small house masonry. Whether or not a portion of the fieldhouse structures is jacal, as often assumed (Reher 1977:84), is not certain, although the sparsity of stone would suggest this. Four rooms, each 4 m^2 were measured; they represent 22% of the estimated 18 fieldhouse rooms. The smallness of the rooms could be indicative of the group as a whole and might reflect the kind of use these structures received, but the size of the sample does not allow conclusive comment.

Artifact Scatters

Six of the nine scatter sites comprise dispersed low-density scatters of sherds and lithics. They are found along the deflated margins and edges of small secondary washes. The majority of these sites are thought to be the result of natural displacement of cultural material from adjacent fieldhouse and small house sites, though a small proportion of the cultural material is probably in situ scatter. A number of the scatters are probably adjacent to, if not within, field areas. Two other substantial scatters may include some architecture. We guessed that one or two small features might have been present at B-15, and we saw enough scattered stone at B-24 to propose that one or two rooms might once have existed here or are buried in the vicinity. Sherds associated with these expansive scatters range from a very few Early Pueblo II examples, to more common Late Pueblo II and Early Pueblo III types (Table 4).

The remaining three scatter sites are small and unique concentrations of cultural material. B-4, covering a 25 m^2 area, includes a few Red Mesa Black-on-white style sherds, a mano, lithics, and several vitrified adobe roof chunks. Possibly a buried structure is indicated.

The second site, B-41, is a 25 m^2 scatter of Early Pueblo III sherds, all probably from the same vessel. This, and a few chipped and ground stone fragments at B-30 are the only Anasazi remains we encountered on the north side of the Escavada Wash.

Table 4 Periods of site occupation as indicated by tree-ring dated ceramics

Site Type/ Number	BM-III/P-I 500-900	EP-II 900-975	LP-II 975-1050	EP-III 1050-1175	LP-III 1175-1300	Other
Chacoan Structure:						
Bis sa'ani:						
East Block		VF		F		
West Block			VF	F		
Small houses:						
B-16	VF		F	A		
B-20				F		
B-23			VF	F		
B-25				F		
B-27						
Room 3			VF	F		
Room 4	VF			F		
B-28				F		
B-29		VF	F	A		
Fieldhouses:						
B-1				F		
B-2				F		
B-5				F		
B-6				F		
B-14	VF	VF	VF	F		
B-17			F	A		
B-18				F		
B-22				F		
B-26				F		
Limited Use Sites:						
Scatters:						
B-4		VF				
B-8		VF	VF			
B-9			VF			
B-10			VF	VF		
B-12				VF		
B-15			VF	VF		
B-24				F		
B-30						O
B-41				VF		
Non-habitation:						
B-3				F		
B-7			VF			
Subtotals by Sites*						
A	0	0	0	3	0	0
F	0	0	3	16	0	0
VF	3	5	9	4	0	0
0	0	0	0	0	0	1
Total No. of Sites*	3	5	12	23	0	1

Explanation of symbols:

* - Totals and subtotals reflect the numbers of sites which were occupied during the period. If two or more units of a site dated to a period, they were counted once.

A - Abundant sherds with styles of indicated period. Site occupied during indicated period.

F - Few sherds with styles of indicated period. Site occupied during indicated period.

VF - Very few sherds with styles of indicated period, <u>or</u> sherds with styles of conjectural temporal placement. Site may have been occupied during indicated period.

0 - No diagnostic ceramics.

Nonhabitation Sites

Two sites in the Bis sa'ani survey area may be referred to as nonhabitation sites, although this categorization is more reflective of their unique appearance and location than our ability to attribute any specific purpose to them.

B-3, a high (1.0+ m), squared mound (10 x 10 m), is located at the southern foot of the badland ridge crowned by the east block of Bis sa'ani (Figure 19). The height of this mound and the possibility that it is a single large room set it apart from other sites in the Bis sa'ani locality, as does its location near the Chacoan structure. Neither the sparse scatter of Early Pueblo III sherds surrounding the structure nor the presence of four obsidian flakes (29% of all obsidian observed in the Bis sa'ani survey) provide evidence as to how the structure functioned. Unfortunately, without an excavation sample, it is impossible to determine the significance of obsidian at this site.

B-7, a low, 3 x 4-m mound of sand and stone could be readily described as another fieldhouse, if it were not for its unique purple-red construction material (#1042) and proximity to two small red shale hills. While these may not be valid criteria for isolating this site as something different, its location away from the best field areas suggests that it may not be a field structure. Labels such as work area or shelter come to mind, but supportive evidence is lacking.

Ceramics

Reflecting the small size of many of the Bis sa'ani sites, little ceramic material was found. However, the sherds found date mostly to the Early Pueblo III period. At sites where only a very few sherds diagnostic of a temporal period are present, occupation of the site during this period is considered conjectural. At sites where few to abundant sherds of a period are in evidence, occupation is considered definite. The temporal spans of ceramic styles are based upon the dates Breternitz (1966) assigned to ceramic types, with some modifications (Hayes 1981). Table 4 documents the occupational span of each site as indicated by dating of the ceramics. For a discussion of ceramic sampling procedures and the ceramic style system employed, see Appendix A. In Appendix B, Table 4 tabulates the sherds found at each site in the Bis sa'ani survey area by ware and style; included are the numbers of estimated surface sherds. This data is summarized in Table 5.

Temporal Dynamics

A few sites in the Bis sa'ani survey area may have been occupied during Pueblo I (three sites) and Early Pueblo II times (five sites), as indicated by a very few sherds diagnostic of these time intervals (Table 4). Of these, sites B-14 and 29 (a fieldhouse and a small house, respectively), are the best prospects for occupation beginning

Figure 19. B-3, nonhabitation site. View of mound looking northeast.

Table 5 Ceramic ware/style frequency totals

Ware/style	Totals for survey area No.	%	Percent of class	No. of sites
Gray Wares:				
Plain gray	358	9	16	18
Banded gray	6	-	-	6
Ribbed gray	16	-	1	5
P-II corrugated	5	-	-	3
P-II/P-III corrugated	1509	38	66	22
P-III corrugated	377	9	17	15
Class Subtotal	2271	57	100	
White Wares:				
Plainwhite	993	25	63	20
*BM-III/P-I	2	-	-	2
*Kana'a	1	-	-	1
Red Mesa	25(1)	1(-)	2(-)	9
Dogoszhi (straight)	194(3)	5(-)	12(-)	18
Dogoszhi (squiggle)	-	-	-	-
Sosi	197(42)	5(1)	12(3)	19
Flagstaff	5(2)	-(-)	-(-)	7
Puerco	5(2)	-(-)	-(-)	5
Wingate	17(1)	-(-)	1(-)	8
Tularosa	1	-	-	1
McElmo	2(95)	-(2)	-(6)	15
Mesa Verde	-	-	-	-
Class Subtotal	1442(146)	36(4)	90(9)	
Red Wares:				
*Plain red	95	2	62	12
*BM-III/P-I	3	-	2	1
*Thick line	41	1	27	8
Puerco	6	-	4	2
Wingate	9	-	6	7
Black & red/orange	-	-	-	-
Black and white/red	-	-	-	-
Class Subtotal	154	4	101	
Total	3867(146)	101		

( ) = carbon painted sherds.
* = frequencies are estimated from percentages.
a = includes Chaco style mineral black-on-white.

in Pueblo I or Early Pueblo II times. This is because the presence of some ceramics of consecutive periods increases the possibility of a continuous occupation. At the remaining sites where only a very few Pueblo I or Early Pueblo II sherds are present, without subsequent later period ceramics, the probability that the early sherds were collected from elsewhere, or represent heirlooms, appears greater.

Two small houses (B-16 and 29) and a fieldhouse (B-17) have enough pottery to indicate definite occupation by Late Pueblo II, while nine other sites have traces of ceramics diagnostic of this time period. Again, the majority of these latter sites are in the bottomland where erosion and filling make site occupation intervals difficult to define. It is impossible to tell how many of the bottomland sites with very few late Pueblo II sherds were actually occupied during the interval; many probably were not. Continued use of Late Pueblo II pottery types during Early Pueblo III times may be the most realistic explanation for the presence of earlier ceramics in small quantities at these sites. If some Bis sa'ani residents did maintain spatially separate bottomland and badland units, such a dichotomy was not apparently widespread until Early Pueblo III, as indicated by the absence of pre-Pueblo III ceramics at all but one of the badland small house sites.

The majority of the Bis sa'ani sites were occupied exclusively in the Early Pueblo III interval (Table 4). Including the Chacoan structure, all of the small houses, and a large number of the limited use sites (fieldhouses, scatters, and nonhabitation sites -- a total of 19 sites) were utilized for an apparently short interval within the 125-year Early Pueblo III period. The complete absence of Late Pueblo III ceramic types indicates the area had been completely abandoned by the inception of the latter period.

Styles and Quantities

The full range of ceramic styles encountered in the survey area is shown in Table 5 and Appendix B, Table 4. Sherds of possible Pueblo I styles occur in very small amounts at three sites. Red Mesa Black-on-white style pottery (Early Pueblo II), present on five sites, is slightly more abundant than the the Pueblo I material. These styles, in combination with some banded utility pottery, do suggest a few Pueblo I or Early Pueblo II components in the bottomlands and at the one mesa-top site. Dogoszhi-style carbon and mineral paint black-on-white sherds (the latter probably Gallup Black-on-white) as well as other mineral and carbon paint black-on-white styles are abundant at Late Pueblo II and Early Pueblo III sites, with Chaco-style black-on-white appearing during the latter interval. Red wares are infrequent, and when present, include Puerco, or Wingate-style black-on-reds, or similar types. No White Mountain polychromes were found, nor were any incised utility pieces observed.

The number of sherds found on the sites was generally few, as is indicated by Table 4 and Appendix B, Table 4. The Chacoan structure blocks cumulatively had less than an estimated 600 surface sherds; although at the ridge bottom of this site, talus rubble and colluvium undoubtedly hide some additional cultural material. Visible sherds at four small houses numbered slightly less, although two had as many sherds as the Chacoan structure and one had less than 100. The limited use sites in almost all cases had less than 100 visible surface sherds.

Lithic Material

Chipped stone remains at the Bis sa'ani sites are fairly sparse (Appendix B, Table 7). Only two sites are estimated to have more than 100 flakes visible on the surface (B-16 and B-23), while the rest have considerably fewer.

Silicified Woods

At the Bis sa'ani sites, as elsewhere in the Chaco Basin, silicified wood comprises the bulk of the lithic material -- nearly 70% of all flakes examined (Table 6). The majority of this wood in the Bis sa'ani survey area is a light brown or white material with a splintery or nonconchoidal fracture (#1110). It appears to derive from local outcrops in the Fruitland Formation badlands. Although significant amounts of this material are found on some of the sites (occurring as naturally deposited sediments, building stones, hammerstones, etc.), it is not really a flakable material, and accordingly, has been omitted from the accompanying numerical tabulations. Excluding this "junk wood," light chalcedonic wood (#1140) is the most common variety (43% of all woods). Three other varieties, dark wood (#1112), waxy white wood (#1113), and light colored variegated wood (#1142), make up most of the other silicified wood flakes (Table 6). All of these varieties appear to outcrop in the immediate area.

Cherts and Chalcedonies

Cherts and chalcedonies comprise approximately 19% of the chipped stone debris at the Bis sa'ani sites (Table 6). No one material type is particularly abundant, but several occur in moderate frequencies at a variety of sites. The most common of these is a red, purple, and occasionally gray chert (#1042) that outcrops within the survey area in the same small hills as the burned red shale. The most prominent "clinker cone" is on the south side of the Escavada Wash, approximately 800 m west of the Chacoan structure. The popularity of this lithic type is best attributed to its accessibility and not to its flaking quality, which is generally poor. Only 10 flakes of this material were recovered from the Pueblo Alto excavations despite the rather short transport distance involved (15 km) (Cameron 1980:personal communication). This material was utilized as wall construction stone at one site, B-7.

Table 6 Lithic material frequency totals

Material Type	Totals for survey area No.	Totals for survey area %	Percent of class	No. of sites
Cherts:				
1011	15	3	16	7
1040	7	1	8	6
1042	24	5	26	8
1050	10	2	11	6
1051	2	-	2	2
1052	4	1	4	2
1053	2	-	2	2
1070	2	-	2	2
1072	7	1	8	5
1080	2	-	2	1
1090	10	2	11	5
1091	3	1	3	1
1231	1	-	1	1
1425	1	-	1	1
1649	1	-	1	1
(Class Subtotal)	(91)	(19)	(98)	
Silicified Woods:				
1112	73	15	22	16
1113	49	10	15	14
1120	7	1	2	4
1130	1	-	-	1
1140	142	30	43	17
1142	53	11	16	10
1151	3	1	1	2
(Class Subtotal)	(328)	(69)	(99)	
Obsidian:				
3520	14	3	100	6
Quartzite:				
Fine	3	1	7	3
Medium	16	3	36	6
Coarse	24	5	55	9
Brushy basin 2205	1	-	2	1
(Class Subtotal)	(44)	(9)	(100)	
Total	477	100		

Other cherts that are relatively common (present at five or more sites) include fossiliferous chert (#1011), Brushy Basin chert (#1040), Pedernal-like chert (#1090), yellow-brown chert with black inclusions (#1072), and miscellaneous white chert (#1050), some of which is probably local silicified wood. Except for the #1040, #1072, and possibly some of the #1090 chert, these are local materials. Because the fossiliferous chert (#1011) probably originated in the Ojo Alamo sandstone outcropping about 5 km upstream, it is possible that cobbles may be found as transported gravels even closer to the Bis sa'ani area.

The Brushy Basin (#1040) and yellow-brown chert (#1072) materials are definite imports. The former occurs in the Morrison Formation, Brushy Basin Member, sections of which are exposed to the north, west, south, and southeast around the edges of the San Juan Basin. Distances to the nearest of these sources range from 70 to 100 km. The yellow-brown jasper is currently known only from Oso Ridge in the eastern Zuni Mountains (Whitmore 1978), approximately 90 km from Bis sa'ani. Some of the #1090 chert may be from the Pedernal area, but it may also occur in lag gravels locally (Love 1980:personal communication).

At least nine other varieties of chert are present in low frequencies. With the exception of Washington Pass chert from the Chuska Mountains (90 km distant) all are local materials. The scarcity of Washington Pass chert (.4% of all lithics) is interesting in contrast to its frequency at Pueblo Alto, where it accounts for nearly 20% of all lithics.

Quartzite Cobbles

Quartzite cobbles in flake and whole cobble (hammerstone) form are quite abundant (9% of all lithics) (Table 6). This frequency is higher than noted at any other location visited in the San Juan Basin. It probably reflects the local proliferation of quartzite cobbles in the thin Ojo Alamo gravels on the nearby mesa tops.

Obsidian

Obsidian comprises 3% of all flakes examined on the Bis sa'ani sites, with 14 specimens noted on six sites (Table 6). In contrast to other lithic material types whose relative frequencies are fairly consistent throughout the Bis sa'ani sites, obsidian appears to be concentrated in the vicinity of the Chacoan structure, especially at sites B-1 and B-3, located immediately below it. Eleven of the 14 flakes were found here (See Appendix B, Table 7). One possibility is that the imported material was acquired by individuals at the Chacoan structure, rather than by the inhabitants of the more distant sites. It should be stressed, however, that the data are minimal and at best only suggestive.

All of the obsidian examined appears to be from the south Jemez sources (Valle Grande-Redondo Peak), some 100 km southeast of Bis sa'ani.

3

THE PEACH SPRINGS SURVEY

Introductory Comments

The Peach Springs survey area is at the north base of Lobo Mesa on the southwestern edge of the Chaco Basin (Figures 1 and 20). Navajo Highway 9 passes east-west through the southern portion of the survey area (Figure 21), approximately 400 m south of the Peach Springs Chacoan structure. The elevation is 1,865 m.

The 1.6 km diameter intensive survey area centers on the Chacoan structure, with selected transects extending outward .8 km further, for a total survey area of ca. 3.5 km^2 (Figure 21). This outer area was surveyed by means of a stratified sample designed to provide more intensive coverage of those areas of high topographic diversity that were presumed to contain the most sites. Of the two major topographic areas that lie within the outer .8 km, the area to the west and south of the core area is the most diverse. The elevation there gradually increases with distance from the core survey area as the topography changes from alluvial bottomland to mesa slope with scattered juniper. It is in this area that the most sites were expected. Outside of the core area to the north and east, the landscape is flat, alluvial bottomland. Few or no sites were expected in this low diversity area.

Five relatively evenly spaced transects were surveyed through the western and southwestern portions of the high topographic diversity area. The result was coverage of approximately 40% of the area and location of 14 Anasazi sites. Ideally, another two to three transects should have been placed further to the southeast, but the shortage of time did not permit this. The topographic similarity of the southeastern area to the remainder of the high diversity areas suggested that additional sites would have been discovered there, a point recently confirmed by Farwell's (1980) survey. Because of the lesser number of sites predicted for the low diversity alluvial bottomlands, only three transects were placed at varying, nonrandomly selected intervals, resulting in about 24% of the area being covered. No sites were found, and it is doubtful that 100% coverage of the area would have altered this negative result.

The major prehistoric road that passes through the Peach Springs community immediately adjacent to the Chacoan structure (Figure 21) is the south branch (Coyote Canyon Road) of the West Road (Figure 1) (Obenauf 1980). From Peach Springs, this feature continues westward at least another 11.5 km to the Grey Ridge community. East of Peach Springs, the road bears east-northeast, bypassing Toyee Spring, enroute to the Standing Rock community (12.5 km). From here the road extends northeast, as traced from many discontinuous segments, until the segments disappear approximately 6 km west of Kim-me-ni-oli Wash. No northeastbearing segments are identifiable by photointerpretive means for another 17 km, at which point several segments of a northeast-bearing road are identifiable before they merge with the north branch

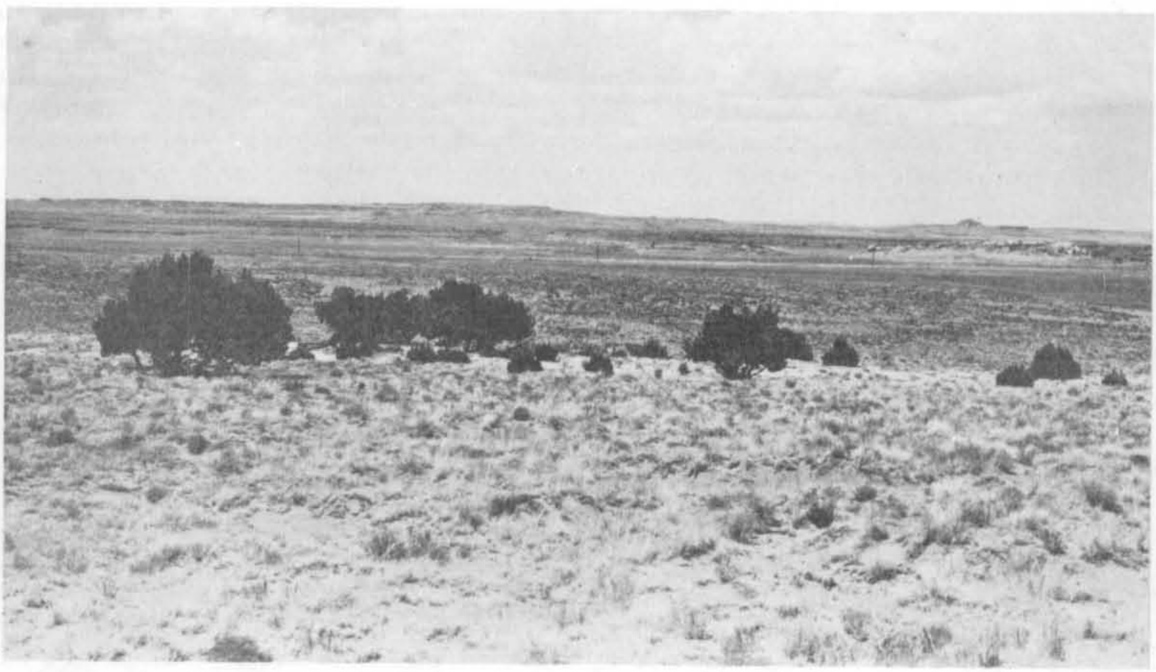
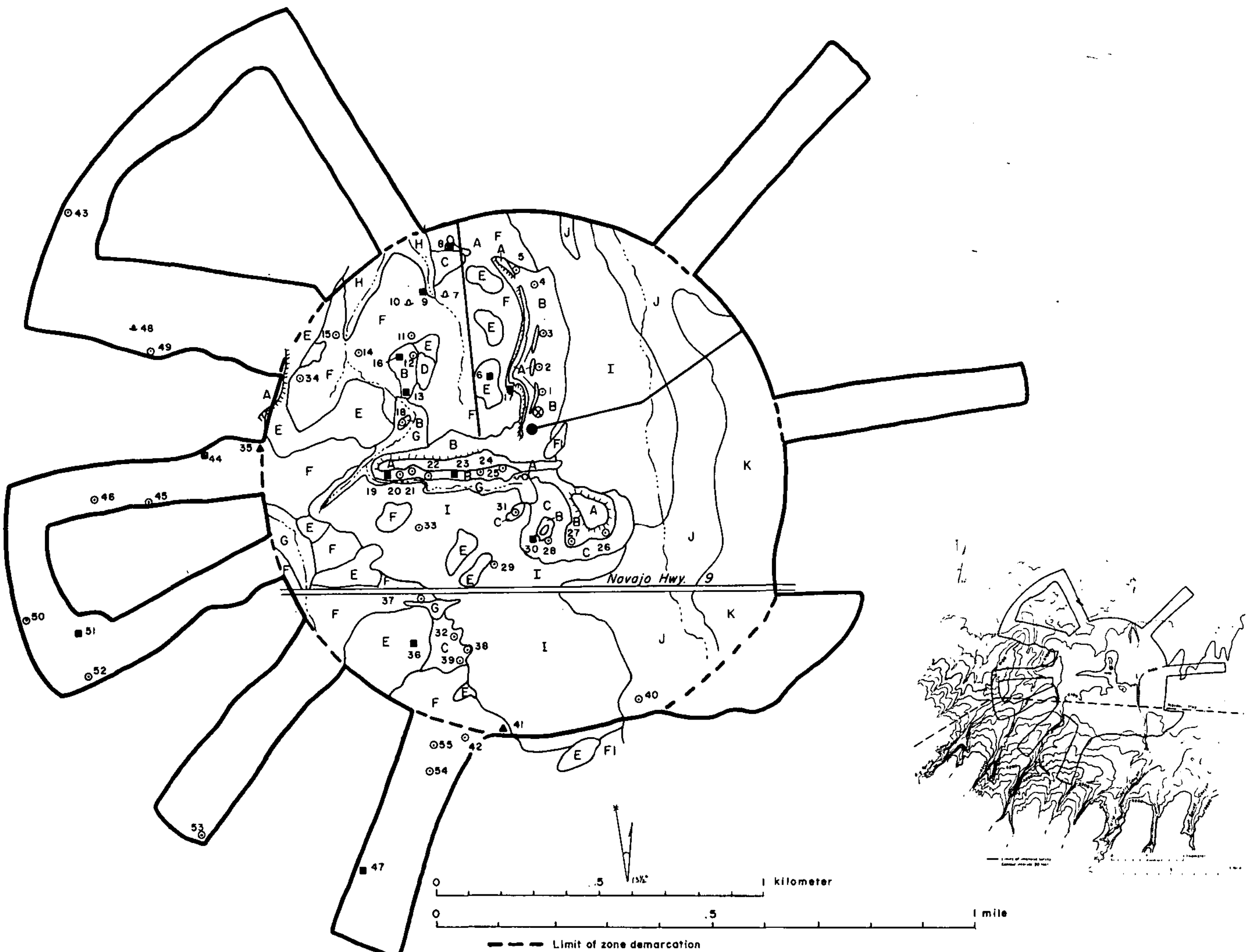


Figure 20. Overview of Peach Springs survey area. Looking north.


Navajo Hwy. 9
0 .5 1 kilometer
0 .5 1 mile
Limit of zone demarcation
Limit of intensive survey
929
82030

(Mexican Springs Road) of the West Road. The latter road is oriented east-west, and a few kilometers further east enters the South Gap of Chaco Canyon. Thus, Peach Springs is approximately 60 km by road from Pueblo Bonito. More direct connection of the Peach Springs community to the north branch of the West Road may be indicated by a 2-km road segment that bears directly north from Peach Springs toward the north branch that passes approximately 7 km to the north (Obenauf 1980).

Although portions of the south branch of the West Road, east of Standing Rock, have been ground-checked and confirmed as prehistoric roadway, little of the remaining West Road system has been examined (Obenauf 1980). Thus the identifications here must be considered tentative and subject to future confirmation.

Physical Environment

Bedrock Geology

The majority of the Peach Springs survey area rests on the lower stratigraphic layers of the Menefee Formation, just above contact with the prominent Point Lookout Sandstone. The Menefee is largely shale, with occasional sandstone members protruding to form low plateaus, buttes or ridges. It is most conspicuous within the survey area in the form of several low and broken outcrop ridges having a maximum relief of 12 m (Figure 21). All of the strata dip to the north-northeast at a slope of 3-4°. As a result, most of the outcrop ridges have their highest, and most prominent, exposures on their south sides and gradually taper to the north. Where exposed, the Menefee sandstones show a wide range of variability, with bed thickness ranging approximately 1-7 m, and colors varying from dark brown to light yellow. A wide range of variability in hardness is present.

Though exposed only in the southern portions of the survey area, the Point Lookout Sandstone is highly visible on Lobo Mesa and in the walls of its northward draining canyons immediately to the south. Within the survey area, it appears as a massive mesa-ridge that parallels the southern and western survey limits.

Topography

The survey area lies in a shallow and broad northward draining valley some 5 km wide (Figure 21). The Point Lookout Sandstone slopes of Lobo Mesa form the southern and southwestern limits, while the low and discontinuous Menefee ridges enclose the valley on the east and northwest.

The valley bottom is formed by the coalescing deposits of numerous drainages as they emerge from canyons entrenched in Lobo Mesa. The larger of these include Big Springs, Wild Berry, and Peach Spring Canyons. Though these drainages have created impressive, deeply incised canyons at the mesa edge, they become substantially less conspicuous upon flowing out onto the aeolian and alluvial flats.

Observation of a few of these drainages shows that they persist in small arroyos, approximately 4 m wide and 2 m deep for 1-3 km from the mesa edge before diffusing among the aggrading deposits.

Although the larger, sheer-walled canyons and the numerous smaller drainages have thoroughly cut and dissected the lower edge of the mesa along the entire south and west perimeter of the survey area, the gradual northward slope of the Point Lookout Sandstone allows the interdrainage slopes to retain a stable cover of aeolian and colluvial deposits and a marginal juniper (*Juniperus* sp.) woodland with associated big sagebrush (*Artemisia tridentata*) and scattered grasses.

Most of the ground surface in the survey area is covered by either aeolian or alluvial deposits, or a combination of the two. A much smaller but significant (in terms of site distribution) portion is the exposed Menefee bedrock and associated colluvium. The exposed bedrock, appearing as low, discontinuous outcrops, forms a number of southwest to northeast trending ridges that dominate the topography in the central and northwestern portions of the survey area. The slopes and edges, or "aprons," of these ridges are covered by colluvial and alluvial wash and slope as steep as 20°, tapering to nearly level plain as they merge with the bottomlands. Nowhere are the slopes sharp enough to form talus.

The bottomlands that dominate the terrain in the north, east, and southeast portions of the core survey area are basically flat with only slight relief. They are largely alluvial in origin, especially in the areas on either side of the individual drainages, such as Wild Berry Wash. However, the presence and form of low sand dunes on the flats, and partial entrenchment of Wild Berry Wash indicate that overbank flooding in areas north of the highway has not been frequent in recent years. There are, however, occasional gravel stringers all across the flats, suggesting aggradation and shifting channels in the not too distant past. These latter features are especially pronounced in the northeastern and northernmost portions of the survey area, where discrete drainage channels give way to gravel and debris flats, indicating frequent and recent flooding.

Aeolian deposits are abundant and surprisingly diverse with respect to color, stability, and vegetative cover. Dune deposits are most common and prominent in the low, broken terrain associated with the irregularly spaced ridges of Menefee sandstone in the northwestern quadrant of the survey area. Here they sporadically cover the colluvial slope deposits from ridge top to drainage bottom. Most of the dune deposits appear to be several meters thick, of yellow to light-brown hue, and usually support a moderately dense shrub cover of four-wing saltbush, big sage, and other plants. Some are more active than others, with steeper contours, poorly developed shrub cover, light color, and frequent ripple marks. In several cases, it appears that dunes have shifted to bury the prehistoric ground surface. This is especially the case in the west-central portion of the survey area where sherds are surprisingly frequent in many small blowout or washout areas. It seems likely that several sites may have been buried and remain unrecorded.

Aeolian deposits are less common on the bottomlands, but there are some rather prominent dunes in the southeastern portion of the survey area. These appear to be semiactive, and the vegetation is dominated by large greasewoods. The greasewoods are often partially pedestaled but have added some stability to the dunes.

The aeolian deposits on the Point Lookout mesa ridges to the south and west are quite different in appearance. Here, fine aeolian sand is relatively stable, with few signs of recent movement. Vegetation is dense (mostly big sage), and soil color is characteristically reddish. The reddish color is probably the result of more extensive oxidation, and, therefore, a probable indication of greater age. The discovery of Basketmaker III remains on these aeolian deposits supports a pre-Pueblo formation date.

Soil Associations, Agricultural Potential and Water

In general, the entire survey area falls within the Hagerman-Travesilla soil association, a unit of minimal potential for modern irrigation agriculture because of its large tracts of poor Class 4 (43%) and Class 6 (48%) soils (see chapter 1). This is a relatively apt characterization of the Peach Springs locality because large portions of it are unfit for any type of agriculture. However, there are portions of the survey area and locations immediately south of the survey that appear to be well suited to primitive agriculture.

In particular, the interface area between the edge of Lobo Mesa and the alluvial bottomlands to the north seems to be a prime agricultural zone. Here, the many ephemeral washes draining the higher, slightly wetter elevations of Lobo Mesa emerge from canyons in the Point Lookout Sandstone. With a maximum elevation of 2,195 m (7,200 feet) at their headwaters, the drainages contribute moisture from areas with a maximum estimated annual rainfall of 277 mm (10.9 in), 66 mm (2.6 in) more than the 211 mm (8.3 in) annual mean estimated for the Peach Springs survey area. Given the low annual rainfall in the field areas, this additional moisture appears critical. Some of the larger canyons, such as Wild Berry, may retain a small permanent flow during wet years.

As the canyon washes emerge from the mesa, the stream gradient lessens, resulting in the deposition of fine sandy alluvium and a high soil moisture level, which is indicated by the large size of individual plants (particularly greasewood) now growing here. With some manipulation of the natural channels, substantial areas around the canyon mouths could be irrigated.

Although the acreage around each canyon mouth is limited, the dozen or more canyons emerging in the vicinity of Peach Springs cumulatively provide substantial field areas. Given the local, spatially limited nature of summer thundershower activity, the canyon drainages also provide an efficient means of concentrating and exploiting precipitation from a substantial surrounding area. The canyon mouth areas thus appear to be relatively ideal locations for agriculture, depending upon the degree of soil moisture delivered by the mesa-canyon drainage systems. As is the case throughout the arid Chaco Basin, a lack of precipitation in the field area or drainage basin would result in crop failure -- a situation expected to occur with some frequency and unpredictability.

In addition to the Lobo Mesa drainages, Peach Springs currently supplies a continuous source of water. It is a capped, artesian spring, located ca. 100 m south of the Chacoan structure. Although the current springs have probably been improved by drilling and capping, they may be the same springs as those identified by Gregory (1916:149) as Manuelito Springs. At the time of Gregory's reconnaissance, several free-flowing springs produced .01-1.0 gallon per minute. If a similar flow bubbled out prehistorically, it undoubtedly supplied the domestic water needs of the nearby population concentration and, indeed, may have been a crucial variable in the development of the Peach Springs community. The springs may also have provided some irrigation water for gardens in the Menefee ridge area.

Micro-environmental Zones and Vegetative Associations

In order to examine the relationship of site distribution to environment and vegetation within the Peach Springs survey area, micro-environmental zones and vegetative associations have been delineated.

The entire core survey area (1.6-km) is subdivided into microenvironmental zones, based on differences in geology, landform, soils and vegetation. The zone within which each site occurs is shown in Table 7 and Appendix B, Table 2, and the spatial distribution of the zones is illustrated in Figure 21. The microenvironmental zones are as follows:

Zone A (Menefee ridges): Exposed bedrock of various sandstone members of the Menefee Formation. Generally devoid of vegetation. Approximately 2% of the total area.

Zone B (Colluvial Slopes): Derived from bedrock outcrops. Vegetation absent to sparse: sand dropseed (*Sporobolus*) and shadscale (*Atriplex confertifolia*). Approximately 7% of the total area.

Zone C (Mixed colluvium): Mostly silty outwash below outcrops. Vegetation is variable with sparse to moderate shrub cover -- sand dropseed and shadscale are dominant. Approximately 2% of total area.

Zone D (Small dunes): Actively transgressing earlier surfaces, but with incomplete coverage. Mostly sand dropseed associations, some shrubs. Dunes are up to .5 m in depth. Less than 1% of total area.

Zone E (Active aeolian deposits): Nearly complete coverage of earlier ground surface, up to 2 m in depth. Vegetation mostly fourwing saltbush association or absent in the most active areas. Approximately 8% of total area.

Table 7 Microenvironmental zones and vegetative associations of the Peach Springs survey area and percentage relationship of microenvironmental zones to Anasazi site distributions

Microenvironmental zone groups		Sites in zone #	Sites in zone %	Zone percentage of survey area	Percent of Anasazi sites in zone	Percent difference[a]	Vegetative Associations	1	2	3	4	5	6	7	8
Menefree Ridges and Colluvian slopes															
	A(A-B)	3	5	2	6	+4	A[b]	2	1	–	–	–	–	–	–
	B(B-D)	20	36	7	38	+31	A	13	5	1	–	1	–	–	–
	C	6	11	2	11	+9	A	3	3	–	–	–	–	–	–
Dune Deposits															
	E	2	4	8	4	–4	A	–	–	2	–	–	–	–	–
	F	15	27	21	23	+2	A	–	5	5	2	–	–	–	–
		–	–	–	–	–	N	–	2	–	1	–	–	–	–
	K	–	–	9	–	–9	–	–	–	–	–	–	–	–	–
Bottomlands															
	G	–	–	3	–	–3	–	–	–	–	–	–	–	–	–
	H	–	–	1	–	–1	–	–	–	–	–	–	–	–	–
	I	2	4	29	4	–25	A	2	–	–	–	–	–	–	–
	J	1	2	18	2	–16	A	–	–	1	–	–	–	–	–
Mesa Ridge															
	L	3	5	–	6	–	A	–	1	–	–	1	2	–	–
	M	4	7	–	8	–	A	–	1	–	3	–	–	–	–
Totals		56	101	100	102	–		20	18	9	6	1	2	–	–

a – Difference between percent of survey area and percent of Anasazi sites
b – A = Anasazi, N = Navajo

Zone F (Stable aeolian deposits): Deposits up to 2 m in depth. Colluvium or residual soil occasionally exposed. Moderate cover of small shrubs, mostly saltbush. Approximately 21% of total area.

Zone G (Wet bottomlands): Lands with abundant moisture receiving runoff from Peach Springs. "Lush" forb vegetation abounds but probably would not survive without water loss from stockponds. Approximately 3% of total acreage.

Zone H (Drainage bottoms): Drainage bottoms with dense forb cover suggesting periodic high moisture content. Russian thistle (*Salsola kali*) dominant. Approximately 1% of total area.

Zone I (Open bottomlands): Bottomlands with silty or occasionally fine sand alluvium. Vegetation very sparse or absent. Short-lived forbs in small, low-lying ponding areas are dominant along with sparsely scattered shadscale and grasses. Approximately 29% of total area.

Zone J (Bottomlands with slight relief): Occasional gravel stringers and small dune deposits. Vegetation is dominated by scattered greasewoods and abundant fourwing saltbush. Forbs dominant in low-lying areas. Approximately 18% of total area.

Zone K (Bottomlands with moderate relief): Mixed alluvial and stable aeolian deposits. Dune relief up to 2 m. Vegetation is dominated by large greasewoods, occasionally pedestaled. Forbs (especially Russian thistle) also common. Approximately 9% of total area.

A number of other microenvironmental zones are present in the outer .8-1.6 km transects. Only those areas where sites are located have been assigned a microenvironmental zone. These are on mesa land to the southwest of Peach Springs.

Zone L (Mesa ridges): Exposed Point Lookout Sandstone, colluvium and minimal aeolian cover. Vegetation is sparse with grasses, sagebrush and scattered junipers.

Zone M (Mesa ridges): Covered by stable or semistable dune deposits. Vegetation predominantly big sagebrush with scattered juniper.

Vegetation within the survey area is dominated by scattered greasewood and saltbush although large open areas support virtually no vegetation at all. In areas where moisture content is high, at, or just below the surface, forb cover is abundant. The vegetation changes drastically on the mesa ridges south and west of the core area; here a sparse juniper woodland occurs with grasses and sagebrush abundant.

Vegetation associations within the survey area generally correlate closely with microenvironmental zone variability, although some of the vegetative associations crosscut the zones. Vegetation associations have been defined only in on-site localities, as shown in Table 7. The vegetative associations are as follows:

Vegetation Association #1 (Vegetation absent or sparse): Sand dropseed and shadscale are dominant.

Vegetation Association #2 (Moderate brush cover): Saltbush usually dominant, but with locally abundant greasewood and sagebrush.

Vegetation Association #3 (Relatively dense shrub cover): greasewood and saltbush are most common, but sage and wolfberry are also moderately abundant at some locations.

Vegetation Association #4 (Dense shrub cover): Sagebrush dominant.

Vegetation Association #5 (Forb cover): In addition to other forbs, Russian thistle is usually abundant.

Vegetation Association #6 (Scattered juniper woodland): Abundant grasses and sagebrush.

Site Distributions

Table 7 reveals a non-random distribution of survey sites with respect to microenvironmental zones and vegetation. The open bottomlands or flats (Zones G, H, I, and J) comprise a large portion of the survey area (51%) but are nearly devoid of Anasazi sites (n = 3, 6%)(Figure 21). Two of the sites in these zones are adjacent to Menefee ridges and outcrops and may have been built upon minor outcrops no longer visible. The third site is on the bottomlands in the southeastern portion of the survey area at the north edge of the mesa-ridge zone. The flats are more extensive in the northern and eastern part of the survey area where they extend well beyond the 1.6-km (0.5-mile) radius of intensively surveyed land. As already noted, transect survey in this area did not reveal any further sites, and it is probable that had our sample included a larger open bottomland area, an even greater discrepancy between percentage of land area and number of sites would have resulted. While a small number of fieldhouse sites might be buried in this area by postoccupational alluviation, it seems unlikely that habitation sites were ever common in the bottomland microenvironmental zones. Occasional sherds are present here, but all are scattered and badly water-worn.

Microenvironmental zones where sites are numerous fall into three major groups: Menefee outcrops and colluvial slopes (Zones A, B, and C), dune deposits (Zones D, E, F, and K), and mesa ridges (Zones L and M)(Table 7). The two former zone groups contain the greater proportion of the Peach Springs Anasazi sites (n = 43, 81%) including Basketmaker III to Pueblo I (Basketmaker III and Pueblo I ceramics were not differentiated in these zones), and Pueblo II and Pueblo III habitation and limited use sites. The mesa-ridge zone sites (n = 7, 13%), on the other hand, are limited almost entirely to Basketmaker III sites. (Mesa-ridge and dune zone boundaries and area percentages in the transect areas were not defined or calculated, and as such are not shown in Figure 21 or Table 7).

Over half of the Anasazi sites (n = 29, 55%), primarily of Pueblo II and III date, occur along the edges of the low Menefee ridges (Table 7). Evidence of Basketmaker III to Pueblo I remains here are relatively scant (only five sites produced such ceramics, and only two had enough sherds to indicate occupation). Considering the tremendous volume of overlying cultural material from succeeding Pueblo II-III components, however, in addition to aeolian and alluvial postoccupational deposition, it is possible that more sites are present but totally obscured. Regardless of period most sites are situated on the colluvial/alluvial slopes around the bases rather than on top of the sandstone outcrops. The Peach Springs Chacoan structure, partially situated on a ridge top is the only obvious exception. Vegetation associated with Menefee ridge sites is most frequently sparse (n = 18, 62%), although a substantial number of site areas have a more moderate shrub cover (n = 9, 31%) (Table 7).

The majority of a smaller number of dune deposit sites (n = 14, 26%) are probably also on Menefee ridges and outcrop slopes, since these dune deposits cover the Menefee bedrock in many instances. Vegetation here is moderate to dense shrub cover (Table 7) -- the most positive vegetative association of Basketmaker III to Pueblo III.

The final area represented by a substantial number of sites is the mesa-ridge zone group, where five (71%) of the seven sites are single-component Basketmaker III habitation sites. These sites are located on the mesa ridges that separate the incised canyons to the southwest of the core survey area. Most of the sites are on gently sloping, stable or semistable dune deposits that cover the ridges to depths of 1 m or more. Only two Pueblo II-III sites (PS-42 and 47) were found in this zone, and of these only PS-42 has permanent habitation features. Characterized by moderate to dense shrub cover and a marginal juniper woodland, a positive plant-site association is present here.

Although no transects were surveyed in the environmentally similar mesa-ridge area to the southeast of the core survey area, subsequent highway right-of-way survey by Robin Farwell (1980) has revealed the presence of one Basketmaker III site and nine Pueblo II-III small houses and limited use sites, approximately 2 km from the Peach Springs Chacoan structure, on the mesa-ridge east of Peach Springs Canyon. On the alluvial bottomlands immediately to the north of these sites are another five Pueblo I-III small house and limited use sites. Notably, this latter area is most similar to Zones J and K. Higher on this same ridge (ca. 1,980-1,995 m) and about 4 km from the center of the survey area are several small sites (some with Pueblo II-III ceramics) with little evident architecture and a few scattered sherds and lithics. Their appearance suggests some type of limited use (Farwell 1980). The inaccessibility of the adjacent canyon floors (60 m below) appears to eliminate use of these sites as agricultural fieldhouses; rather, their location in the pinyon-juniper woodland suggests use as camps for hunting or gathering.

In view of the evidence from both Farwell's and our survey, it is apparent that the occupation of mesa-ridge areas occurred during Basketmaker III as well as the Pueblo II-III intervals. To date, Pueblo I occupational remains have not been found, although they may well be present considering the relatively limited area of mesa-ridge zone localities surveyed so far.

A full range of Basketmaker III to Pueblo III remains are indicated for both Menefee ridge and dune zone group areas surveyed, although evidence of Basketmaker III to Pueblo I material in the Menefee ridge zones is minor. Few sites are documented for the bottomland areas, but including those in Farwell's transect area, Pueblo I-III occupation is indicated.

The occurrence of Basketmaker III remains in both upland (mesa-ridge) and Menefee ridge and dune zones, in contrast to the Menefee ridge, dunes, and alluvial bottomlands distribution of Pueblo I sites, may be a product of sampling error, may indicate abandonment of the mesa-ridge zone, or may even mean partial resettlement outside the survey area. Further survey of both zones is required to resolve this problem.

Even if the mesa ridge zone were completely abandoned during Pueblo I, those portions of the zone in Farwell's transect area were reoccupied during Pueblo II-III. During this time very limited occupation of the southwestern transect area is also indicated, but it does not appear to be as substantial as the occupation documented further to the east. Why one portion of the mesa-ridge zone should be abandoned with little apparent subsequent occupation while another portion of it was resettled merits explanation.

In general, a strong argument for settlement in all of the surveyed portions of the mesa-ridge zones is provided by the proximity of this zone to canyon-mouth field areas and water sources, as well as to higher mesa, pinyon-juniper woodland floral and faunal resources. Since only a portion of the mesa ridge zone appears to have remained relatively unoccupied during Pueblo II-III, the assumption is that it reflects some environmental condition specific to that unoccupied portion of the zone.

From this perspective, the most apparent environmental difference between portions of the mesa ridge zone is that most of the canyons adjacent to the southwestern transect areas are of small size and hence, theoretically provide small field areas and small, unreliable amounts of water (this correlation is assumed since neither potential field areas nor runoff regularity nor quantities have been calculated). During the Basketmaker III occupation, population growth and increased reliance on agriculture may have caused abandonment by at least part of the population, although it remains uncertain why the area was virtually abandoned, with little subsequent reoccupation. Possibly, the discovery that other zone areas and other portions of the mesa-ridge zone were much better suited to a primarily agricultural subsistence base may account for this.

In contrast to the small canyons in the southwestern mesa-ridge transect area, the mesa-ridge zone area in Farwell's survey area is adjacent to a number of substantially larger canyons, including Wild

Berry, and Peach Spring Canyons. Presumably, these canyons would have provided relatively larger field areas, as well as larger and more reliable flows of water (again, the correlate between canyon size, field areas, and water supply is assumed but not documented). The presence of both small house sites and limited use sites (probable fieldhouses) in the alluvial bottomlands to the north of these mesa ridges and large canyon mouth areas seems to similarly attest to the favorability of this area.

Whether or not the Menefee ridge or dune zone group areas were preferred settlement areas over large canyon mesa-ridge locations during Pueblo II-III is not known. A majority of documented settlement did occur in these two former areas -- both of which appear to have a number of locational advantages and disadvantages with respect to the mesa-ridge zone areas. One of the most favorable aspects of the Menefee ridge and dune areas surveyed is their relative proximity to Peach Springs. If the springs did flow prehistorically, they would have provided a perennial source of water, and additionally may also have supported some small agricultural areas in their immediate vicinity (benefiting Menefee ridge zone sites only).

A second advantage to location within both areas is the relative proximity of the easily quarried tabular fracturing Menefee sandstone. Although small potential field areas are present in the dune and Menefee ridge zones (particularly in select dune areas), one apparent disadvantage of settlement in these areas is the relatively longer distance to potential field areas at canyon mouths -- which almost certainly would have been required to supplement the few nearer field areas. Another disadvantage is the relatively longer distance to pinyon-juniper woodland resource areas. From an overall view, however, the most distant Menefee ridge and dune site locations are only 1-2 km from canyon-mouth and mesa-ridge resource areas.

Site Remains

Chacoan Structure

The Chacoan structure of the Peach Springs survey area is situated at the south end of the most densely occupied Menefee ridge in the survey area. Also, it is only a short distance north of the springs. From its situation atop the ridge, the structure commands a view to most of the surrounding sites and immediate terrain in all directions.

Layout

At this site, as well as most others in the survey area, the large amounts of fallen masonry, cultural refuse and aeolian sand make it difficult to accurately determine the configuration and relationship of the architectural features composing the sites. At best, our data and descriptions approximate what may be hidden under these protective mantles.

The Peach Springs structure appears to be a two-story, rectangular house block (Figure 22), fronted by a small, partially offset plaza which is enclosed and tied to the house by an arced masonry wall (Figure 23). The overall configuration of both house and plaza appear to be D-shaped. Rising to 4 m, the majority of the house mound appears to have comprised two stories, with the exception of a single row of one- story chambers along the eastern edge of the house and plaza. An estimate of 30 rooms may be slightly conservative since it assumes most rooms are substantial in size. A low area in the front center of the house may be a second-story kiva or possibly a tower kiva. No other kiva depressions are visible in the house or plaza surface, but ceremonial rooms may be concealed by the debris, especially in the latter area. Including the enclosed plaza and postulated second-story room areas, a total floor area of 1,880 m^2 is indicated for the structure.

To the south of the house are two substantial trash mounds (Figure 23), the larger, southeastern mound (Mound B) possibly concealing a small number of abandoned rooms (Figure 24). Abundant quantities of Early Pueblo II pottery, a lesser amount of Late Pueblo II, and a sprinkling of Early Pueblo III ceramics indicate the time span (Appendix B, Table 5). The smaller, south trash midden (Mound A) which appears to be entirely refuse, has some Early Pueblo II to Late Pueblo II pottery littering its surface, but the greatest part of its ceramics are of Early Pueblo III date (Appendix B, Table 5).

North and east of the house are extensive trash areas (Mounds C and D), whose depth and nature are difficult to estimate. The refuse area to the north may be just a heavy scatter, or it may be a deep mound with some buried rooms. This deposit continues around the north-east corner of the house, surrounding a large shallow depression -- almost certainly a buried great kiva. Rubble debris along the north and east perimeter of the depression may indicate some peripheral great kiva rooms, but again aeolian fill and cultural debris obscure the situation considerably. Similarly unclear is whether or not the great kiva connects with the Chacoan structure across an intervening distance of less than 10 m. South of the great kiva, extensive, and probably deep, trash spills down the length of the ridge slope (Figure 23). The refuse on the entire east side of the Chacoan house block and great kiva areas is so substantial that we were able to distinguish it from the next ridge slope site only by drawing a somewhat arbitrary boundary down the center of a small drainage channel that cuts the refuse. Similar means had to be employed to differentiate the other house blocks and refuse areas that cover the ridge expanse to the north.

Architecture

Though the Chacoan structure mound is a massive heap of masonry, exposed wall sections are few and appear to result from recent, futile, attempts by pothunters to plumb the depths of this structure. Where open to view, wall segments are 45-55 cm thick, and of core and veneer or compound masonry. A treasure hunter's burrow in the west end of the

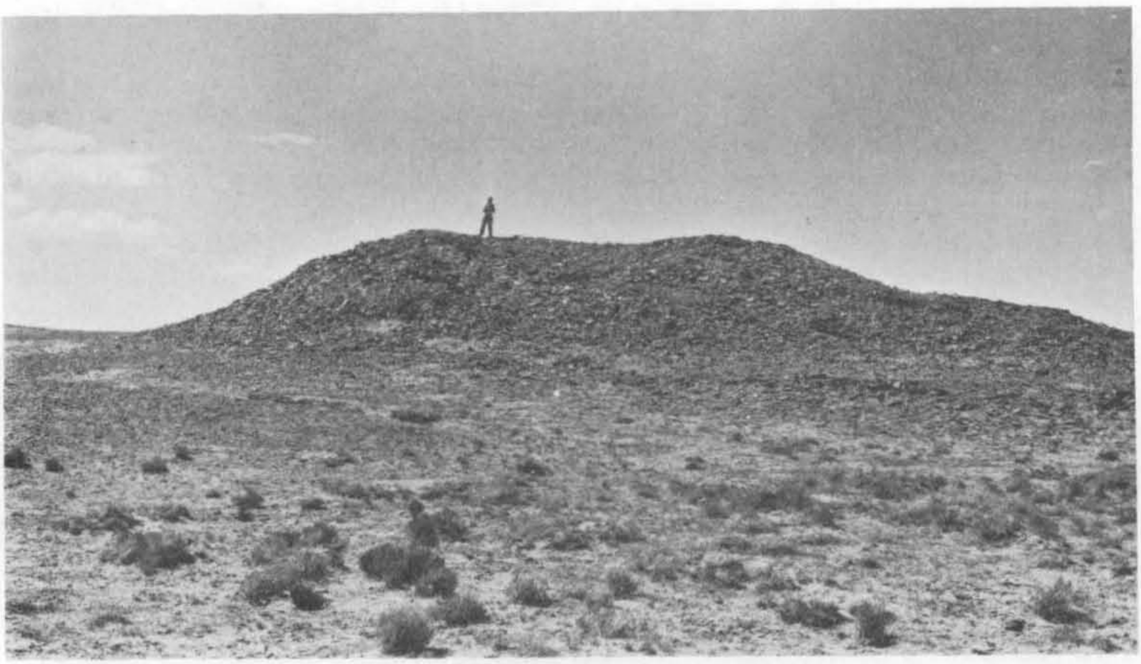


Figure 22. Peach Springs Chacoan structure. Note kiva depression roomblock center and plaza wall in foreground. Looking north.

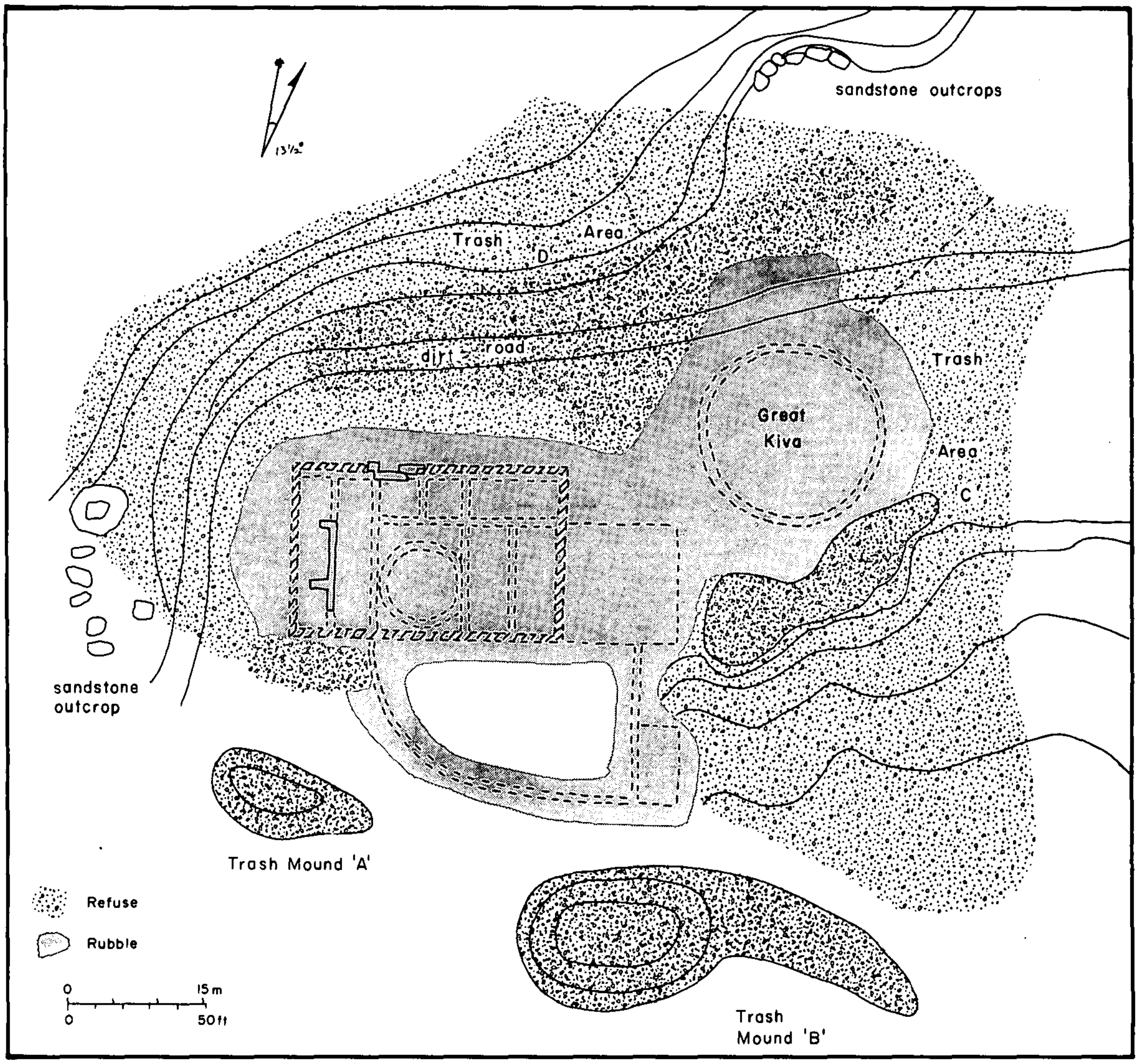


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Figure 23. Peach Springs Chacoan structure.

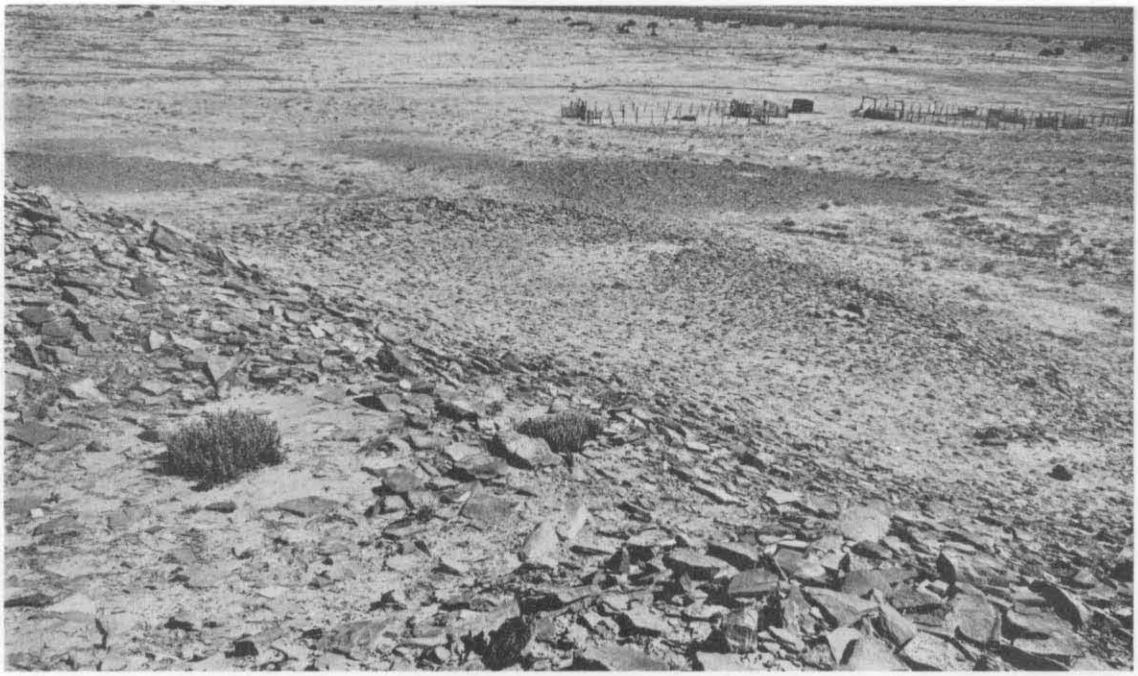

Figure 24. Peach Springs Chacoan structure. Looking southeast from house mound to walled plaza and Trash Mound B.

Figure 25. Peach Springs Chacoan structure. Early, affinis Type I masonry in pothole on north wall of structure. Late, outside wall visible at left of 30 cm scale.

north house wall provides the best architectural vantage point, and fortuitously gives limited architectural confirmation of the long occupational sequence indicated by the range of ceramics visible in the associated middens. This pit exposes two walls, one of which is stylistically late and has been cut through to reveal an earlier wall directly behind it (Figure 25). The early wall is especially interesting as it appears to duplicate the thin slab, compound construction seen in the early wall sections at Una Vida, Pueblo Bonito, and Kin Bineola (Bannister 1965). First documented as "Type I" masonry by Hawley (1934) and later called "unfaced slab," this style of construction is thought to date between 900-950 (Bannister 1965; Lekson et al. 1982). While not identical to the Type I masonry exposed at early Chaco Canyon structures, the small, thin slabs, occasional long slabs, and copious mortar that compose this wall section are quite similar to other early Chacoan structure masonry. Given differences in available construction material, they seem to duplicate it.

The later core and veneer masonry exposed in this cut, and at few other spots over the extent of the mound, utilizes large-to-medium shaped slabs with some small chinking spalls. Although this stonework resembles more closely the late, post-1050 Chacoan masonry styles, it is impossible to suggest any definite style affinities because what little masonry is exposed is also badly weathered.

The enormous quantity of collapsed masonry covering the mound makes it practically impossible to comment on the other architectural features of this house. Only one room is sufficiently exposed to estimate its size (3 x 6 m). Floor-to-ceiling heights cannot be determined, although the height of the mound suggests the possibility of high Chacoan ceilings for both stories. Although an elderly Navajo woman who has resided near the survey area for most of the last 50 years informed us that one ceiling stood intact until the 1920s, no wood or other ceiling elements are now visible, nor to our knowledge, have any wood samples been submitted for dating. No features of the single-room block kiva are exposed, nor are the architectural attributes of the great kiva any more self-evident.

Small Houses

The small house remains of the Peach Springs survey area reveal a long continuum of Anasazi occupation, with sites representing all archaeological time periods from Basketmaker III through Late Pueblo III (Appendix B, Table 5). A limited number of single-component Basketmaker III sites, at least some of which are habitation sites, were briefly noted and are located on the mesa ridges in the transect area southwest of the central .8 km-radius survey area. A few sherds of Basketmaker III to Pueblo I pottery were also found at seven sites in the Menefee ridge slope and dune zone groups. Occupational debris resulting from the extensive occupation of six of these sites during later Pueblo II and Pueblo III intervals completely covers any Basketmaker III or Pueblo I architecture that may be present.

Early Pueblo II architecture is similarly obscured by Late Pueblo II and Early Pueblo III debris, although there is no question that Early Pueblo II architectural remains would be revealed by excavation. At some Late Pueblo II sites, and of course at Early Pueblo III and Late Pueblo III sites, the architectural remains are visible to a limited extent. In the discussion below, layout and architecture of these latter periods are treated together, and minor differences are noted.

Basketmaker III Layout and Architecture

The assumption that the seven Basketmaker III sites found in the Southwest transect area are habitation sites as shown in Table 8 is little more than an educated guess based on the supposition that pithouses may be buried in the aeolian sand. Two extensive scatters of burned slabs, Lino gray sherds, and occasional upright slabs at PS-46 and 52 appear to make these sites the best candidates for Basketmaker III house clusters. The remaining five sites (PS-49, 50, 53, 54, and 55) consist of smaller scatters of occasional burned slabs and the diagnostic Basketmaker III pottery, perhaps indicating the locations of isolated houses or small house clusters.

Pueblo II and III Layout

The site layout of the 31 Pueblo II-III small houses in the survey area is often obscured by fallen rubble, cultural refuse (at 30 sites), and aeolian fill. As a result, many distinctive features are not visible. The configuration that does remain intelligible is so uniform that the following general description and representative site plans (Figures 26 through 30) provide a more than adequate summary of the range of morphological variation encountered.

The small house mounds are small to moderate-size rubble mounds ($n = 31$, $\bar{x} = 255$ m^2, sd = 148), usually less than 1.5 m high (estimated mound heights range from .25 - 2.5 m). They vary from simple rectangular blocks to more elaborate and usually temporally later, E, C, and D-shaped units (Table 8). Most are one to three room tiers wide, having 5-30 rooms per house, with a mean of 14.5 rooms per site. Small outlying clusters of three to four rooms, or isolated storage features, are often situated a short distance from the roomblock. Twenty-five kiva depressions are visible at 19 sites, usually immediately south of the house block, in an open or partially enclosed plaza. A small number of possible, enclosed block kivas may be present; but the actual frequency of these is uncertain, again due to the nature of the deposits. A mean of one kiva per 18 above-ground rooms is indicated by a straight tabulation of the visible depressions, although a lower ratio in the neighborhood of one kiva per 10 to 12 rooms is probably nearer the actual mean -- since many more kivas than are visible are assumed to be present. One or more trash mounds or an associated scatter are typically south or east of the house plaza area.

Table 8 Site layout and architectural data

Site Type/ Number	Structure Configuration	No. of Rooms	No. of Kivas	Masonry Type [a]	Trash [b]	Site Size (m)	Estimated Structure Size (m^2)	Comments
Chacoan Structure:								
Peach Springs	D-shaped	30	1?	cv	m,s	105 x 100	1880	Great kiva connected to main house?
Small Houses:								
PS-1	C-shaped	15?	1	-	m,s	100 x 50	425	Earlier rooms under trash?
PS-2	Rectangular	15?	?	-	m,s	55 x 40	580	Earlier rooms under trash?
PS-3	Rectangular	15?	?	cv	m,s	60 x 55	275	Earlier rooms under trash?
PS-4	C-shaped	15	1+	-	m,s	85 x 50	405	-
PS-5	Rectangular	05	?	-	s	25 x 20	90	-
PS-11	E-shaped	20	2	-	m	65 x 50	450	Probably some second story rooms. Large 1 m^2 firepit on ridge top with possible jacal structure.
PS-12	Rectangular	15	?	-	s	120 x 100	495	Two room blocks.
	L-shaped	20	?	-	s			
PS-14	Rectangular	10?	?	-	s	50 x 10	75	Room estimate may be high.
PS-15	E-shaped	20	2	-	s	40 x 20	265	Associated trash may be buried.
PS-18	E-shaped	15?	2?	-	s	50 x 30	450	Associated trash may be buried.
PS-20	C-shaped	15	1?	-	m,s	50 x 30	145	-
PS-21	2 rectangular room blocks	15 03	1?	-	m,s s	50 x 25	135	Reduced by livestock. Slab cists front large roomblock.
PS-22	Rectangular	15	?	-	m,s	40 x 35	340	Reduced by livestock.
PS-24	L-shaped	15	1	-	m,s	55 x 25	255	Reduced by livestock.
PS-25	L-shaped	15	1?	-	m,s	30 x 25	180	Reduced by livestock.
Small Houses:								
PS-26	L-shaped	20	2?	-	m,s	60 x 30	440	Roomblock partially bulldozed.
PS-27	2 rectangular blocks [c]	10	?	-	s	40 x 30	110	One roomblock and refuse partially bulldozed.
PS-28	L-shaped	20	2?	-	m,s	50 x 30	110	Two roomblocks.
	Rect. block [d]	07	1?	-	s		170	Some bulldozer disturbance.
PS-29	L-shaped	30	1?	-	m,s	50 x 70	255	"L" block overlies earlier houseblock of undetermined configuration.
PS-31	L-shaped	15	1	-	s	45 x 40	340	House partially bulldozed.
PS-32	C-shaped	25	1?	-	m,s	60 x 40	190	-
PS-33	Rectangular	25	?	-	m,s	60 x 50	510	Cists front houseblock.
PS-34	C-shaped	10	1?	-	m	40 x 35	120	-
PS-37	(?) block	10	?	-	s	35 x 15	125	South half of mound bulldozed.
PS-38	C-shaped	15	1?	-	m,s	45 x 35	220	Room estimate very tenuous.
PS-39	Rectangular	05	?	-	m,s	40 x 40	55	-
PS-40	Arced block	08	?	-	m	30 x 20	110	Numerous sandstone abraders on site surface.
PS-42	C-shaped	15	1	-	m	40 x 30	220	-
PS-43	L-shaped	08	1	-	m	25 x 15	155	-
PS-45	D-shaped	15	1	-	m,s	80 x 45	220	Two concentrations of burned rock to E. of house may be roasting pits.

Table 8 (continued)

Site Type/ Number	Structure Configuration	No. of Rooms	No. of Kivas	Masonry Type[a]	Trash[b]	Site Size (m)	Estimated Structure Size (m^2)	Comments
Small Houses:								
PS-46		pithouses?	-	-	s	75 x 45		Extensive scatter with Basketmaker ceramics and sandstone slabs. Cists visible, pithouses conjectured.
PS-49		pithouses?		-	s	-	-	Basketmaker ceramics. Pithouses conjectured.
PS-50		pithouses?	-	-	s	-	-	Basketmaker ceramics. Pithouses conjectured.
PS-52		pithouses?	-	-	s	-	-	Extensive scatter of Basketmaker ceramics. Pithouses conjectured.
PS-53		pithouses?	-	-	s	-	-	Basketmaker ceramics. Pithouses conjectured.
PS-54		pithouses?	-	-	s	-	-	Basketmaker ceramics. Pithouses conjectured.
PS-55		pithouses?	-	-	s	-	-	Basketmaker ceramics. Pithouses conjectured.
Limited Use Sites:								
Ancillary Units:								
PS-13	1 rectangular 1 squarish	7	-	-	s	40 x 20	-	Two possible units of 3-4 rooms each.
PS-17	Squarish	2	-	-	s	40 x 20	-	Concentration of rubble; one room probable. Similar concentration of rubble 25 m to east may also contain one room.
PS-19	Rectangular	2	-	-	s	20 x 10	-	-
PS-23	Cist	1	-	Upright slabs	-	1.5 x 01	-	No associated cultural material, but is in vicinity of PS-22 and PS-24.
PS-30	Rectangular	2	-	-	s	-	-	One probable unit of 1-2 rooms. Two additional rubble concentrations, may include another 1-2 rooms, but could be cultural talus accumulations.
PS-44	2 cists	2?	-	Upright slabs	s	40 x 10	-	May be buried rooms adjacent to cists. Two surface rooms at site are Navajo.
PS-51	1 cist	1	-	Upright slabs	-	-	-	No associated cultural material. Affiliation unknown.
Fieldhouses:								
PS-35	Rectangular	2	-	-	s	20 x 20	-	-
PS-41	Rectangular	2	-	-	s	30 x 15	-	-
Non-habitation:								
PS-47	Rectangular	3	-	-	s	15 x 05	-	-
Scatters:								
PS-6	-	-	-	-	s	50 x 20	-	May be buried architecture
PS-8	-	-	-	-	s	150 x 150	-	Extensive scatter probably result of float from nearby habitation sites.
PS-36	-	-	-	-	s	15 x 15	-	May be buried.
Miscellaneous:								
PS-9	-	-	-	-	s	10 x 09	-	Concentration of Anasazi lithic material in Navajo trash dump.
PS-16	-	-	-	Slab alignment	s	45 x 15	-	Alignment initially identified as possible road border. Probable non-cultural feature.

a - Masonry type abbreviations are: s = simple, c = compound, cv = core and veneer.
b - m = mound, s = scatter.
c - Houses A, C, and D. For purposes of this table, A and D are considered a single roomblock.
d - Houses A, B, C, and D. For purposes of this table, A and B, and C and D, are considered as two roomblocks.

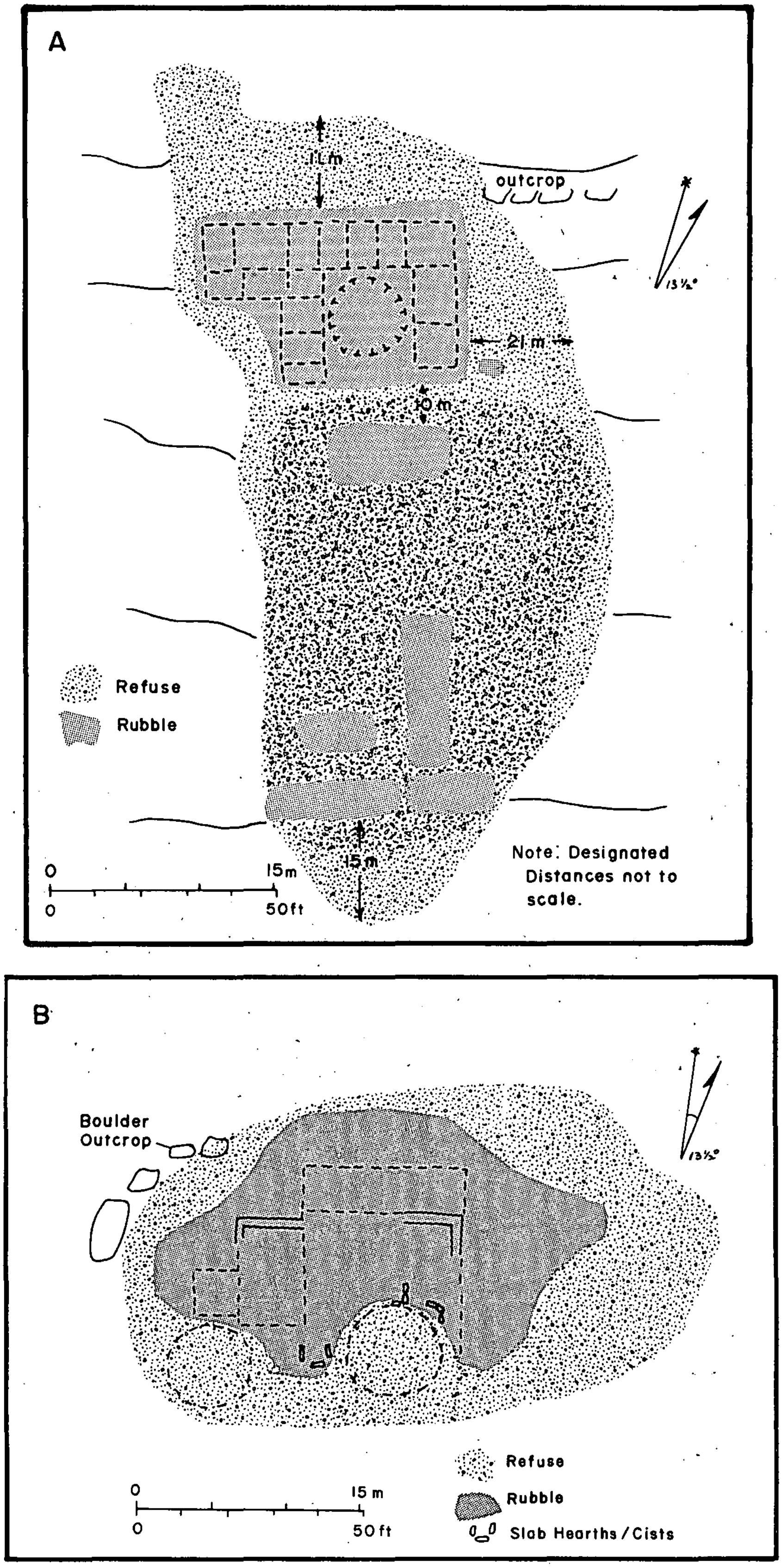

Figure 26. Site plans of selected small houses: A) PS-1; B) PS-18.

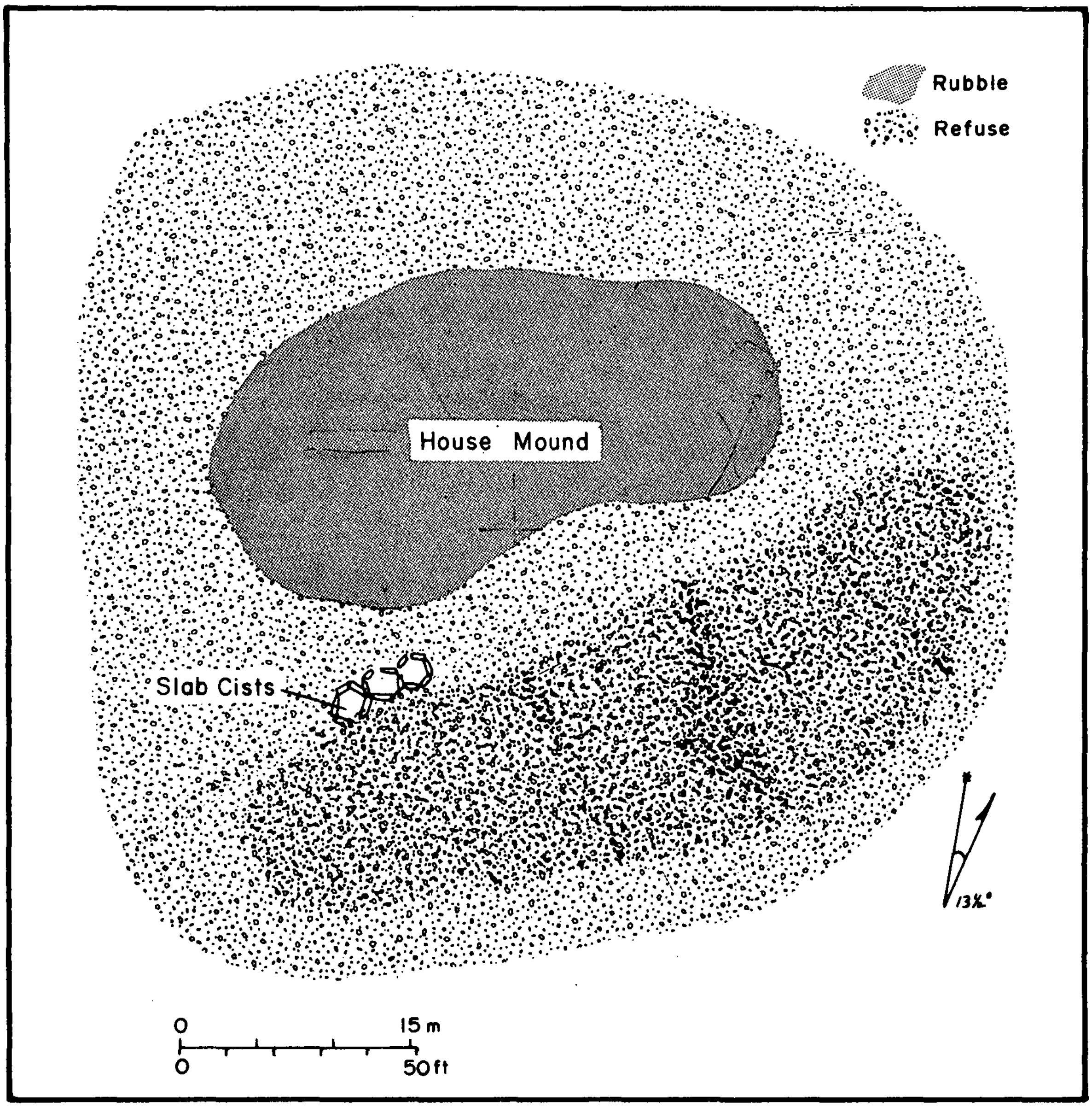

Figure 27. Site plan of small house, PS-33.

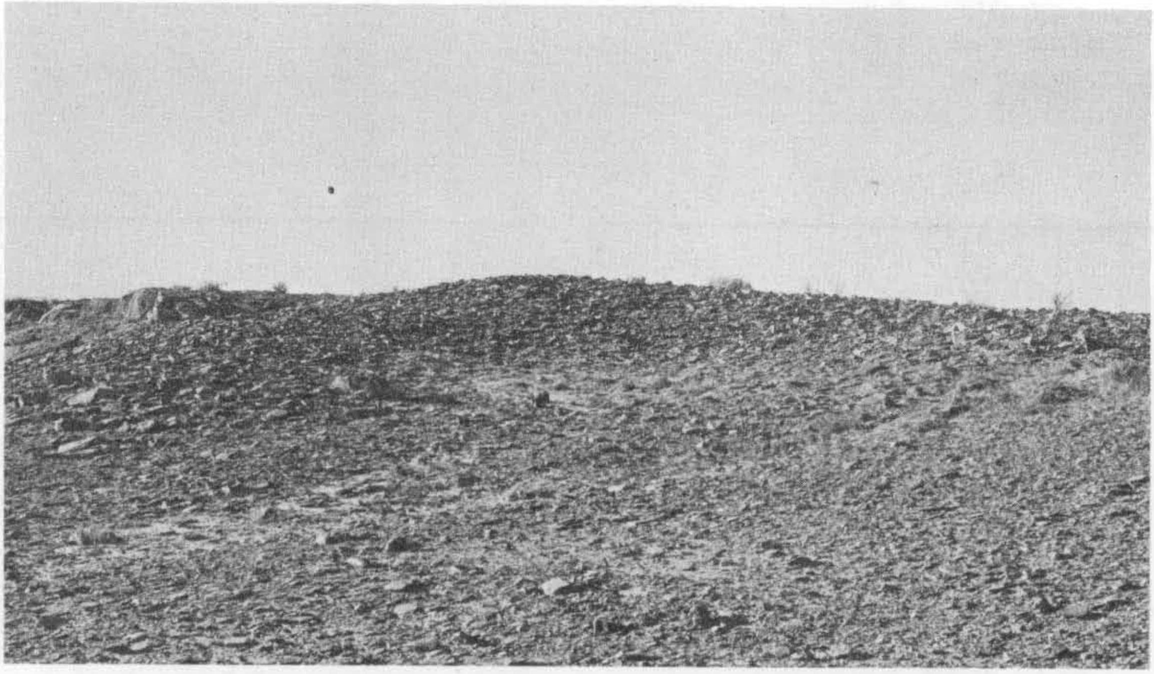

Figure 28. PS-24, small house. General view of house mound looking northwest.

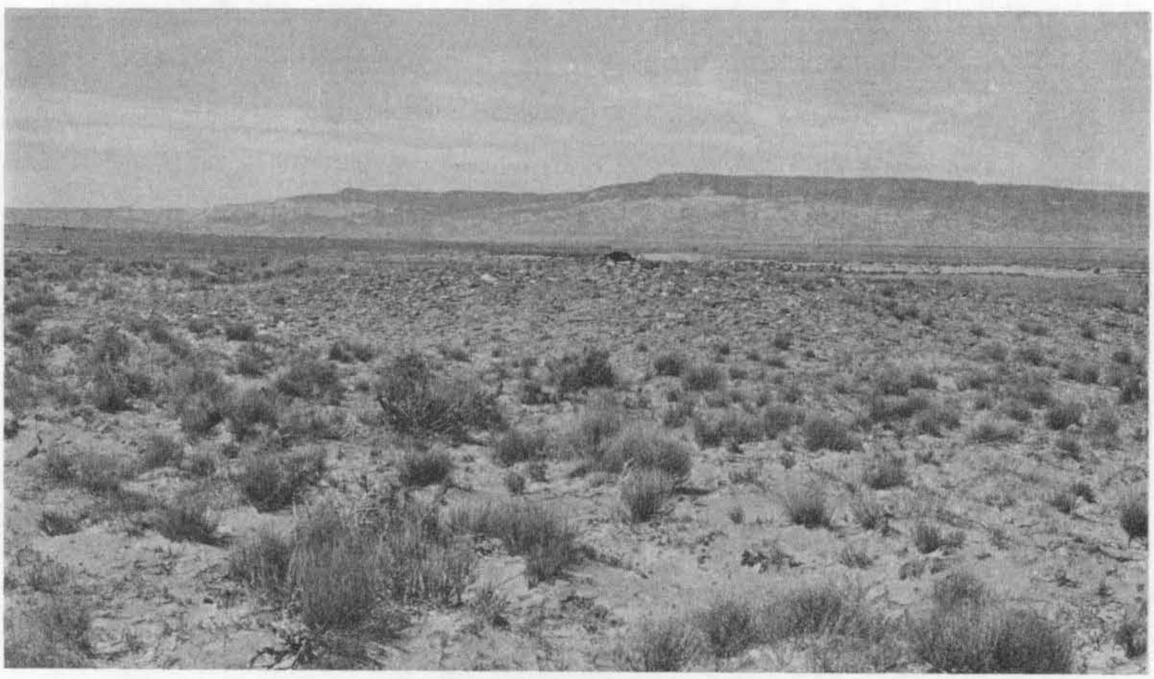

Figure 29. PS-5, small house. General view of house mound looking northwest.

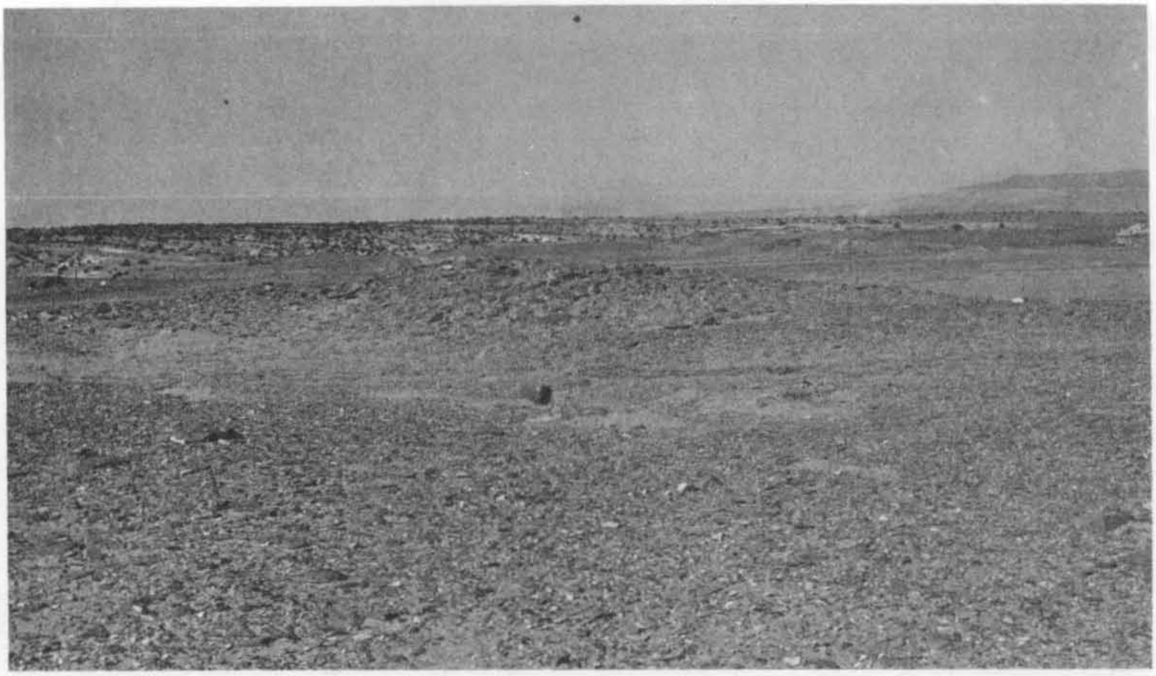

Figure 30. PS-29, small house. View of house mound from refuse area, looking west.

Figure 31. PS-3, small house. Exposed core and veneer masonry in west wall of pothunted room.

Pueblo II and III Architecture

The expansive trash areas associated with many of the small house mounds indicate occupation over several time intervals. Thousands of small sandstone spalls and pieces of discarded building stone littering the refuse mounds also tell of considerable architectural addition and modification during occupation. Such additions and alterations are not otherwise generally recognizable, although at one small house, a roomblock was clearly constructed over an earlier one (PS-29). Concentrations of larger pieces of stone are also present in portions of some trash mounds. They originally led us to speculate that some trash mounds may have covered abandoned roomblocks. The locations of these conjectured roomblocks, however, are generally at odds with traditional locations of extant roomblocks. Furthermore, they lack their own respective kiva and refuse areas. Thus it is probable that the stone in most of the mounds reflects remodeling and construction debris. Large ovoid to rectilinear slabs, visible on the surface of many mounds, may be burial slabs exposed as a result of pothunting and mound deflation.

Only one house mound, PS-11, exceeds 1.5 m in depth. With a house mound 2.0-2.5 m high, PS-11 is thought to have had a limited number of second-story rooms. Room size and floor-to-ceiling measurements could not be made at any of the small house sites because of collapsed masonry and covering by aeolian sand, but the relatively shallow mound depth (<1.5 m) of many small houses implies that wall thicknesses and ceiling heights are less than those in the Chacoan structure.

Because of the masonry rubble and aeolian sand, exposed small house walls are virtually nonexistent. The only substantial exposure of small house masonry is in a pothunted room at PS-3 (Figure 31). The walls exposed in this room are core and veneer, with the veneer facing composed of small, roughly shaped slabs interspersed with occasional larger slabs and blocks. Little chinking is evident, but the stones may have washed out after years of exposure. In comparison to the limited masonry visible in the Chacoan structure, the slabs employed here are smaller, requiring less chinking. However, the small wall section exposed does not appear to be qualitatively poorer than the exposed sections of masonry at the Chacoan structure. Unfortunately, the representativeness of the Chacoan structure and small house masonry samples is equivocal, since they comprise such a small percentage of the stonework present within the Peach Springs sites.

The discovery of core and veneer construction in a small house site (PS-3) is somewhat of a surprise, since this type of masonry has been considered more characteristic of the large Chacoan structures, with only minor occurrence at small houses in Chaco Canyon (Vivian 1970b:170). How extensive the core and veneer masonry construction is within the Peach Springs area cannot presently be determined, although the Early Pueblo III and Late Pueblo III sites with substantial rubble mounds are the best candidates. Although the advent of core and veneer masonry may eventually be dated prior to ca. 1030 (Bannister 1965:150), the lesser rubble bulk of most pre-Pueblo III sites would appear to eliminate the possibility of use of core and veneer techniques in their construction.

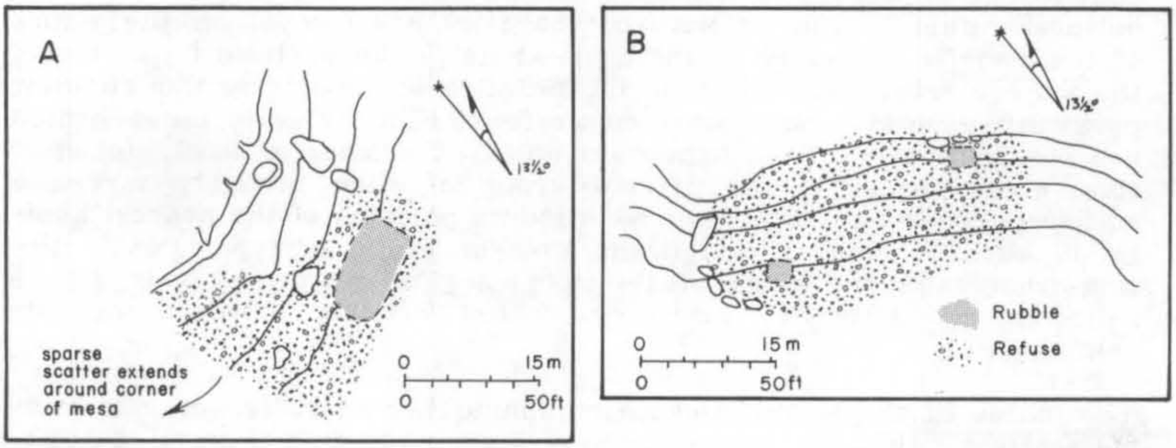

Figure 32. Site plans of selected ancillary units: A) PS-19; B) PS-17

Figure 33. PS-23, ancillary unit. Remains of slab-lined cist.

Limited Use Sites

Ancillary Units

The seven sites comprising this typological group (Table 8), all contain one or more small rubble areas surrounded by a light scatter of cultural refuse. The majority of the sites are located on the slopes of the Menefee ridges or in the dune areas in the northwest quarter of the survey area. The function of the sites is uncertain, though their proximity to small house sites suggests storage or some other limited use complementary to the habitation unit. A number of small, detached room areas similar to the present group of sites probably served a similar purpose but have been recorded as portions of the nearest habitation sites. Thus, although the present group is typologically distinguishable on the basis of its morphological features, it is also a reflection of somewhat arbitrary spatial criteria involved in site delineation.

Three of the seven sites each include two spatially separate rubble scatters, while the remainder have one rubble area (Figure 32 A,B), or an isolated slab cist (Figure 33). The bigger rubble scatters have two to four rooms estimated, while the smaller have one. The insubstantial amount of rubble present at each suggests small rooms or receptacles in which stone may have been a minor construction element. The location of many of the rooms immediately below ridge-top outcrops may have been fostered by the advantages they provided as construction backdrops or foundations. Jacal and large amounts of mortar may have been the major materials, although no trace of these remain today. At one or two units, the stone debris is so similar to the outcrop material above it that identification is not certain. Surrounding most of the room areas were light scatters of cultural refuse that, in part, resulted from the utilization of these units. At some locations, however, significant portions of the cultural material may be float from adjacent habitation sites.

Fieldhouses

Only two fieldhouse sites (PS-35 and 41) were identified by the survey (Figure 34 A,B). Each consists of a small rubble area that may contain two rooms and a surrounding scatter of cultural refuse of limited extent and light density. The primary distinguishing criterion between these and the ancillary sites is location. Whereas the ancillary units are very close to habitation sites, the present sites are at least 100 m from the closest site. They are also in topographic situations that appear to be more suitable for agriculture.

The lack of fieldhouses in the Menefee ridge dune areas is not particularly surprising. Numerous habitation (small house) sites are immediately adjacent to these areas, thereby eliminating the need for fieldhouses. Fieldhouses might be expected in greater numbers at the canyon mouths; and, in fact, a number of the sites located in Farwell's survey area, near the mouths of several large canyons, may be fieldhouse sites (Farwell 1980).

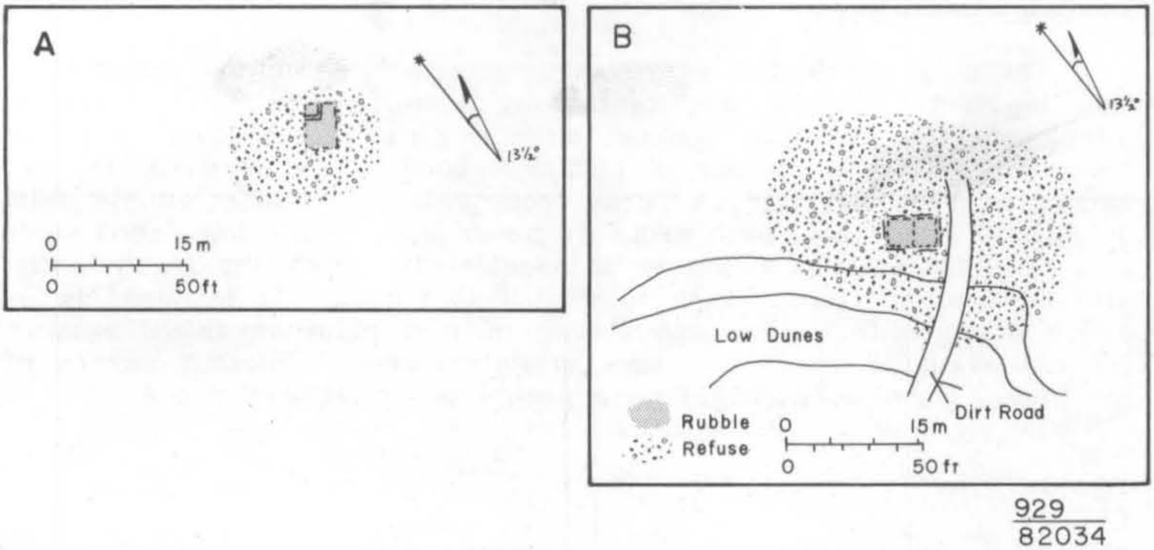

Figure 34. Site plans of selected fieldhouses: A) PS-35; B) PS-41.

Figure 35. PS-47, shelter/campsite. 30 cm scale leans against rubble forming wall. Looking north-northwest.

Nonhabitation Site

The only site in the survey area included within this categorization is PS-47 (Figure 35), tentatively identified as a shelter/camp site located on the Point Lookout mesa ridge at the southern edge of the survey area (a number of similar special use sites were also recorded by Farwell [1980]). Three rectangular clusters of rubble indicate three enclosures, each probably never more than a low walled shelter. A light scatter of refuse is associated. Both the insubstantial architecture and sparse trash suggest limited use. The topographic location of the site implies exploitation of wild plant or animal resources not available within the main habitation area. Further survey of the higher mesa slopes might be expected to reveal similar sites.

Scatters

Three scatters of Anasazi refuse without visible architecture were recorded by the survey (Table 8). Because all three are obscured by dune areas and because occasional sandstone slabs are associated, there is a possibility of architecture at each site. All of the sites are near other substantial habitation units, so it is also possible that all, or major portions of the refuse are float derived from occupation of these adjacent sites.

Miscellaneous Limited Use Sites

The two sites discussed here include a possible chipping station and a possible prehistoric road segment. The chipping station (PS-9) is a 9 x 10-m concentration of Anasazi lithic debris and tools. The site would be a self-explanatory, although unique, manifestation if not for the fact that a large amount of additional cultural material, all twentieth century Navajo trash, forms the major part of the concentration. While the Anasazi material seems to be an assemblage, there is a distinct possibility that the lithics are the result of Navajo collection.

In addition to the road which connects Peach Springs with Grey Ridge community, a road segment is inferred from a 45 m-long alignment of stone, oriented northeast to southwest. No swale or road depression is visible, although a light scatter of refuse is associated. The possibility that some stones in the alignment are outcropping bedrock makes this identification very tenuous. Subsequent aerial imagery examination has not confirmed any prehistoric roads in this portion of the survey area.

Ceramics

Pottery found on the Peach Springs sites is voluminous and indicative of a long occupational span. At sites where only a very few sherds diagnostic of a temporal period are present, occupation during the period is considered conjectural. At sites where few to abundant sherds of a period are in evidence, dating is considered definite. Table 9 documents the occupation span of each site as indicated by the dating of the ceramics; it also shows the frequency of site types by temporal period. In Appendix B, Table 5 tabulates the sherds found at each site in the Peach Springs survey area by ware and style; included are the number of the estimated surface sherds. This data is summarized in Table 10.

Temporal Dynamics

At seven sites, only Basketmaker III ceramics are present in sufficient quantities to indicate occupation. Seven additional sites have been lumped into one Basketmaker III-Pueblo I category, since no differentiation between the ceramics of the two periods was made. Of these, four have enough diagnostic pottery to indicate occupation. At the other three sites, so few diagnostic ceramics are present that occupation is uncertain. Thus it is difficult to accurately evaluate the extent of either the Basketmaker III or Pueblo I occupations within the survey area, primarily because additional sites could be entirely obscured by later cultural material or by postoccupational deposition.

By Early Pueblo II, eight sites (the Chacoan structure, five small houses, and two limited use sites) have sufficient Early Pueblo II style ceramics to indicate occupation. Another 22 sites have very few Early Pueblo II ceramics, indicating possible occupation. Considering the substantial amount of overlying, later occupational debris at many of these sites, and its effect in obscuring the early remains, a substantial number of these "possible" sites may have been occupied during this interval.

In the succeeding Late Pueblo II period, the Chacoan structure, 25 small houses and nine limited use sites display enough ceramic material to indicate certain occupation. This is the peak number of sites within the survey area. By Early Pueblo III, the number of occupied sites dropped slightly to include the Chacoan structure, 21 small houses and three limited use sites. Another six villages and five limited use sites have so few ceramics of the period that definite assignment is not possible.

The number of occupied sites in the survey area is greatly reduced by Late Pueblo III, with only the Chacoan structure and 10 small houses containing enough pottery to indicate occupation. By the end of that period, the entire area had been abandoned.

Styles and Quantities

The full range of styles encountered in the survey area is shown in Table 10 and Appendix B, Table 5. Abundant styles include plain gray ware (probably Lino Gray), which is present in substantial quantities on all the single component Basketmaker III sites. Basketmaker III-Pueblo I sherds are most common along the heavily occupied Chacoan structure ridge, where Kiatuthlanna style black-on-white, and

Table 9 Periods of site occupation as indicated by tree-ring dated ceramics

Site Type/ Number	BM-III/P-I 500-900	EP-II 900-975	LP-II 975-1050	EP-III 1050-1175	LP-III 1175-1300	Other
Chacoan Structure:						
House				A		
Trash A		F	F	A		
Trash B		A	F	VF		
Trash C		A	A	A	F	
Trash D				F		
Great Kiva				F		
Small houses:						
PS-1	F	A	A	F	F	
PS-2		A	A	F		
PS-3	VF	A	A	F		
PS-4	VF	A	A	F	F	
PS-5		VF	A	VF	A	
PS-11						
House			F	F		
Trash A		VF	F	F	F	
Trash B		F	F	F		
Hearth Area C				VF		
PS-12						
House C		VF	F			
House D			F	F		
Trash A		VF	F	VF		
Trash B		VF	F	VF		
PS-14		VF	F	A		
PS-15		VF	F	A	A	
PS-18		VF	F			
PS-20		VF	F	A	A	
PS-21		VF	F	A		
PS-22		VF	VF	F		
PS-24		VF	F	VF		
PS-25		VF	F	VF		
PS-26			F	A		
PS-27						
House A				VF		
Mound B				A		
House C				VF		
House D			F	F	F	
PS-28						
House A			F	VF	A	
House B		VF	F	F	A	
House C + D			VF	VF	VF	
Trash E					F	
PS-29	F	VF	F		F	
PS-31		VF	F			
PS-32		VF	F	F		
PS-33		VF	F	VF		
PS-34			F	F	F	
PS-37			VF	F		
PS-38	F		F	F		
PS-39	VF		F	VF		
PS-40				F		
PS-42		VF	VF	F		
PS-43		VF	F	VF		
PS-45		VF	VF	F		
PS-46	F					
PS-49	F					
PS-50	F					
PS-52	F					
PS-53	F	VF				
PS-54	F					
PS-55	F					

Table 9 Continued

Site Type/ Number	BM-III/P-I 500–900	EP-II 900–975	LP-II 975–1050	EP-III 1050–1175	LP-III 1175–1300	Other
Limited Use Sites:						
Ancillary Units:						
PS-13			F			
PS-17			F	VF		
PS-19		VF		A		
PS-23				0		
PS-30						
House A		VF	F	VF		
House B		F				
PS-44				F		
PS-51				0		
Fieldhouses:						
PS-35				VF		
PS-41		VF	F			
Non-habitation:						
PS-47				F		
Scatters:						
PS-6	F	VF	A	VF		
PS-8		F	A	VF		
PS-36			F			
Miscellaneous:						
PS-9			A			Navajo
PS-16			F			
<u>Subtotals by Sites*</u>						
A	0	5	9	8	4	0
F	11	3	26	17	7	0
VF	3	22	4	11	0	0
0	0	0	0	0	2	0
Navajo						1
Total No. of Sites*	14	30	39	36	11	1

Explanation of symbols:
- A – Abundant sherds with styles of indicated period. Site occupied during indicated period.
- F – Few sherds with styles of indicated period. Site occupied during indicated period.
- VF – Very few sherds with styles of indicated period, <u>or</u> sherds with styles of conjectural temporal placement. Site may have been occupied during indicated period.
- 0 – No diagnostic ceramics.

* Totals and subtotals reflect the number of sites which were occupied during the period. If two or more components of one site dated to a period, they were only counted once. In such a case the unit or area with the most definitive ceramic evidence for occupation was considered representative of the site (i.e., a site with VF, F, and A units was classed as A).

Table 10 Ceramic ware/style frequency totals

Ware/style	Totals for survey area No.	%	% of class	No. of Sites
Gray Wares				
Plain gray	1810	15	38	44
Banded gray	339	3	7	33
Ribbed gray	121	1	3	28
P-II corrugated	86	1	2	15
P-II/P-III corrugated	1960	16	41	41
P-III corrugated	460	4	10	35
Class Subtotal	4776	39	101	
White Wares				
Plain white	4498	37	64	43
*BM-III/P-I	6	-	-	5
*Kana'a	30(12)	-(-)	-(-)	11
Red Mesa	1161(6)	10(-)	17(-)	38
Dogoszhi (straight)[a]	724(11)	6(-)	10(-)	41
Dogoszhi (squiggle)	-(2)	-(-)	-(-)	1
Sosi	221(59)	2(-)	3(-)	38
Flagstaff	10(3)	-(-)	-(-)	9
Puerco	30	-	-	15
Wingate	42(4)	-(-)	1(-)	17
Tularosa	1	-	-	1
McElmo	3(167)	-(1)	-(2)	23
Mesa Verde	-(22)	-(-)	-(-)	10
Class Subtotal	6726(286)	55(2)	95(3)	
Red Wares				
*Plain red	131	1	38	27
*BM-III/P-I	-	-	-	-
*Thick line	45	-	13	15
Puerco	11	-	3	5
Wingate	101	1	30	22
Black & red/orange	1	-	-	1
Black and white/red	52	-	15	16
Class Subtotal	341	3	99	
Total	11843(286)	99		

( ) = carbon painted sherds.
* = frequencies are estimated from percentages.
a = includes Chaco style mineral black-on-white.

some possible Kana-a style black-on-whites are found. No La Plata or White Mound style black-on-white sherds are present. Pueblo II decorated ceramics are dominated by Red Mesa style black-on-white, with Late Pueblo II sites showing large amounts of Dogoszhi style, mineral black-on-white (probably Gallup or affinis). Early Pueblo III sites show Red Mesa, Dogoszhi and Chaco style black-on-whites, with related utility wares. Early Pueblo III carbon paint sherds, present in small quantities at most sites of this period, are primarily McElmoid in design style, but most of the sherds probably derive from the Cibola, Chuska or Kayenta areas. Late Pueblo III ceramics are represented by sherds comparable to Tularosa and Mesa Verde style black-on-whites, with relatively large amounts of St. Johns and related polychromes.

Incised and banded utility pieces are consistently present at Late Pueblo II and Early Pueblo III sites, but in small amounts. They are perhaps comparable to Los Lunas Smudged.

To provide rough quantification of the sherds present at each site, the total number of sherds exposed on the surface of each site has been estimated (Appendix B, Table 5). The Chacoan structure has the largest number of exposed sherds, with an estimate of over 200,000. Ceramics at small houses range from smaller quantities up to 10,000 sherds (16 sites) to larger numbers of over 10,000 to 150,000 sherds (14 sites). All limited use sites have less than 500 surface sherds estimated.

Lithic Materials

Chipped stone remains are quite plentiful at the Peach Springs sites, with some of the larger trash mounds containing several thousand flakes on the surface alone. Over 2,000 flakes, estimated to be approximately 3% of the exposed lithics, have been examined and categorized by material type (Table 11).

The Peach Springs greathouse has 10,000 surface lithics estimated, a total that is exceeded by only one small house site, PS-29, with 14,000 estimated (Appendix B, Table 8). The majority of the small houses have substantially fewer, with from 0 to 500 lithics at 16 sites and 500 to 10,000 lithics at 14 sites. These are large trash deposits, much larger than anything encountered elsewhere during the outlier survey. Only one of the limited use sites has more than 100 lithics; the majority have less than 10.

Silicified Woods

Within the survey area, as in nearly all localities in the Chaco Basin, silicified wood is the major lithic material. Of all the flakes examined, nearly 66% are wood of one variety or another (Table 11). Virtually all are thought to have come from local sources within a few kilometers. Most undoubtedly came from the Menefee formation that underlies much of the Peach Springs survey area.

Table 11 Lithic material frequency totals

Material Type	Totals for survey area No.	%	Percent of class	No. of sites
Cherts:				
1011	26	1	4	15
1040	11	1	2	5
1042	-	-	-	-
1050	6	-	1	3
1051	3	-	-	3
1052	1	-	-	1
1053	6	-	1	6
1060	3	-	-	3
1070	6	-	1	3
1072	468	22	73	34
1080	92	4	14	20
1090	14	1	2	5
1091	1	-	-	1
1425	5	-	1	4
(Class Subtotal)	(642)	(30)	(99)	
Silicified Woods:				
1112	424	20	31	39
1113	81	4	6	25
1120	145	7	10	31
1130	-	-	-	-
1140	96	5	7	21
1142	589	28	42	37
1151	53	3	4	19
(Class Subtotal)	(1388)	(66)	(100)	
Miscellaneous:				
3240	1	-	50	1
4525	1	-	50	1
Obsidian:				
3500	1	-	5	1
3510	15	-	68	9
3520	6	-	27	6
Quartzite 4000:				
Fine	9	-	16	6
Medium	14	1	25	10
Coarse	29	1	53	15
Brushy Basin 2205	3	-	5	3
(Subtotal)	(55)	(3)	(99)	
Total	2109	100		

Most common is a light colored, variegated wood (#1142) that constitutes nearly 28% of all flakes at the Peach Springs sites and 42% of all wood. Our criteria for this one material type may be too inclusive; pieces with rather dull luster, as well as chalcedonic specimens, were included as long as they showed streaks of brown, white, black, or a mixture of these. As such, the category grades into white wood (#1113) at one end of the range of variability and into dark wood (#1112) at the other. A more rigorous application of Warren's classification system would perhaps limit this category to the more chalcedonic materials.

Only slightly less abundant than the variegated varieties of wood are the dark shades (#1112), which account for 20% of all flakes and 30% of all wood. Other wood types include a surprisingly high percentage of reddish wood (#1120, 7% of all flakes) a chalcedonic wood (5%), white wood (4%), and a small amount of jasper-like wood (2.5%). Though the frequency of reddish wood may appear rather low, it is considerably more common here than at most other areas in the Chaco Basin.

Cherts

The vast majority of the nonwood chert flakes are of the very distinct yellow-brown chert with prominent black inclusions (#1072). At a few sites (PS-11, 14, 15, 26, 28, 29, 32, 40), this material is present in such high percentages that it appears that some tool manufacture, or at least core reduction, was taking place (Appendix B, Table 8). Beside the variegated wood, this is the most common lithic material at the Peach Springs sites, with 22% of all flakes and no less than 73% of the nonwood cherts (Table 11).

Oso Ridge (75 km) in the eastern Zuni Mountains is presently the only known source of this material (Whitmore 1978). Nearer source areas are suspected but have not yet been identified.

The next most abundant nonwood material is Washington Pass chert (#1080), deriving from Washington Pass in the Chuska Mountains, 42 km distant. This distinctive pink chert comprises 4% of all flakes and 14% of the nonwood cherts. The amount encountered at the Peach Springs sites is greater than at any other locality visited during our fieldwork. At one site (PS-9), Washington Pass chert is more abundant than any of the wood varieties -- a situation not duplicated at any other site (Table 11 and Appendix B, Table 8).

The lithic assemblage at this site is also divergent in that the lithics outnumbered ceramics. Unfortunately, or perhaps explaining this unique situation, both Anasazi and Navajo remains are intermixed at the site.

The only other chert type noted at more than ten sites is a fossiliferous cobble chert (#1011), that comprises approximately 1% of the sampled lithics. While this material is abundant in the Ojo Alamo conglomerates further north, it is suspected that specimens found at Peach Springs were derived from some closer but as yet undefined source.

Chert types of moderate abundance (present at five or more sites) include intrusive Brushy Basin chert (#1040), chalcedony with black inclusions (#1053), and intrusive Pedernal or Pedernal-like chert (#1090). The nearest probable sources for Brushy Basin and Pedernal cherts are 45 and 190 km respectively. The Pedernal chert is of interest because of the relatively high frequency of prepared tools; three projectile points were found in addition to 11 flakes.

Quartzite

Another material showing an even higher proportion of tools is a fine-grained, light gray quartzite (#2205), probably from the Brushy Basin member of the Morrison Formation. All three specimens of this material were in the form of projectile points. Source areas have not been established, but the material may derive from the northern San Juan Basin, 100 km to the north.

Flakes from quartzite cobbles are rather sparse but are present at numerous sites. Purple, white, and light brown are the most common colors.

Obsidian

Obsidian is present only in small amounts; 22 flakes comprise 1% of the total assemblage sampled. Southern Jemez (Valle Grande-Redondo Peak [#3520]) and Grants Ridge (#3510) materials are both represented despite the fact that the latter source is located at half the distance of the Jemez material. Subsequent x-ray florescence identification of obsidian recovered from Chaco Canyon sites indicates that much of the obsidian visually identified as Grants Ridge material actually derives from the more distant Red Hill source (180 km) in west-central New Mexico (Sappington and Cameron 1981). Some or all of the material identified by us as Grants Ridge obsidian may therefore actually be Red Hill material. In addition, a single flake of material possibly from the San Francisco Peaks area was noted (Helene Warren 1976:personal communication).

Other Lithic Materials

In addition to the chipped stone, stone ornaments and exotic minerals are relatively abundant at the Peach Springs sites. Azurite was noted at no fewer than eight sites; calcite beads or bead material at eight sites; worked shale pendants and ornaments at nine sites; turquoise at three sites; and a single shell bracelet at one site. There is no noticeable tendency for these items to be concentrated at the Chacoan structure or at the small house sites on the heavily occupied ridges. Rather, they appear to be equally abundant at the smaller house sites surrounding the central ridges.

There are definite indications that bead manufacturing (at least of calcite beads) was taking place at some of the Peach Springs sites. Unfinished beads (hole drilled, but periphery unshaped) or partially shaped chunks of raw materials were noted at three separate sites. At one site, a thin abrader with a shallow circular groove along one edge was found; it is remarkably similar to the turquoise bead abraders found at site 29SJ629 in Chaco Canyon (Windes 1978b).

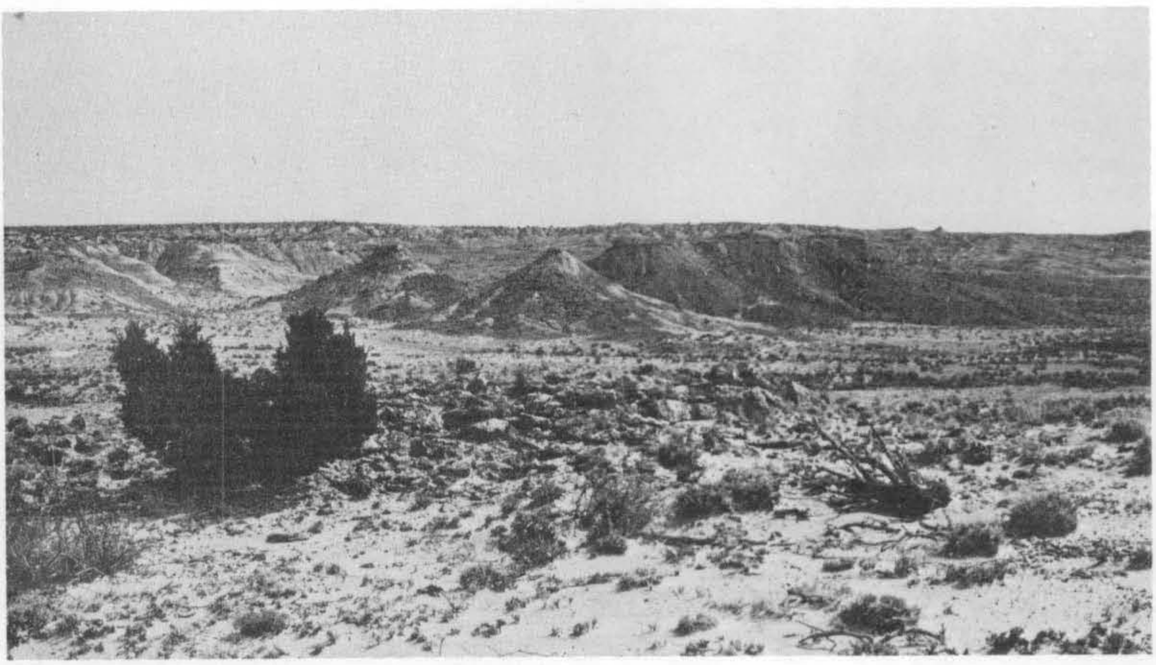

Figure 36. Overview of Pierre's survey area, looking southeast to Pierre's butte.

4

THE PIERRE'S SURVEY

Introductory Comments

The Pierre's survey area is on the north valley slopes of an unnamed tributary of Coal Creek, in the east-central portion of the Chaco Basin (Figures 1 and 36). Elevation is approximately 1,981 m above sea level.

The survey area includes a 1.6-km diameter core area, centered on three Chacoan structures, in addition to selected areas another .25 km beyond this limit (Figure 37). Cumulatively, the area surveyed totals 3.0 km^2.

As at Peach Springs, limitations in time permitted intensive survey only within a .8-km radius of the Chacoan structures. The area between the .8 and 1.2-km circumferences was accordingly sampled in a stratified fashion, based on settlement pattern data obtained from the core area. The procedure was to sample each of seven microenvironmental zones based on relative size and site density. We arbitrarily selected for survey those portions of each microenvironmental zone in contiguous zones nearest to the .8-km radius perimeter. Therefore, the resulting sample areas are for the most part continuous, although the outer survey limit fluctuates greatly. This is because the cutoff line was determined arbitrarily or by topographic, drainage, or microenvironmental zone boundaries. Ultimately, approximately 30% of the .8-1.2-km radii area was surveyed.

Because the survey within the core area had produced a large percentage of sites on the Farmington sandstone caprock ridges and buttes and a lesser number of sites on the shale slopes below, it was expected that these same zones in the outer .8-1.2-km radii area would also yield a substantital number of sites. Therefore, these zones were surveyed in their entirety. In view of the minor percentage (9%) that these zones comprise within the .8-1.2-km radii area, the expectation of a "substantial" number of sites was confirmed, with four additional Anasazi sites recorded.

Even though no Anasazi sites were found within the upper Kirtland shale and mesa-top zones in the core area, it was felt that the areas of these zones in the .8-1.2-km radii area should also be examined, since they comprised about 42% of the outer area. As such, over 30% of these zones (cumulatively) were surveyed, although only a small percentage consisted of mesa top. No Anasazi sites were found.

The valley slope and wash alluvium areas that include 50% of the outer area were also expected to yield few or no sites, based upon the lack of sites in these zones within the core. This expectation was also confirmed for no Anasazi sites were found in 21% of the bottomland area surveyed between the .8-1.2-km radii. We originally planned to continue this environmental zone sampling scheme out to the 1.6-km

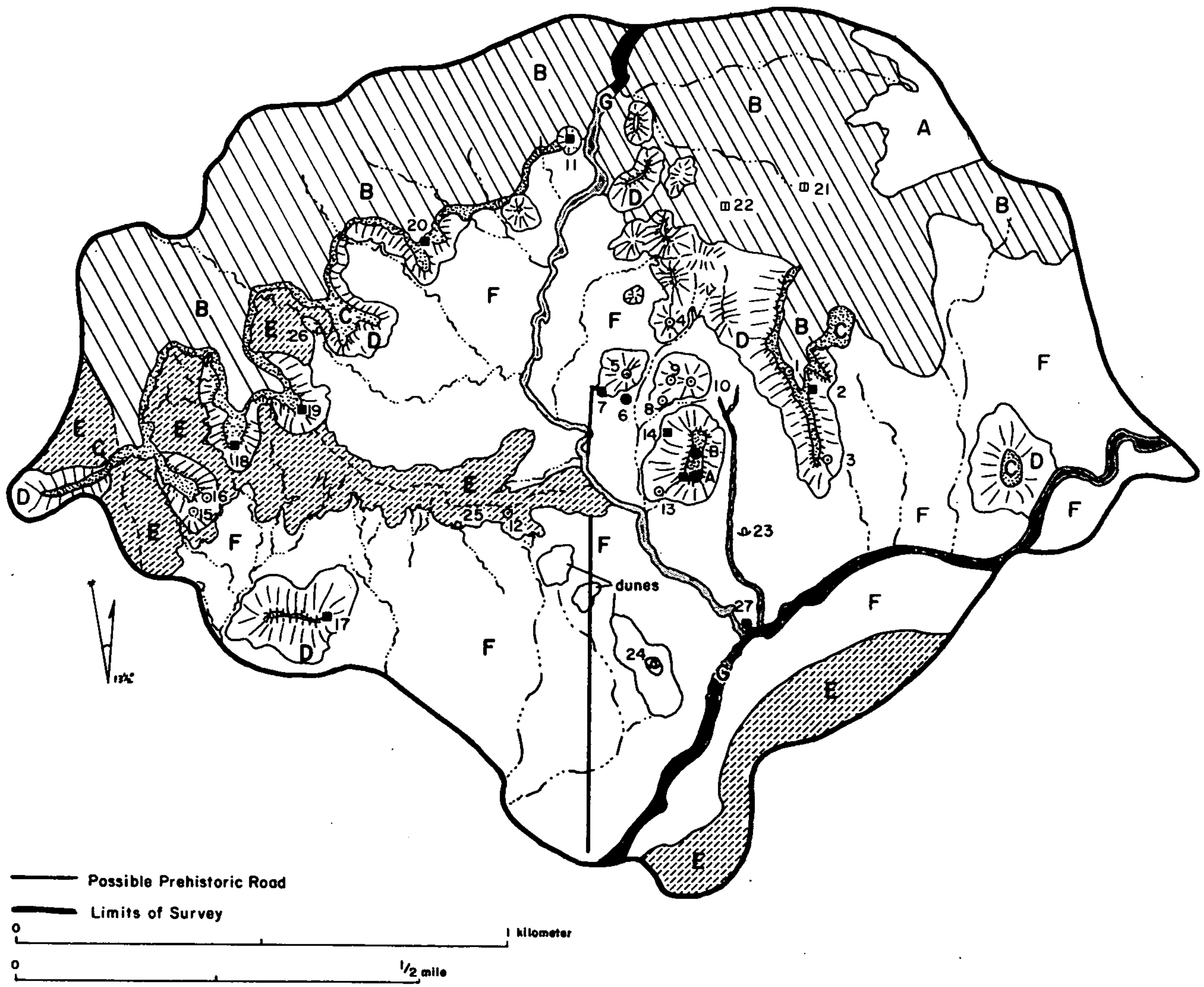

Figure 37. Pierre's site types and microenvironmental zones.

radius, if the density of sites within the .8-1.2-km radii seemed to warrant further survey. However, given the negative results within the mesa top, upper Kirtland shale badland, valley slope, and wash alluvium zones, additional survey in these zones beyond the 1.2-km limit did not appear worthwhile at the time. Data subsequently derived from a Bureau of Land Management sample survey (Huse 1978), however, indicate that a more areally extensive sample of the mesa-top zone, particularly in the outer 1.2-1.6-km radii area, should have been conducted. The BLM survey has revealed nine Pueblo II-III Anasazi "special activity camps" and seven isolated finds on the mesa top in the northwestern quadrant of the 1.2-1.6-km radii area (Huse 1978). While in retrospect it is clear that a larger proportion of the mesa-top zone should have been surveyed, we believe that further survey out to the 1.6-km limit in the remaining zones would have produced few or no additional sites. Unlike the mesa-top zone, substantial proportions of these zones were surveyed within the core and .8-1.2-km radii areas.

The handful of sites found within the sandstone caprock and lower shale slope zones within the .8-1.2-km radii did indicate to us that further survey in these zones out to the 1.6-km limit might produce more sites. However, the caprock and lower shale slopes are neither distinct nor substantive between the 1.2-1.6 km radii in the eastern half of the survey area (indeed, they largely disappear within the .8-km radius area). Although these zones do continue into the 1.2-1.6-km radii area in the western half of the survey area, the sandstone caprock that is responsible for formation of the ridges and buttes in the core occurs there in an increasingly thin and discontinuous layer; and, as a result, the prime site locations formed by this rock cap are not present. Some survey in these zones beyond the 1.2-km perimeter was carried out, and reconnaissance was conducted out to the 1.6-km limit. No sites were found in this extended area.

Although no road segments are clearly visible from the ground within the Pierre's survey area, the Great North Road (Lyons and Hitchcock 1977; Morenon 1977; Obenauf 1980) does pass north-south through the center of the survey area (Figure 37) -- within 50 m of P-6, the largest Chacoan structure in the community. The Great North Road, one of the few prehistoric roads that has been examined on the ground, was initially surveyed by E. Pierre Morenon (1977), who discovered the Pierre's site aggregation. We named the community after him.

As the Great North Road approaches the center of the survey area, it is approximately 19 km north of Pueblo Alto (Figure 1). Northward from Pierre's, it is another 16 km to Halfway House and another 21 km to Twin Angels Pueblo. Both of these latter sites appear to be isolated Chacoan structures. From a point 6.5 km south of Twin Angels to the Great North Road's presumed destination at Salmon Ruin (16 km), the road is not physically definable; it is presumed to have led down the bottom of Kutz Canyon wash. Additional Chacoan structures or communities along the Great North Road are not presently known, although a number of small limited use sites, including possible signaling station were, recorded by Morenon. As with other prehistoric roads, the

Great North Road is definable only from discontinuous segments, as illustrated by Obenauf (1980).

Physical Environment

Geology

Two major geologic formations, the late Cretaceous Kirtland Shale and the overlying early Tertiary Ojo Alamo Sandstone are present within the survey area (Figure 37). The bedrock of the bulk of the survey area is formed by the Kirtland Shale that exhibits three recognizable subdivisions: lower and upper shale units separated by a hard, almost quartzitic, blocky sandstone known as the Farmington Sandstone Member. The latter forms the thin (1-2 m), resistant caprock of the area's numerous isolated buttes and mesa edges. This is nearly the southern limit of the Farmington Sandstone, and the outcrop width here is a considerable reduction from the ca. 175-m thickness at the San Juan River. Though prominent at this locality, the sandstone is not at all conspicuous to the northwest; it is totally absent to the southeast. As a result, the buttes here are among the most prominent features between Chaco Canyon and Huerfano Mesa.

Below the Farmington Sandstone Member is the lower part of the Kirtland Shale, a gray or greenish silty mudstone that has eroded into the badland slopes of the buttes and mesas. Above the sandstone is the upper shale unit consisting of low, eroded ridges of shale and soft, silty sandstone. Eroding out of the Kirtland Shale, particularly its upper member, are numerous and frequently very large specimens of silicified wood. Literally whole logs can be seen in the drainages north of Pierre's Site.

The Ojo Alamo Sandstone is restricted to the northern edge of the survey area, just below the edge of the mesa top. Only the lower conglomeratic and silty layers of the formation are present, but unconsolidated lag gravels derived from eroded parts of the formation are abundant. The gravel deposits are concentrated on the higher ridges but are also scattered downslope over both the upper shale and Farmington Sandstone members of the Kirtland. These gravels are mainly 2-8 cm in diameter and include a number of usable cherty lithic materials, among them a yellow fossiliferous chert (#1011), the most common chipped stone material found at the Pierre's sites.

Topography

The 1.6 km diameter of the core survey area embraces a cross section of the valley topography from rolling mesa-plain on the north to entrenched valley bottom arroyo on the south (Figure 37). In between the two topographic extremes, considerable geological, soil, vegetational, and elevational variability are encountered.

Occurring only in a small northeastern portion of the survey area is gently undulating mesa land, covered with a moderately thick layer of sand loess. The sandy soil supports a dense shrubland of big sagebrush with a few widely scattered juniper and pinyon (Pinus edulis). Although only occurring within a small portion of the survey area, the mesa-plain topography is dominant immediately north of the survey area. From there it extends virtually uninterrupted to the San Juan River, a distance of over 45 km to the north.

At the southern edge of the mesa-plain, the land breaks away to the rough and eroded sandstone and shale outcrops of the Kirtland Formation. In turn, these outcrops are cut by several shallow drainages. In the northwestern portion of the survey area, the ridges and slopes retain a cover of sandy aeolian soil that supports sparse-to-moderate vegetation, including big sagebrush, fourwing saltbush, grasses, and scattered juniper and pinyon. In the northeastern portion of the survey area, however, erosion has been more extensive, and plant density is lower. In both areas, vegetation is relatively more dense along the edges of the small, sandy-bottomed drainages.

Near the sandstone-capped mesa-ridge edges, the overlying and less resistant sandstone and shale have been eroded away, exposing the Farmington sandstone caprock. Away from the immediate ridge edges, the caprock is covered by thin lenses of colluvial soil and residual gravels. Vegetation is sparse to nonexistent and includes isolated sage, grasses, and a few struggling juniper distributed along the mesa points and edges. Below the caprock, steep slopes of the lower portion of the Kirtland Shale support far less plant life: mainly shadscale, occasional saltbush, and grasses. The low, less precipitous shale ridges in the center of the survey area are largely mantled by low aeolian dunes, and this allows the survival of scattered saltbush, grasses, and a few dispersed junipers.

Below the badland strata and composing the lower valley slopes and bottomlands are deep deposits of alluvium- and aeolian-derived sediments that support a moderate to thin shrub cover (including saltbush, wolfberry, and greasewood). Portions of the bottomland alluvium are also covered by moderately large, stable dunes. Several shallow, sandy-bottomed washes drain the bottomland area and join the main arroyo in the south-central portion of the survey area. Although the present 4-5-m deep entrenchment of the main arroyo does not allow seasonal overbank flooding, alluvial sediments along the arroyo indicate flooding in the past, prior to arroyo formation. Greasewood is the predominant vegetation bordering the main arroyo as well as the tributary washes.

Soil Associations and Agricultural Potential

All of the Pierre's survey area falls within the Turley-Badland soil association (45% Class 3, 3% Class 4, 52% Class 6). Overall, this unit has a poor irrigability rating because of its high percentage of badland acreage and lack of permanent water (Maker et al. 1973:14-15). Included within the unit are mesa-top Farb soils, Rockland or Badland soils, valley slope and bottomland Turley soils, in addition to wash alluvium and floodplain Azfield soils.

Aside from the Badland and Rockland soils, which have virtually no agricultural potential, the mesa-top loess (Farb soils) appears to have the least potential for agriculture because of present inadequate rainfall (estimated annual mean of 213 mm [8.4 in]) and the infeasibility of providing irrigation water to the mesa lands. Possibly during a few optimum seasons, the mesa loess could support a crop entirely dependent on rainfall, but such seasons are presently few and far between.

The bottomland Turley soils, the floodplain, and the alluvial Azfield soils are well situated topographically for flood water irrigation, although the main wash is presently incised in an arroyo 4 m deep. The main tributary arroyo that passes through the middle of the survey area is also entrenched, although much of its course is not as deeply incised. Examination of Soil Conservation Service aerial photography (1:20,000) taken in 1936 shows entrenchment as extensive as that identifiable on more recent photos, although relatively subtle changes in arroyo courses have been noted by Windes (1980a); alterations in arroyo depth, channel widening, or headward erosion might also be confirmed by a detailed examination of the photography. Because of the entrenchment of both major washes, it would presently be difficult to practice either simple floodwater farming or ditch irrigation, utilizing water from these drainages. Since these are the major sources of run-off, the inability to exploit them seriously reduces the amount of available arable land. Whether similarly entrenched arroyos were present during the occupation of the Pierre's community is not known, although 125-140 cm of alluvium covering an Anasazi hearth (P-27 -- this feature was not recorded until 1979, but was assigned the next number in the original survey sequence) exposed in the north wall of the main wash indicates that an aggrading floodplain was present at some time subsequent to the use of this feature and prior to the beginning of the current down-cutting regime. An archaeomagnetic date of 1060 $\pm$ 15 (1 sd) and a radiocarbon date of 1080 $\pm$ 55 (1 sd) from the hearth are thought to date the same temporal event as indicated by an F test (analysis of variance: F = .13 for 1 sd, and F = .03 for 2 sd) at the .001 level of confidence (Windes 1980a).

Portions of carbonized corn stalk recovered from the hearth do suggest prehistoric fields in the area. Immediately north of the location of this hearth, the 1936 S.C.S. photos show a Navajo field that appears to have been situated so that the floodwater collected from the small tributary drainage area above it would flow over much of the field area. Although many minor tributaries within the survey area are incised in their upper courses, a number, like this wash, appear to flow into small floodplain areas where degradation has not progressed far enough to eliminate all overbank flooding. The feasibility of small plots in these locations was attested to by a local Navajo who informed Windes (1980a) that his parents had grown corn, squash, and watermelon in the sandy side washes 30 years ago.

A final factor that may also affect arability within the survey area is soil quality. The productivity of some of the bottomland soils may be marginal because of the derivation of large portions of the alluvium from the very fine-textured badland shale deposits. As noted in the Bis sa'ani discussion, clayey soils of this type may not be well suited to agriculture (c.f. Bradfield 1971).

Though of limited extent, the lowland dune deposits covering portions of the bottomlands, as well as portions of the low shale ridges in the central survey area, might provide ancillary field locations. Although a somewhat higher density of vegetation does indicate some additional soil moisture in some dune areas, these locales are rather small.

In summary, given that present precipitation patterns and amounts are similar to those experienced during the Anasazi occupation, the ability to produce agricultural crops within the Pierre's community is dependent on floodwater irrigation. Present entrenchment of the major drainages appears to substantially reduce the amount of arable land, although some bottomland areas adjacent to the small tributary washes do still provide some small field areas. If only these small drainages were usable prehistorically, similar drainages over a substantial area (extending outside the survey limits) must have been exploited to support the community. Whether or not this was the case cannot be determined without further investigation. If undertaken, such an investigation would have to include detailed examination of alluvial stratigraphy, population estimates, arable land estimates, and further survey.

Microenvironmental Zones and Vegetative Associations

In order to examine the relationship of site distribution to environment and vegetation within the Pierre's survey area, microenvironmental zones and vegetation associations have been delineated. Concomitant with the identification of the archeological sites, the spatial extent of seven microenvironmental zones were identified and mapped (Figure 37). Zone differentiation is defined primarily on the basis of gross geologic, soil, topographic and vegetation differences. Each zone is described below, and the zone of each site is shown in Table 12.

Zone A (Mesa top): Loess-covered and underlain by the Ojo Alamo Formation. Predominantly sage with a few pinyon and juniper. Dominant north of the main survey area. Approximately 2% of survey area.

Zone B (Upper Shale Badlands): Exposed upper Kirtland shale and sandstone with fossil inclusions. Highest badland zone, found only on mesa-ridge tops at valley edge. Sparse to moderate vegetative cover of shrubs and grasses with scattered pinyon-juniper. Approximately 28% of survey area.

Zone C (Sandstone Caprock): Farmington sandstone exposed on mesa edges. butte, and pinnacle summits. Sparse to nonexistent soil and vegetation. Approximately 2% of survey area.

Zone D (Steep Shale Slopes): Steep mesa and butte slopes of Kirtland shale with caprock talus. Vegetation sparse. Approximately 11% of survey area.

Zone E (Lower Shale Slopes): Gradually sloping badlands, with low ridges cut by arroyos. Some dune cover and moderate vegetation of saltbush, wolfberry, and scattered juniper. Approximately 11% of survey area.

Zone F (Side Valley Slopes): Gently sloping alluvial and aeolian-covered valley slopes and valley bottoms. Predominantly grassland with saltbush and greasewood. Approximately 44% of survey area.

Zone G (Wash Alluvium): Stream-deposited alluvium; includes both floodplain deposits and coarse, sandy alluvium of present arroyo bed. Greasewood dominant. Approximately 3% of survey area.

Except for the sage-covered mesa tops and greasewood-dominated wash peripheries, shrub cover is generally sparse throughout the survey area. While present on the mesa top, upper shale slopes, and low dune-covered slopes, juniper are sparse and widely spaced. Pinyon occur sporadically on the mesa top and upper shale slopes but do not occur with the juniper in the lower portions of the survey area. Both species are thinly distributed on the higher elevations around the survey area but are absent in the lower areas to the south and southwest. The vegetation associations at the sites are divided into seven categories, depending on the density of shrub cover and the presence or absence of tree cover (Table 12). No attempt has been made to delineate the areal extent of these classes; rather, the categories apply only to the plant cover on and immediately adjacent to the sites.

Vegetation Association #1 (Moderately dense shrub cover): Greasewood dominant with big sage and saltbush also present.

Vegetation Association #2 (Moderate shrub cover): Big sage dominant, with saltbush and greasewood present.

Vegetation Association #3 (Sparse shrub cover): Mostly shadscale. Grasses abundant, especially sand dropseed.

Vegetation Association #4 (Grasses only): Predominantly sand dropseed. Mostly badland situations.

Vegetation Association #5 (Moderately dense junipers): Some pinyon. Moderate shrub undergrowth, predominantly sage.

Vegetation Association #6 (Sparse juniper): Occasional pinyon. Moderate shrub cover.

Vegetation Association #7 (Sparse juniper and shrub cover): Big sage dominant.

Table 12 Microenvironmental zones and vegetative associations of the Pierre's survey area and percentage relationship of microenvironmental zones to Anasazi site distributions

Microenvironmental zone groups		Sites in zone #	Sites in zone %	Zone percentage of survey area	Percent of Anasazi sites in zone	Percent difference[a]		Vegetative Associations 1	2	3	4	5	6	7
Mesa Top	A	–	–	2	–	–2		–	–	–	–	–	–	–
Badlands	B	2	7	28	–	–28	O[b]	–	–	–	–	–	2	–
	C(C–D)	12	44	2	57	+55	A[1]	–	2	4	–	–	–	1
		–	–	–	–	–	A[2]	–	–	–	–	3	1	1
	D	7	26	11	33	+22	A[1]	–	–	5	1	–	–	–
		–	–	–	–	–	A[2]	–	–	–	–	–	–	1
	E	2	7	11	5	–6	A	–	–	–	–	–	1	–
		–	–	–	–	–	O	–	–	–	–	–	1	–
Bottomlands	F	4	15	44	5	–39	A	–	1	–	–	–	–	–
		–	–	–	–	–	O	1	–	1	–	1	–	–
	G	–	–	3	–	–3		–	–	–	–	–	–	–
Totals		27	99	101	100	–		1	3	10	1	4	5	3

a: Differences between percent of survey area and percent of Anasazi sites
b: A = Anasazi, O = Other (includes Navajo and lithic [possible Archaic] sites)
1 – indicates butte top formation
2 – indicates mesa top/mesa slope formation

Site Distribution

Though Zones C and D (sandstone caprock and steep shale slope) comprise only 2% and 11% of the survey area respectively, 12 Anasazi sites (57%) are located atop the Farmington sandstone-capped mesa points and buttes, while another seven (33%) are situated on the steep shale slopes below the caprock (Table 12, Figure 37). Cumulatively, only two Anasazi sites (10%) are located on the lower shale slopes (Zone E) and bottomland areas (Zone F); these zones comprise 11% and 44% of the survey area respectively. No Anasazi sites were found in the mesa top (2%), upper shale badland (28%), or wash alluvium zones (3%) (Table 12). (See also Appendix B, Table 3.)

Apparent preference for Zone C locations atop isolated buttes is most clearly demonstrated by the presence of one or more sites on every major butte within a 1-km radius of the centrally prominent Pierre's Site butte. The survey also examined buttes outside the radius area with mixed results. Butte tops to the west did have sites (P-15 and 17), but .8 km to the southeast, one of the largest buttes in the vicinity reveals no evidence of prehistoric use. Physiographically, this butte is very similar to Pierre's Site Butte, with one apparent exception -- the range of visibility. From Pierre's Site Butte, it is possible to see directly to Pueblo Alto, 19.0 km to the south, and to the Gallegos-Chaco Divide, 12 km to the north, both probable sighting points on the Great North road. Neither of these locations is visible from the unoccupied butte, which is to the east of the main line-of-sight "channel." In contrast, the majority of the occupied buttes have direct visibility to one or both of these points, suggesting that visibility was an important factor in their selection as well.

Seven sites are situated either partially or completely on the steep shale butte slopes (Zone D), with the majority on the upper slopes near the caprock building stone. These upper slope locations have nearly the same visibility range as the butte-top sites. Given the steepness of the butte slopes and the difficulty these locations must have engendered for construction, the choice of slopes for site locations is somewhat surprising. Because butte-slope sites occur only on buttes crowned with sites, the slope sites may have been constructed contemporaneously or secondarily with the caprock site to provide additional living space and, in some instances, a location more suitable for kiva construction. The fact that the spatially limited butte top and slope locations were chosen for eight of eleven small house sites and two of three Chacoan structures indicates that the buttes were preferred as habitation sites over the mesa point (also Zone C) and mesa slope locations (Zone D). It was the latter locations that were most commonly chosen for a type of limited use site, here termed isolated rooms sites (five of eight limited use sites).

While butte and mesa top/slope locations are similar topographically, a substantial range and variety of vegetation is shown for these zones (C and D) (Table 12). However, if the zones are subdivided into groups, mesa top and slope versus butte top and slope, relatively little variability is found within each group. At 12 of the 13 Anasazi butte top and slope sites, vegetation (Associations 2, 3, and 4) ranges from scattered grasses to sparse-to-moderate shrub cover. Only one site has a sparse juniper and shrub cover. In contrast, the six sites on the mesa points and slopes have a slightly more dense, more varied, and larger plant environment (Associations 5, 6, and 7) characterized by sparse to moderately dense juniper and shrub cover, with pinyon, sage, saltbush, and grasses.

Presently, it appears that visibility, access to building stone, and possibly defense were the primary reasons for situating habitation sites on butte tops and slopes. A final possibility, that sites located in these areas were positioned in part to avoid loss of arable land to structures, does not appear to aid explanation of the settlement pattern since sites could have been located at the base of the slope zones without disturbance of agricultural land and with far easier access to field areas.

Although a correlation between the location of isolated room sites and generally more dense and varied vegetative associations has been observed, the import of this apparent relationship is uncertain and will be discussed in conjunction with the description of these sites.

Of the two sites (7%) not located on the butte or mesa quartzitic caprock and shale slopes, one is on a lower Kirtland shale slope (Zone E) and one is in the valley side slope bottomlands (Zone F). The lower shale slope site (P-12) is not spatially associated with a butte top or upper slope site. The other lowland thereby stands out as the only Anasazi small house site in the survey area that is not closely adjacent to the quartzitic caprock.

Site P-6, a Chacoan structure, is the largest site in the survey area; and, as the only site on the bottomland alluvium, it is clearly the ground-level center of the site aggregation. Its position immediately east of where the Great North road (as interpreted from visible road segments) passes through the Pierre's community suggests that its location was determined in part by location of the road. Sparsely vegetated associations comprise the plant life in the immediate vicinity of both P-6, while the vegetation of P-12 is slightly more extensive, including scattered juniper and brush cover (Association #6).

Site Remains

The physical remains found at the Anasazi sites recorded in the Pierre's survey area are discussed below, and described in tabular form in Table 13.

Chacoan Structures

In the Pierre's survey area, there are three Chacoan structures, each manifesting a number of architectural attributes typical of these sites. Two of the structures, Houses A and B, are atop a large butte near the center of the survey area (Figure 38). Together these two

Table 13 Site layout and architectural data

Site Type/ Number	Structure Configuration	No. of Rooms	No. of Kivas	Masonry Type[a]	Trash[b]	Site Size (m)	Estimated Structure Size (m^2)	Comments
Chacoan Structure:								
Pierre's Site:								
House A	Rectangular	15	3	c,cv	ts	80 x 40	255	-
House B	Rectangular	13	1	cv	ts	80 x 30	315	-
P-6	Rectangular	18	2	cv	m	50 x 55	505	-
Small houses:								
P-1	Rectangular	07	-	c	s	40 x 25	70	Presence of kiva unlikely.
P-3	Rectangular	07	1?	-	ts	-	105	-
P-4	Rectangular	04	1?	-	ts	30 x 25	65	Although only three rooms are clearly visible, at least four are present.
P-5	Squarish	04+	-	-	ts	50 x 30	100	60 x 90 cm firepit on butte summit. Rubble indicates more rooms than presently intact.
P-8	Unknown (prob. kiva cluster, poorly defined walls)	?	2	-	ts	40 x 25	180	Partially exposed wall segments may enclose kivas, or clue presence buried rooms.
P-9	Rectangular	05	-	s,c	ts	40 x 25	115	P-8 is probably the kiva unit for this site and P-10.
P-10	Rectangular	10?	-	cv	ts	60 x 40	95	-
P-12	Squarish	04	1?	-	s	30 x 15	105	Low wall may enclose kiva. A second rubble area 40 m east has exposed wall segments which probably define one or two additional rooms.
P-13	L-shaped	07	1?	-	ts	45 x 40	145	Kiva enclosed by plaza wall.
P-15	Rectangular	10?	-	c,cv	ts	20 x 50	70	-
P-16	Rectangular	04	1?	c,cv	ts	25 x 20	105	Three thick walls south of possible kiva may have functioned as retaining walls for later structure.
Limited Use Sites:								
Isolated Rooms:								
P-2	-	01	-	-	-	03 x 03	-	-
P-11	-	01	-	-	ts	03 x 03	-	-
P-18	-	01	-	-	-	03 x 03	-	-
P-19	-	01	-	-	-	03 x 06	-	-
P-20	-	01	-	-	s	25 x 15	-	-
Pierre's Site Area C	-	01	-	-	-	10 x 10	-	-
Isolated Firepit								
P-17	-	-	-	-	s	10 x 10	-	A bedrock firepit ca. 3 m^2 in size, with associated mound of burned and cultural debris.
Non-habitation								
P-7	Rectangular	02	-	-	ts	20 x 10	-	-
P-14	Rectangular	02	-	-	ts	20 x 20	-	Possible wall projects west from rooms.

a - Masonry type abbreviations are: s = simple, c = compound, cv = core and veneer.
b - Trash types: ts = talus scatter, m = mound, s = scatter.

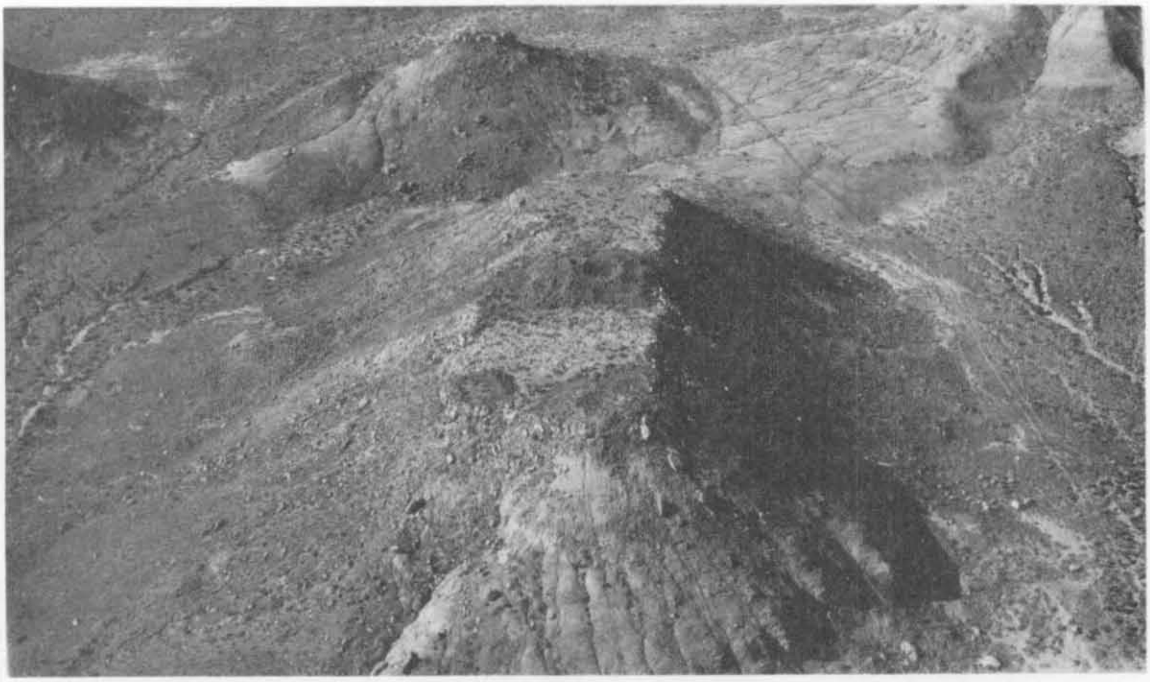

Figure 38. Overview of Pierre's butte. Chacoan structures House A (southeast corner of butte) and House B (butte center) are visible on butte top; Area C is on southwest corner of butte. Looking north.

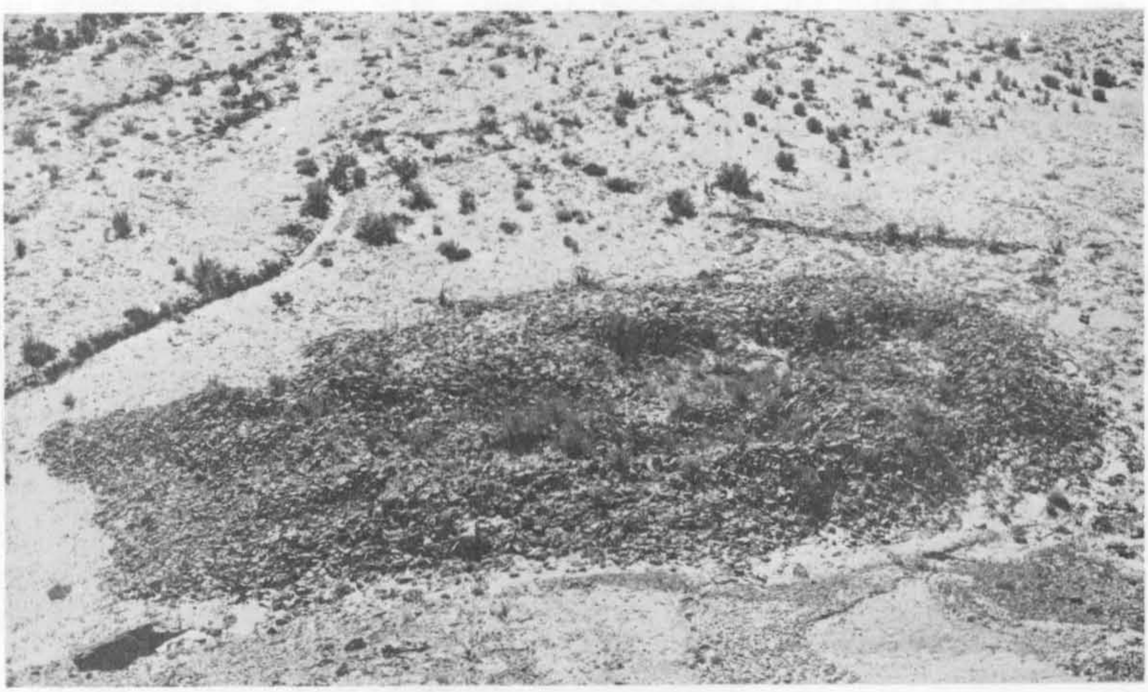

Figure 39. Overview of P-6. Chacoan structure as seen from butte top to north. Note rubble (wall) alignment to the southwest of the mound.

units (in addition to Area C, a large isolated room) compose the Pierre's Site. Immediately northwest of this butte, at the southern foot of a smaller butte, lies the third Chacoan structure, P-6 (Figure 39).

Layout

On the southeastern corner of the Pierre's Butte is House A, a rectangular mound roughly 255 m^2 and 2 m high, with an estimated 15 ground-floor rooms (Figure 40A and 41). Two tiers of small rooms form the northern half of the house while a single tier of larger rooms lines the southern edge of the structure, enclosing three kivas. Because many walls and room corners are obscured by rubble, it is impossible to determine whether or not the structure was erected in a single planned building phase, although the regular room and kiva layout suggest this. Location of the site on the southeastern corner of the butte has resulted in the collapse of the eastern portion of one kiva and possibly a couple of rooms. However, during the prehistoric occupation of the site, proximity to the mesa edge facilitated refuse disposal to the south and southeast. A moderate scatter of cultural refuse extends down the steep talus slope all the way to the butte base.

House B is located approximately 30 m north of House A, occupying the center of the butte caprock (Figure 42). Also rectangular in shape, this house measures 14 x 18 m and includes 13 rooms and a single, centrally located and enclosed kiva. A single room west of the kiva appears to have been the only second-story chamber, presently giving the mound a maximum relief of 3 m. The total floor area of the structure, including the second-story room, is approximately 315 m^2. Examination of the ground plan (Figure 43) suggests a structure built in one planned construction effort, although overlying rubble prevents confirmation of this. Refuse from this house appears to have been broadcast off the eastern edge of the butte, resulting in a talus scatter that extends to the butte base.

A final structure on the Pierre's butte caprock is Area C, located at the southwestern corner of the butte immediately west of House A (Figure 43). The rubble indicating this structure forms a single, large rectangular outline approximately 5 x 7 m in size and .75 m in depth. The substantial amount of rubble present appears to indicate a full walled, roofed room. No cultural refuse directly relatable to Area C was found. In some respects, this structure resembles the isolated rooms present on the mesa points in the northwestern portion of the survey, as is discussed later in this section.

The third and largest Chacoan structure is P-6, the only Anasazi site in the survey area located in the microenvironmental zone of valley slope-bottomland. Basically rectangular and measuring 15 x 20 m along its north-south and east-west axes, the internal arrangement of this site is the most distinctive and asymmetrical of the three structures (Figure 39). Again, rubble that partially covers the remaining walls prevents identification of planned construction units, although

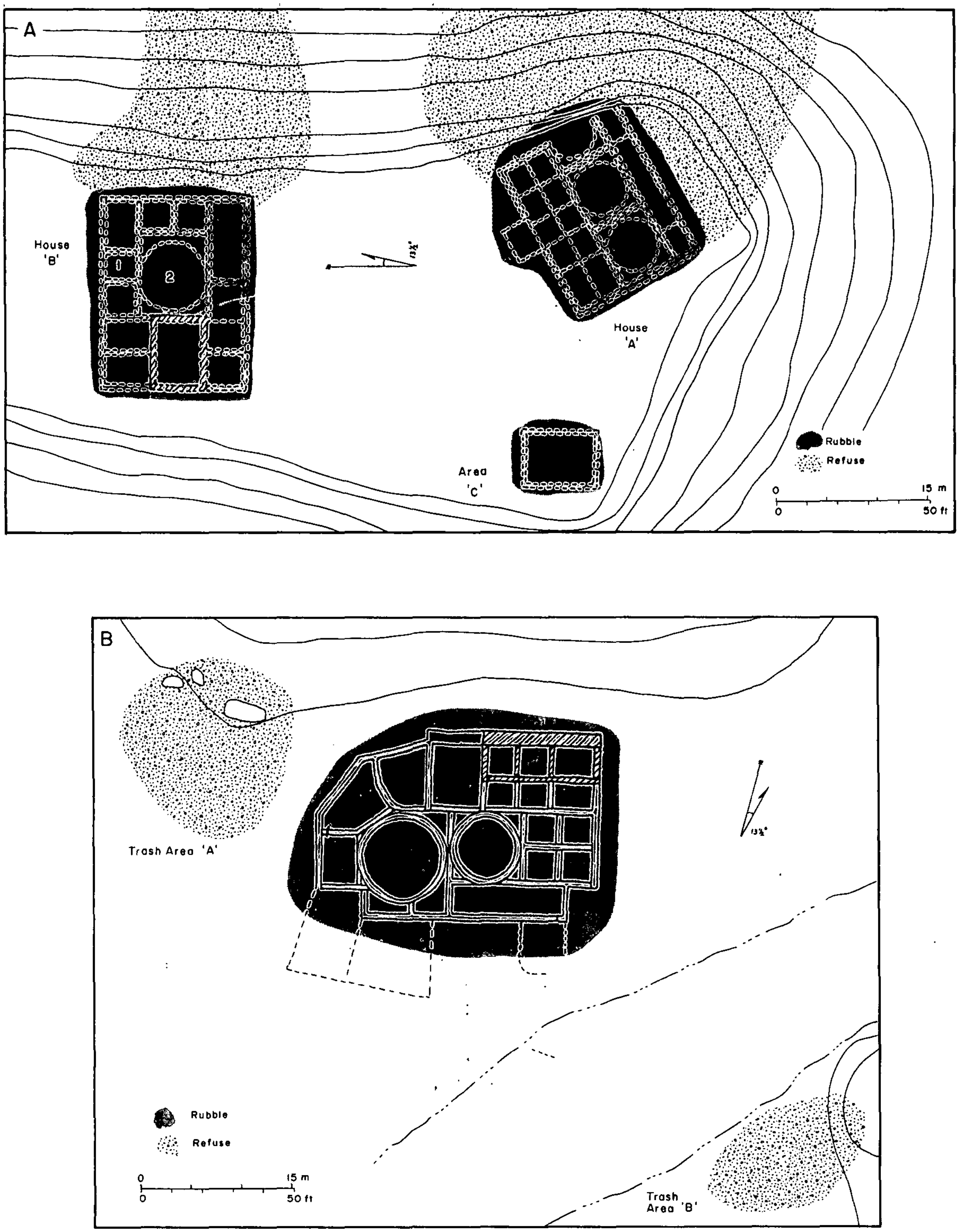

Figure 40. Pierre's Chacoan structures. A) Pierre's site, Houses A and B, Area C; B) P-6.
1. Provenience of Laboratory of Tree-Ring Research, specimen CNM 382.
2. Provenience of Laboratory of Tree-Ring Research, specimen CNM 384.

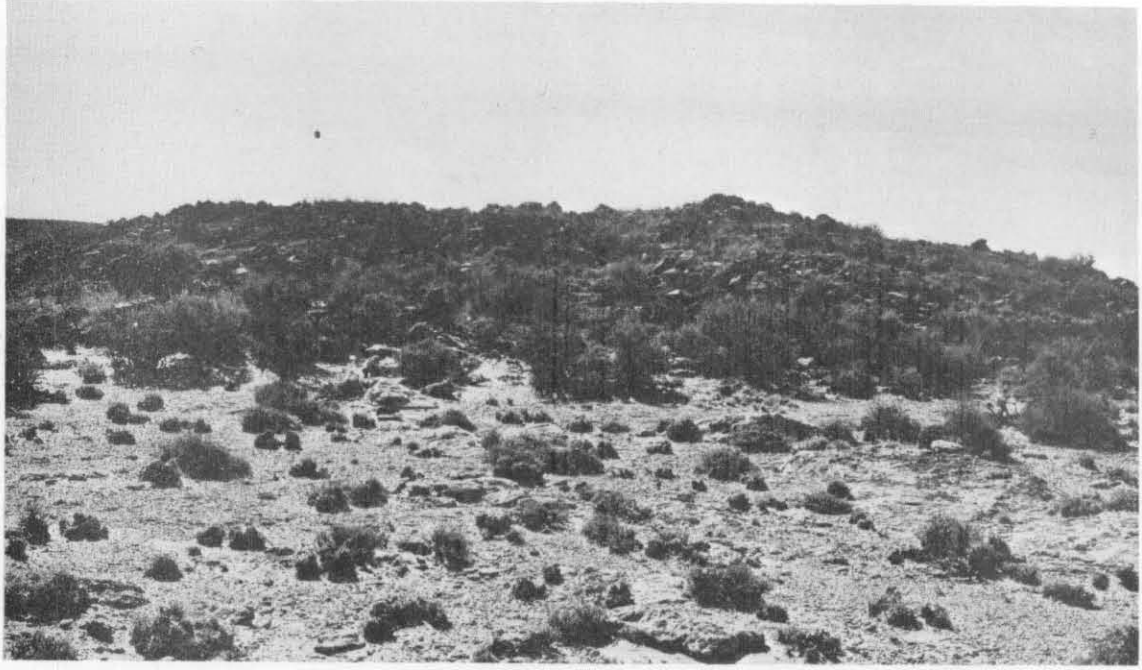

Figure 41. Pierre's Butte, House A Chacoan structure. Looking south.

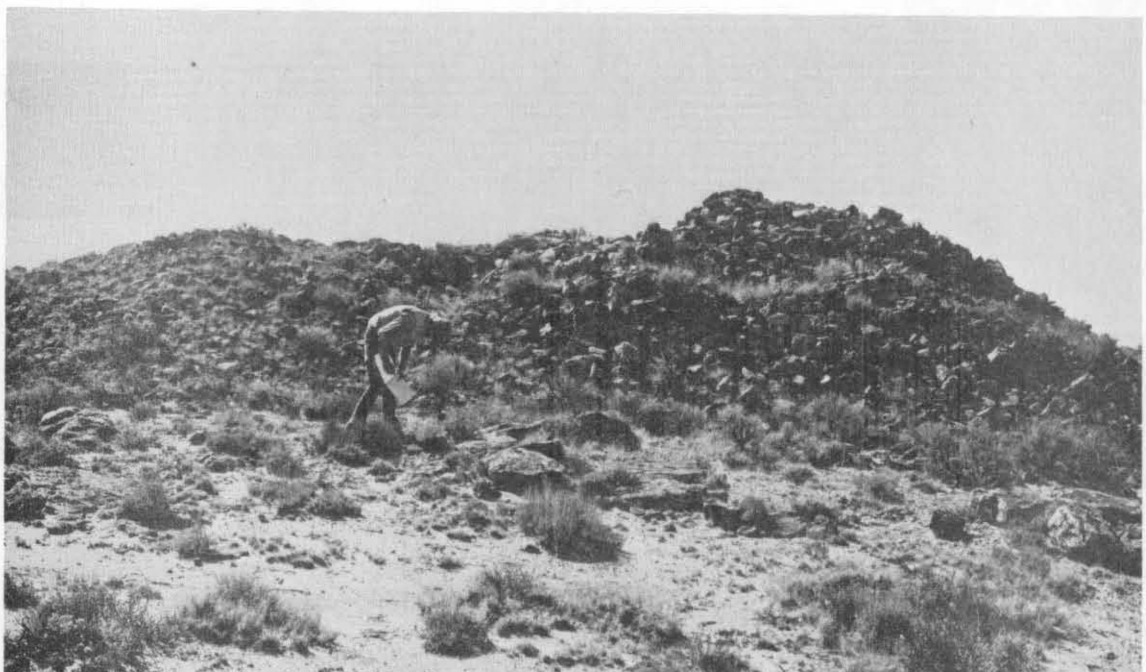

Figure 42. Pierre's Butte, House B Chacoan structure. Looking south.

Figure 43. Pierre's Butte, House C. Looking west.

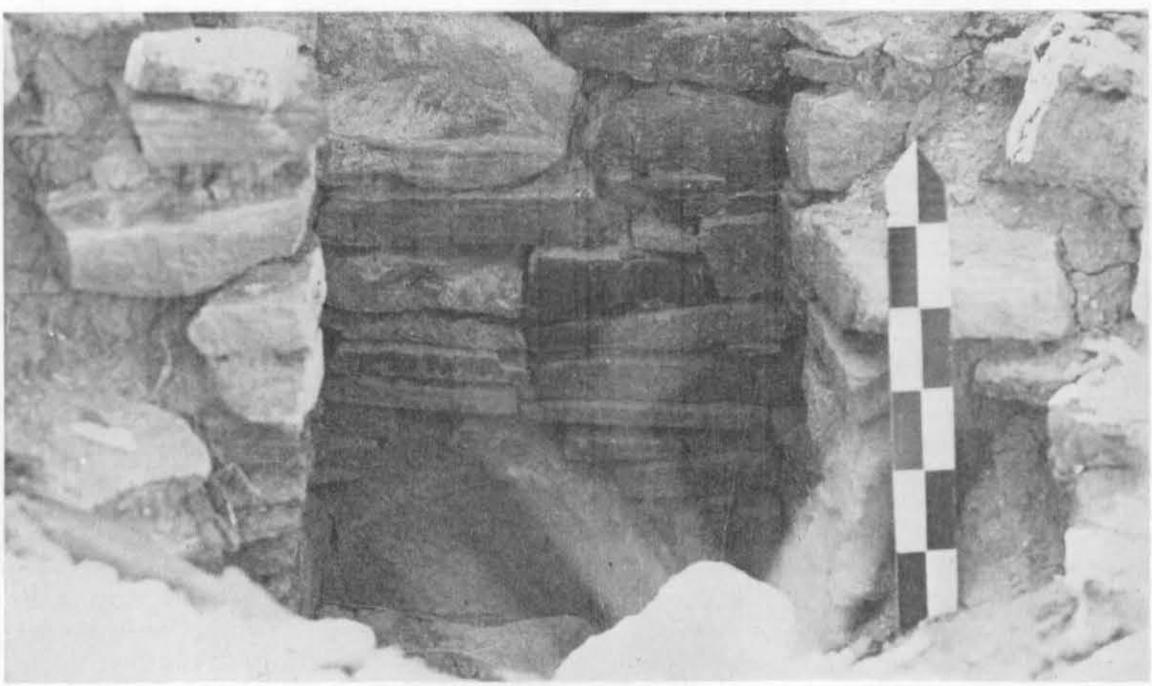

Figure 44. House B. Tabular masonry exposed in pothunted ventilator shaft. 30 cm scale.

here the asymmetry of the site suggests that several construction intervals may have been involved (Figure 40B).

The eastern portion of this house is composed of small, regularly tiered rooms that may have stood two stories high, resulting in the present 2.5-3.0 m rubble accumulation. The western section of the house, however, is composed of larger, less regularly shaped chambers that surround two kivas. Combined, the house floor area including the proposed second-story room is approximately 505 m^2. To the south of the house, several low rubble alignments appear to indicate a number of associated enclosures rather than enclosed rooms. It seems possible that the low-walled enclosures to the south of the house may have performed some undefined function in conjunction with the use of the Great North Road.

Architecture

From the perspective of size and bulk, P-6 is the most massive Chacoan structure, with Houses A and B, second and third respectively. The rear wall of P-6 now stands to a height near the top of the first story. No accurate determination of its height from the original ground surface is possible since a great deal of colluvial material has washed in along the back wall. The exposed top of the wall, however, reveals core and veneer masonry that forms a wall up to 90 cm wide. In contrast, the other walls at P-6 as well as those at Houses A and B are considerably less massive, ranging from 40 to 50 cm in width. This is not surprising, particularly in the latter structures where little if any second-story architecture is indicated. The walls exposed in House B are clearly core and veneer. The lack of visible wall tops at House A does not permit definite identification, although general width suggests either core and veneer or compound construction. Though the amount of rubble present at each site is substantial, with mound heights ranging 2-3 m, the rubble-covered nature of the sites does not permit accurate estimation of original floor-to-ceiling heights.

The stone employed in all three structures is predominantly the hard, quartzitic Farmington sandstone, present as caprock or talus throughout the survey area. Limited examination of the stone used in the houses shows that little of it is shaped; the builders no doubt found it more economical to retain the natural cleavage planes of the large angular blocks and slabs. A pothunter's burrow in the House B kiva ventilator shaft also reveals use of the brown, tabular sandstone that outcrops in the upper shale layer of the Kirtland (Figure 44). The sparsity of this stone on the mounds appears to indicate its selective use, perhaps only when the harder, blockier, and less easily shaped quartzitic sandstone was not suitable, as in detail work. The tabular masonry in the House B ventilator is the only masonry exposed at the three Chacoan structures that has a definite Chacoan flavor, most resembling the late Chacoan styles (Hawley 1934, 1938). House A reveals only a couple of very small and eroded sections of blocky masonry (Figure 45), which vaguely resemble the blocks of the Chaco Canyon McElmo house masonry (Vivian and Mathews 1965). At House A, however, the blocky appearance of the masonry may be more a result of

Figure 45. House A. Detail of crude block masonry construction. 30 cm scale.

the characteristics of the material at hand rather than intentional creation of McElmo-style masonry. No intact masonry is exposed at P-6, although, as at House A and B, the rubble tends toward blockish stone shapes with little tabular material.

The absence of aeolian fill at the Pierre's sites allows more accurate room size estimations for a larger number of rooms than is possible in the two other survey areas. Of approximately 46 rooms estimated for all three Chacoan structures, 38 (83%) are sufficiently exposed to allow size estimation. As Table 14 indicates a relatively wide range of room sizes is present. House A rooms are consistently small ($\bar{x}$ = 5.0 m^2, sd = 1.6) in relation to both the House B ($\bar{x}$ = 11.7 m^2; sd = 6.0) and P-6 ($\bar{x}$ = 13.6 m^2; sd = 10.4) rooms, which range from equally small to relatively large rooms.

With one, two and three kivas present at House B, P-6 and House A, respectively, kiva-to-room ratios of 1:13, 1:9, and 1:5 are indicated for each site. With the exception of the House B kiva vent shaft, no kiva features are exposed.

Perhaps the most unexpected aspect of the Pierre's survey was the discovery of several pieces of badly weathered wood exposed on the surface of House B and on one of the small house sites, P-15. The fragments collected at House B appear to have been ceiling beams (probably vigas) that may have lain exposed on the surface of the site for several hundred years. When the wood was collected, we were extremely skeptical of its value. However, when two tree-ring dates of 1109vv and 1109+v (Table 15) were obtained from the House B wood, and 1106++vv and 1124r dates were obtained from P-15, we went back to search for anything that might have been missed. This final effort has resulted in two more dates from House B, 1000vv and 1108+vv (Table 15).

While the single 1124 tree-ring date obtained from this group of dates is not sufficient to indicate major construction during that year, the 1106-1109 cluster of four vv specimens, in conjunction with the 1124 date, do suggest one or more construction intervals during the first quarter of the 1100s. While the tree-ring dates do provide needed time control on construction activity, the dates do not provide initial and concluding occupation dates. The P-27 hearth has yielded an earlier radiocarbon date of 1080 ± 55 (1 sd) and an archaeomagnetic date of 1060, ± 15 (2 sd), suggesting at least seasonal occupation of the community prior to the 1100 dates. Similarly, while occupation did not carry over to the advent of Late Pueblo III ceramic types (ca. 1175), it probably did not terminate immediately following 1124.

Also interesting are the species of the dated timbers -- ponderosa pine and white fir. The four ponderosa specimens could be from the relict stand on Hunters' Wash (Reed 1968; Vivian 1972; Vivian and Mathews 1965), approximately 9 km to the northwest of the Pierre's survey area. But the nearest present-day stands of white fir are in the La Plata Mountains, 105 km to the north.

Table 14 Estimated room size by site type

Site Type/ Number	Room Size (m) 3-5	6-7	8-9	10-12	15-16	21-26	32-35	Mean Room Size (m^2)	Standard Deviation (m^2)	Total Rooms Measured	Total Est. Rooms	Percent Rooms Measured
Chacoan Structures												
Pierre's Site												
House A	8	2	2					5.0	1.6	12	15	80
House B		2	5	3		2		11.7	6.0	12	13	92
P-6		5	5	1			3	13.6	10.4	14	18	78
Sub Totals	8	9	12	4		2	3	10.3	8.0	38	46	83
Small houses												
P-1	2	3	1	1								
P-3	3	3	1									
P-4	1	1										
P-5				2		1						
P-8												
P-9		1			2	2						
P-10	1	1										
P-12				2	1							
P-13	1											
P-15		1	1									
P-16	2			1								
Sub-totals	10	10	3	6	3	3		9.0	6.0	35	62	56
Limited Use Sites												
Isolated Rooms												
P-2												
P-11	1											
P-18	1											
P-19			1									
P-20			1									
Pierre's Site												
Area C							1					
Sub-totals	2		2				1	12.2	13.1	5	6	83
Non-habitation												
P-7	1	1										
P-14		2										
Sub Totals	1	3						5.8	.5	4	4	100
Total	21	22	17	10	3	5	4					

Table 15 Dendrochronological Specimens from the Pierre's Site

Site No.	Provenience	TRL No.	Species	Dating Inside	Dating Outside
Pierre's Site:					
House B	Room north of kiva	CNM-382	PP	1037p	1109vv
	Kiva	CNM-384	WF*	1051p	1109+v
	-	CNM-594	WF*	1065p	1108+vv
	-	CNM-592	PP	946np	1000vv
P-15	Trash on SE talus slope	CNM-378	PP	1020	1106++vv
	" "	CNM-376	PP	1062p	1124r

* Cory Breternitz (personal communication) believes these may be from the same tree.

Explanation of Selected Symbols (for further explanation, see Robinson, Harrill, and Warren 1974):

The symbols used with the inside date are: year - no pith ring present; p - pith ring present; np - near pith; few rings missing.

The symbols used with the outside date are:

r - less than a full section is present, but the outermost ring is continuous around available circumference.

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

vv - there is no way of estimating how far the last ring is from the true outside.

\+ - one or more rings may be missing near the end of the ring series whose presence or absence cannot be determined because the specimen does not extend far enough to provide an adequate check.

++ - a ring count is necessary due to the fact that beyond a certain point the specimen could not be dated.

The symbols B, G, L, c and r indicate cutting dates in order of decreasing confidence, unless a + or ++ is also present.

Species: PP - ponderosa pine; WF - white fir.

Small Houses

Eleven sites (Table 13) recorded during the Pierre's survey are felt to represent small house sites or components thereof. While (as emphasized in the discussion below) several sites lack kivas, they have been included as small houses because they appear to be habitation sites.

Layout

The site layouts of the small houses vary somewhat according to the topographic constraints of their location, although it would be presumptuous to attribute all variability to the limitation of talus slope and caprock location.

Least affected by space constraints are five small houses with rectangular to L-shaped or squarish blocks of three to seven rooms (Figure 46A, B and Figure 47). In some instances, they have a southward extending arm or arms partially enclosing a fully subterranean kiva. In several instances, the kiva, placed in a small plaza, seems to be enclosed or protected by a low, arcing wall extending from the roomblock corners. Though alluviation precluded any examination of kiva architecture, slight plaza depressions indicate their presence at some sites, while at others, kivas are postulated in bare, flat areas between the southern edge of the house and the northern limit of the refuse area -- even though no depression is discernible. Only one small house (P-1), situated on the Farmington sandstone caprock, probably lacks a kiva. The location of four of the five sites on slopes or mesa edges resulted in trash disposal on the steep talus slope.

A second group of six sites does not conform as closely to the classic small house configuration displayed by the first five sites. Presumably, this is because they were located on the more constricted butte top and talus slope. Four of these are rectangular-to-squarish clusters of three to ten rooms, located entirely or partially on top of the butte caprock or directly under the caprock lip on the talus below. None appear to have kivas or plaza areas. Trash is present at all sites in the talus debris below the unit.

A possible ceremonial unit for two of these sites (P-9 and P-10) is P-8 (Figure 46C), located at the foot of the butte crowned by P-9 and 10 (Figures 48 and 49). This site has two, or possibly three, circular structures that are tentatively identified as kivas. Additional rubble outlines are present but unclear, indicating the possible presence of adjoining rectangular rooms or walls enclosing the kivas.

A third small house without apparent kivas is P-5 (Figure 50). The presence of at least four rooms, in addition to extensive trash and rubble, suggests this is a habitation site even though no kiva is present.

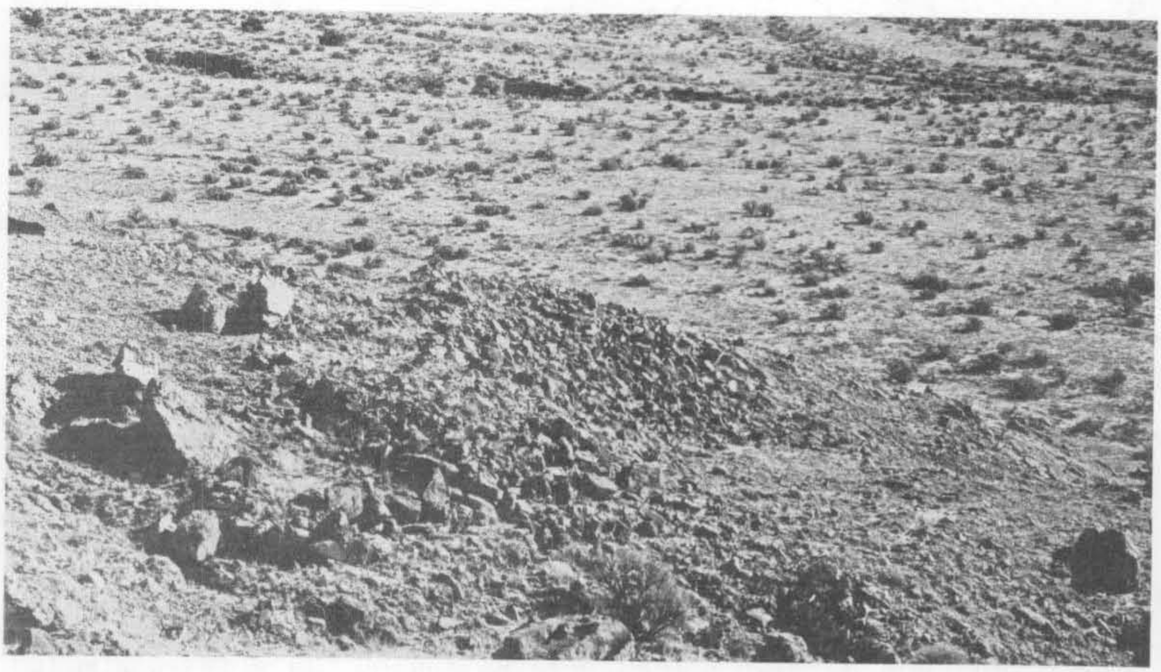

Figure 46. P-3, small house. Rubble defines roomblock, with depression marking possible kiva.

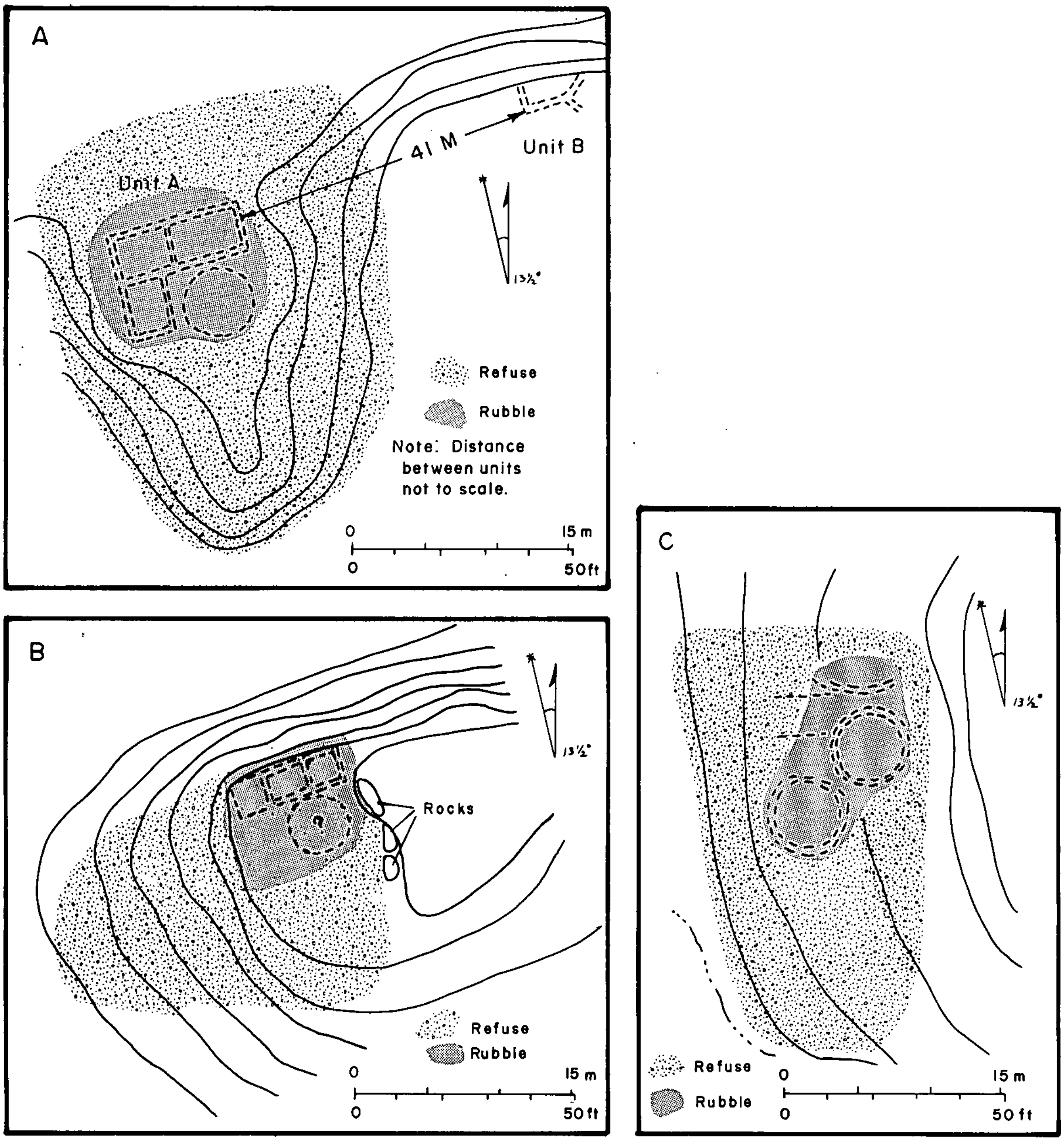

Figure 47. Site plans of selected small houses: A) P-12; B) P-4; C) P-8.

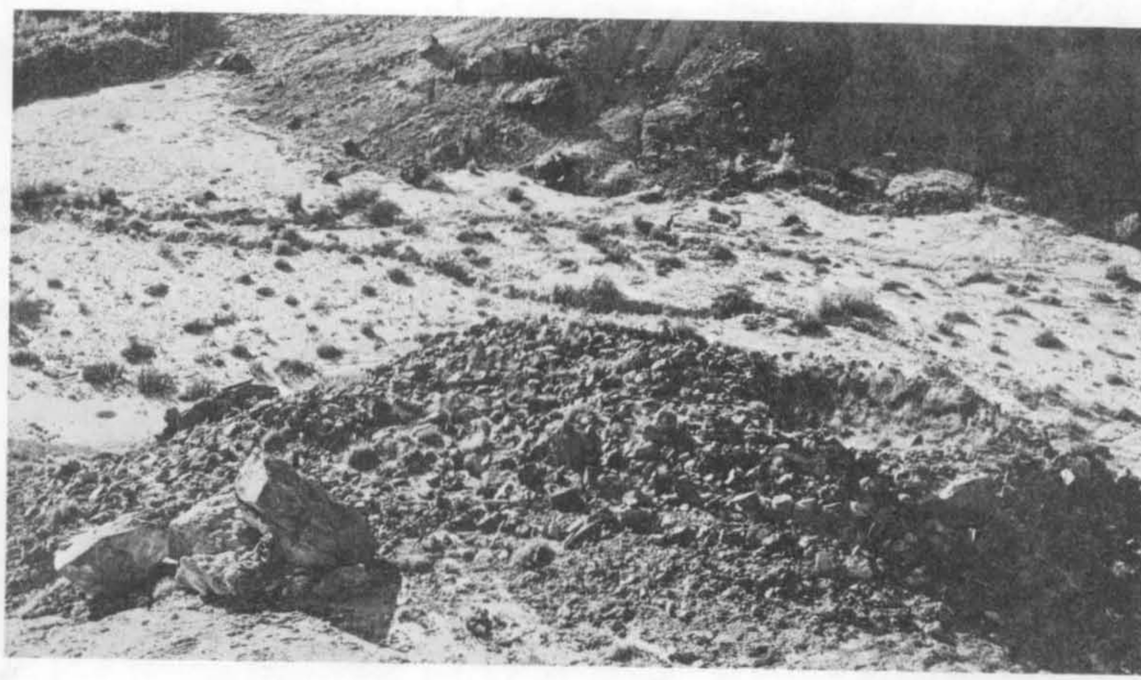

Figure 48. P-9, small house. Looking northwest.

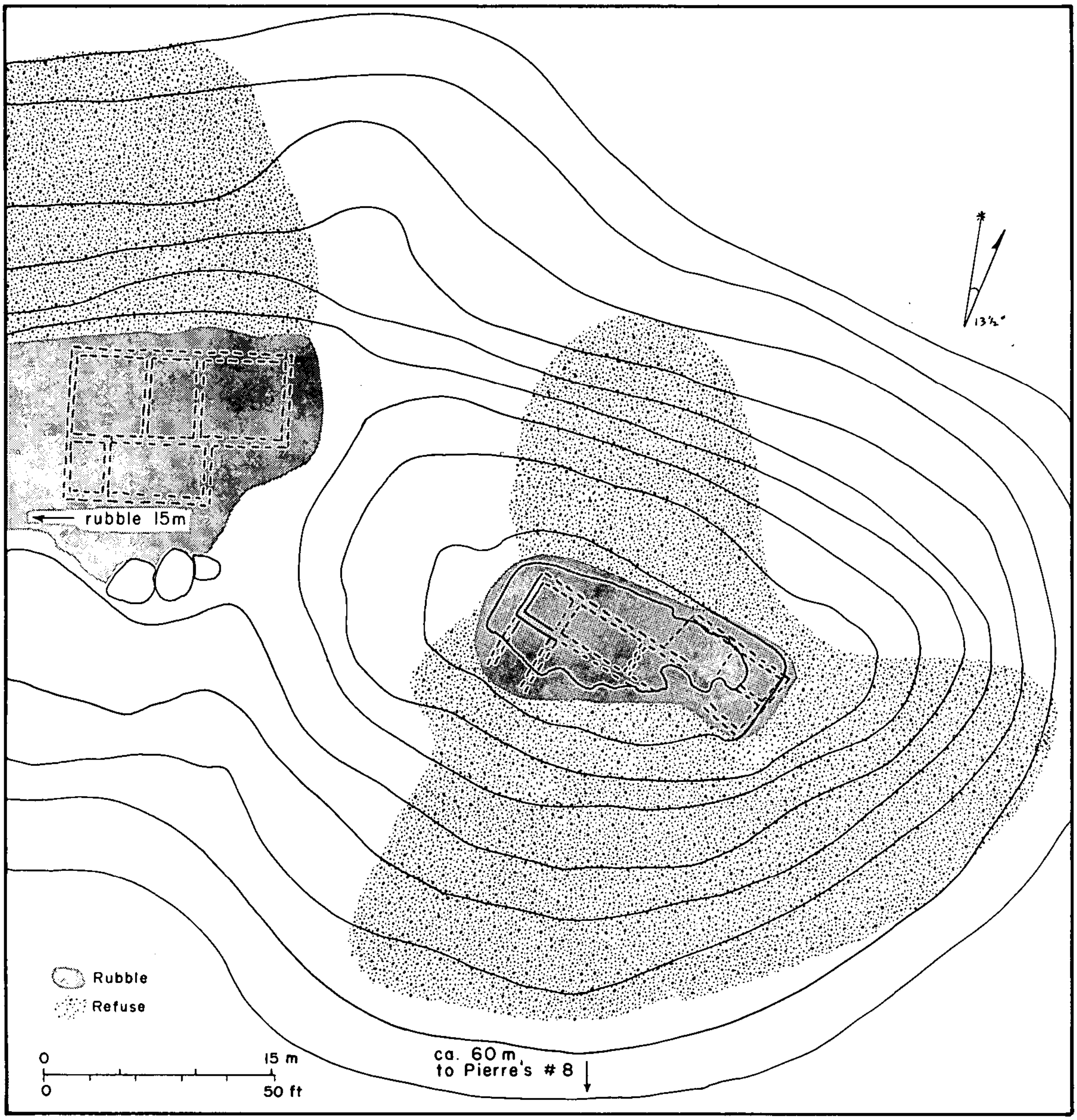

Figure 49. Site plans of small houses P-9 and P-10.

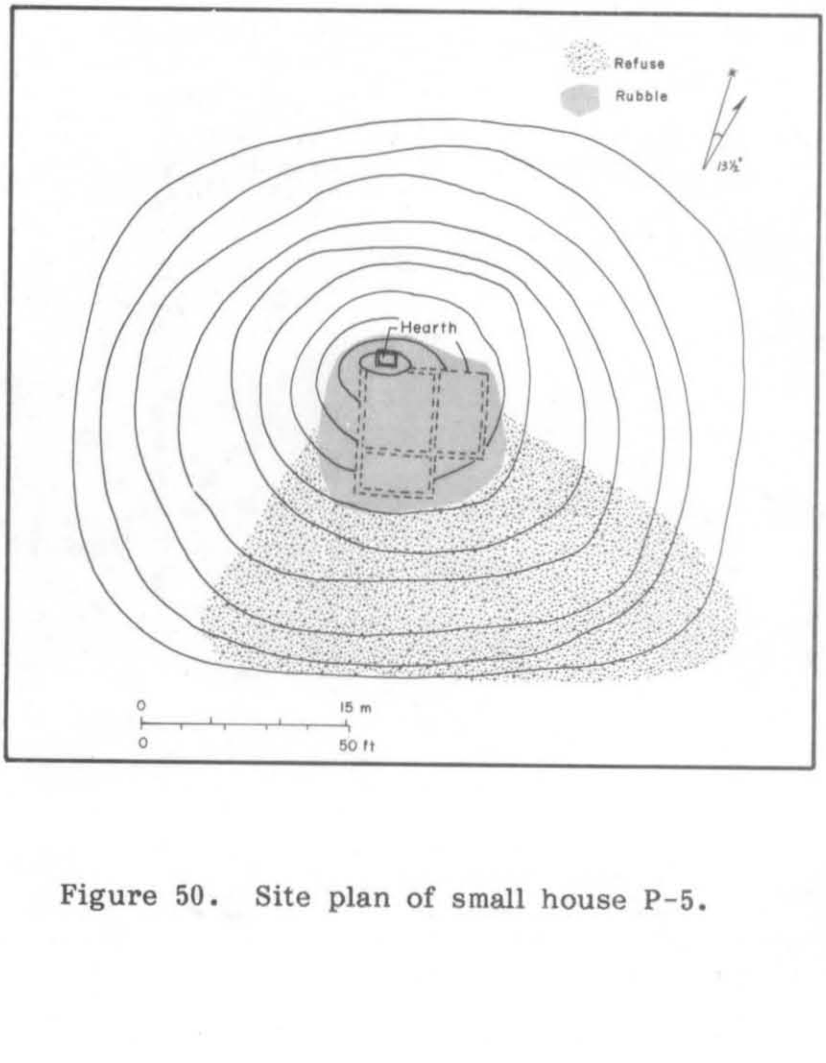

Figure 50. Site plan of small house P-5.

P-16, on a talus knoll immediately below P-15 (which lacks a kiva), has no visible kiva remains, but three thick retaining walls 5 m downslope from two of the site's four rectangular rooms may have served to support and enclose a kiva (Figure 51). Whether a kiva is present at P-15 or not, its proximity to P-16, and relative isolation from other sites suggests the two sites were closely interrelated.

Overall, a comparison of all of Pierre's small house kiva depressions and probable kiva locations with the small house room total yields a kiva-to-room ratio of 1:8.

Architecture

The Pierre's small houses use the same construction material as the Chacoan structures; however, their size ($n = 11$, $\bar{x} = 105$ m^2, $sd = 34$) and massiveness differ greatly from the Chacoan structures. Small house masonry, where exposed in intact walls, ranges from simple to core and veneer construction, with compound and core and veneer masonry most common. Occasionally, more than one type is present in a single site. The only substantial standing wall exposure from the small houses is in a pothunted room at P-10 where rough stonework of alternating blocks and slabs forms a core and veneer wall 35 cm thick (Figure 52). P-9, on a northern knoll of the same butte, has little intact masonry, but the basal blocks of several walls are composed of giant blocks and slabs up to 100 x 50 x 40 cm in size. Considering the width of this basal course, the overlying masonry, now fallen, was probably compound or core and veneer construction.

Although of core and veneer construction, the thinner (35-40 cm) walls of the small houses are reflected in the considerably more diminutive small house rubble mounds, which nowhere exceed 1 m in height (range is .25-.75 m). The size of the small house mounds is difficult to assess in many instances -- particularly for those sites located on the talus slopes where the masonry once composing the small house rooms is now scattered over a long talus slope. Ceiling heights are impossible to estimate given the collapsed nature of the walls, but at one site (P-5), there does appear to be enough masonry to suggest exceptionally high-ceilinged rooms or one or two second-story rooms.

With 35 small house rooms (56% of all small house rooms) measured for size, the mean small house room appears to be about 9 m^2, or 1 m^2 less than the mean Chacoan structure room (Table 14). While the room-size ranges of both types of sites are very similar, a small number of large rooms at the Chacoan structure account for some of the difference.

Limited Use Sites

Isolated Rooms

All six sites composing this group are clearly limited use structures, and five of the six are typologically similar to a degree sug-

Figure 51. P-16, small house. Retaining walls and possible kiva area in foreground. P-15, small house, is in background on butte top. Looking northwest.

Figure 52. P-10, small house. Detail of wall masonry in potted room. Looking northwest.

gesting comparable usage. Although all of the sites are situated on mesa-point (n = 4) or butte tops (n = 2) with good visibility, five of the sites consist of a single room or enclosure, indicated by a low, four-sided alignment of rubble (Figures 53A, B and 54). Most of the rooms are small, in the range of 2 x 2 m, although P-19 is 2 x 5 m. The amount of rubble present at each is minor, and it seems likely that the walls were not more than waist high or were supplemented by jacal construction. If the structures were roofed, the ceilings must have been supported by upright posts.

The sixth, and exceptional site, is Area C of the butte top Chacoan structure complex (Figures 40 and 43). Although this site consists of only a single room, it is, as we have noted, much larger (5 x 7 m) and may have had full height masonry walls. Furthermore, its immediate proximity to Houses A and B contrasts with the more isolated locations of the remaining sites, which are one hundred to several hundred meters from the nearest habitation sites.

The purpose of all six structures must remain for the present unknown, since several possible explanations all seem relatively unsatisfactory. Although we have noted the comparatively positive vegetative association of the mesa-point locations, the short distance from each locus to habitation sites would appear to eliminate the possibility that these are camps or work areas associated with the collection or processing of mesa-top resources. Alternately, the use of the sites as sighting stations also seems unlikely since similar or better visibility is present from most of the nearby habitation sites.

Windes' (1978c:63) suggestion that the Area C structure is a stone circle is a plausible but tentative proposal, given the structure's butte-edge location, sighting capabilities, and bedrock footing. However, the structure is rectangular, rather than circular or ovoid, and is at the small end of the size continuum of known stone circles, almost all of which are greater than 50 m^2, with circles in the 100-300 m^2 range common. The presence of alluvial fill and rubble within the structure prevents determination of the presence or absence of bedrock basins and abrading tools, which are additional important diagnostic features/artifacts associated with stone circles (Windes 1978c).

Isolated Firepit

On top of a lone butte in the southwestern portion of the Pierre's survey area (Figure 55), the survey team found a large, 3 x 3 m bedrock firepit (P-17) with an associated artifact scatter and a small midden of burned rock and charcoal (Figure 53C). Because of the excellent visibility to the north and south afforded by the firepit's location, it is quite possible that this isolated feature functioned as a signaling device to similar stations north and south on the Great North Road.

A somewhat smaller firepit (60 x 90 cm) occurs on the butte caprock at P-5, but here a number of surrounding talus rooms makes it

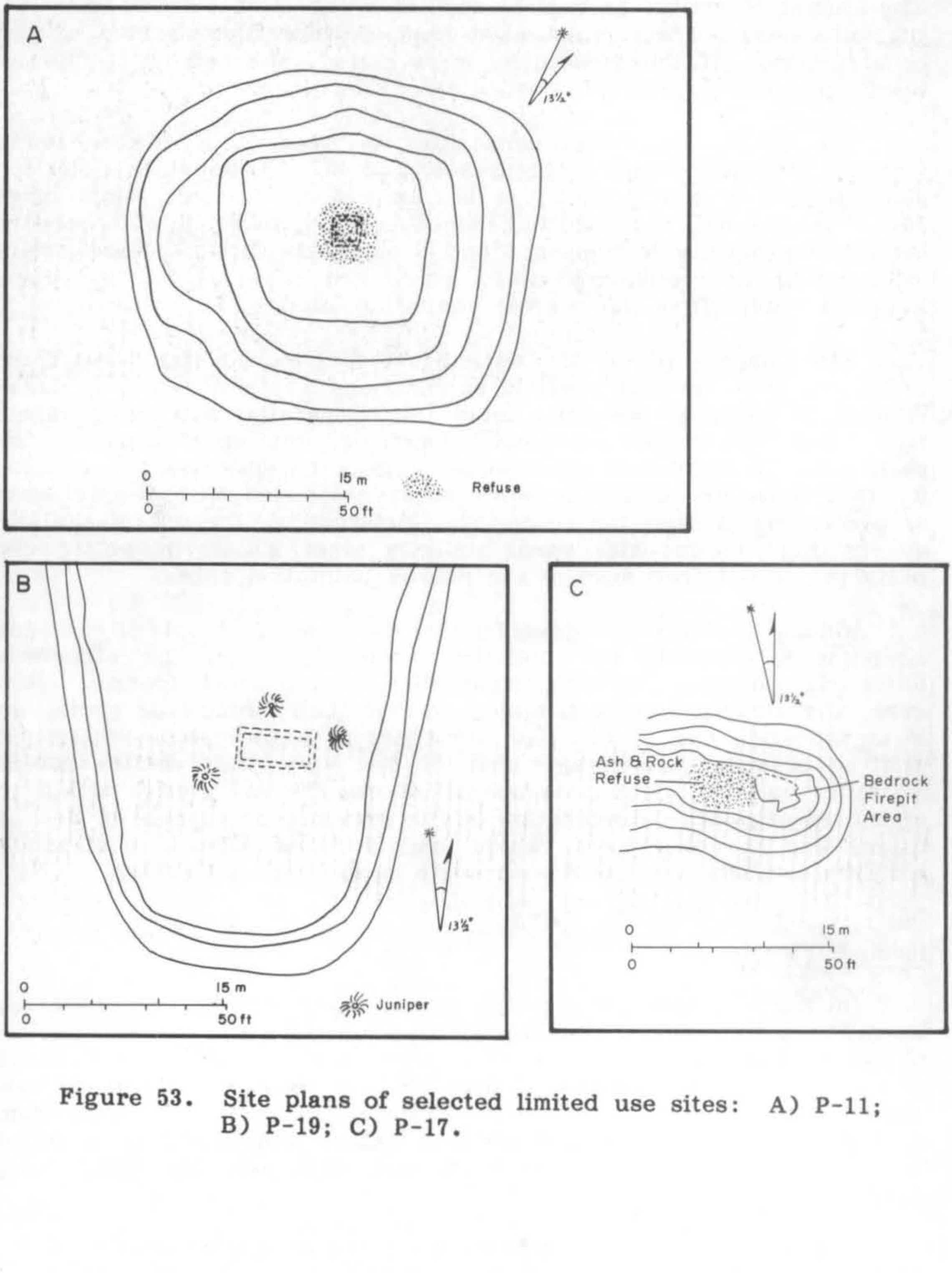

Figure 53. Site plans of selected limited use sites: A) P-11; B) P-19; C) P-17.

Figure 54. P-11. View of rubble forming isolated room foundation.

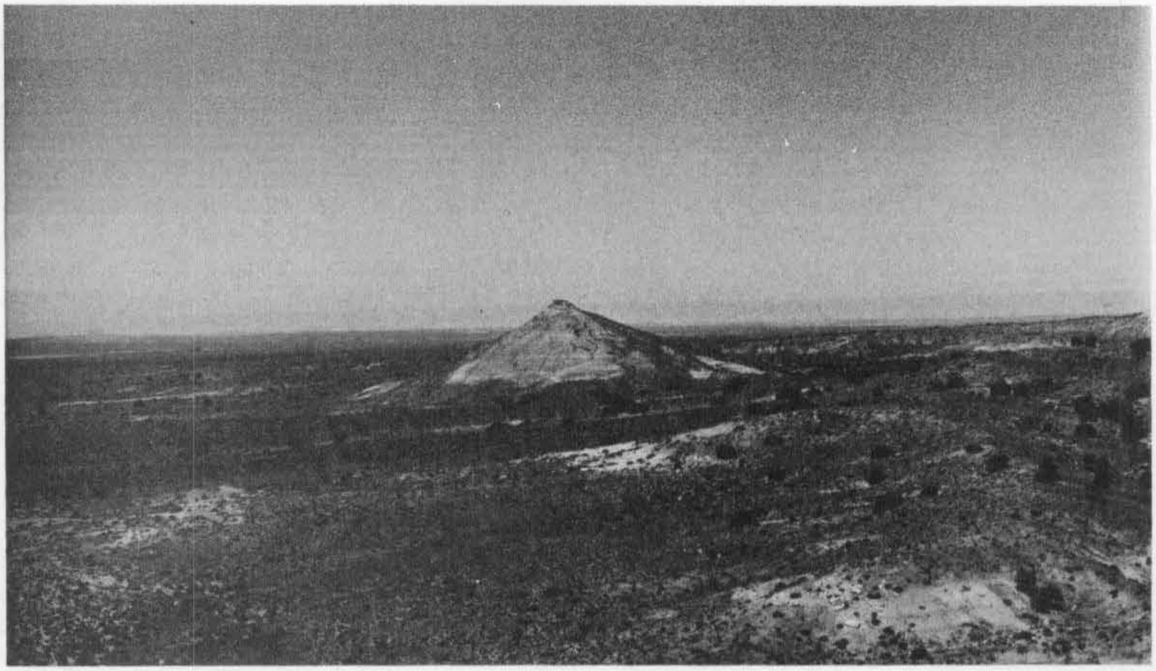

Figure 55. P-17. Signaling hearth is located atop butte. View is from Pierre's butte looking southwest.

impossible to determine whether the firepit is a signaling device or simply a domestic feature of a collapsed living room.

Miscellaneous Nonhabitation Sites

Two additional sites may also have been utilized for limited or specialized activities, but again, these functions are not presently known. P-7, composed of two contiguous rooms and an associated light scatter of trash, is situated immediately northwest of P-6 and a few meters east of the Great North Road. It is possible that this site may have been used in conjunction with the road.

P-14, situated on a small talus knoll on the western side of Pierre's Site Butte, also has two contiguous rooms and an extending wall that leads downslope for approximately 7 m. The rooms are small but have enough associated masonry to suggest they were roofed structures. A light scatter of refuse extends to the south. Possibly this site controls or "oversees" an access route to the butte top or is otherwise associated with the Pierre's Site.

Ceramics

Reflecting the short occupation of the Pierre's community, the quantity of sherds found is more comparable to that of the Bis sa'ani sites than to the Peach Springs community sites. At sites where only a very few sherds diagnostic of a temporal period are present, occupation of the site is considered conjectural. At sites where few to abundant sherds of a period are in evidence, occupation is considered definite. Table 16 documents the occupational span of each site as indicated by the ceramics; it also shows the frequency of site types by temporal period. In Appendix B, Table 6 tabulates the sherds found at each site in the Pierre's survey area by ware and style; included are the numbers of estimated surface sherds. This data is summarized in Table 16.

Temporal Dynamics

The sherds found at four sites suggest that the Pierre's survey area was occupied during Late Pueblo II times. Three small houses and one nonhabitation site produced enough pottery to indicate occupation or use. House B, two small houses, and a single isolated room also have traces of ceramic material from this interval (Table 16 and Appendix B, Table 6). However, the real site explosion within the survey area occurs during Early Pueblo III, when all three Chacoan structures, nine small houses, two isolated rooms and one additional nonhabitation site evidence occupation. Six sites yielding very few ceramics, no diagnostic ceramic material, or lacking pottery remains altogether, were probably also occupied at this time (Table 17). Although the tree-ring, archaeomagnetic, and radiocarbon dates, as well as the ceramics, indicate that the bulk of the occupation and subsequent total abandonment transpired within the confines of the Early Pueblo III, the few absolute dates provide only a poor focus on chron-

Table 16 Ceramic ware/style frequency totals

Ware/style	Totals for survey area No.	%	% of class	No. of Sites
Gray Wares:				
Plain gray	117	6	9	17
Banded gray	31	2	2	11
Ribbed gray	4	-	-	3
P-II corrugated	3	-	-	2
P-II/P-III corrugated	709	35	55	17
P-III corrugated	431	21	33	16
Class Subtotal	1295	64	99	
White Wares:				
Plain white	351	17	49	14
*BM-III/P-I	-	-	-	-
*Kana'a	-	-	-	-
Red Mesa	24	1	3	8
Dogoszhi (straight)[a]	100(5)	5(-)	14(1)	17
Dogoszhi (squiggle)	-	-	-	-
Sosi	155(16)	8(-)	22(2)	17
Flagstaff	25(6)	1(-)	3(1)	7
Puerco	1(2)	-(-)	-(-)	3
Wingate	10	-	1	5
Tularosa	-	-	-	-
McElmo	8(12)	-(1)	1(2)	9
Mesa Verde	-	-	-	-
Class Subtotal	674(41)	33(2)	93(6)	
Red Wares:				
*Plain red	17	1	39	10
*BM-III/P-I	-	-	-	-
*Thick line	15	1	34	6
Puerco	1	-	2	1
Wingate	10	-	23	2
Black & red/orange	1	-	2	1
Black and white/red	-	-	-	-
Class Subtotal	44	2	100	
Total	2013(41)	101		

( ) = carbon painted sherds.
* = frequencies are estimated from percentages.
a = includes Chaco style mineral black-on-white.

Table 17 Periods of site occupation as indicated by tree-ring dated ceramics

Site Type/ Number	BM-III/P-I 500-900	EP-II 900-975	LP-II 975-1050	EP-III 1050-1175
Chacoan Structures:				
Pierre's Site:				
House A				F
House B			VF	F
P-6				
House				F
Trash A				F
Trash B				F
Small houses:				
P-1				VF
P-3				F
P-4				F
P-5			VF	F
P-8				F
P-9			F	F
P-10			F	F
P-12				
Unit A				F
Unit B			VF	
P-13			F	F
P-15				F
P-16				VF
Limited Use Sites:				
Isolated Rooms:				
P-2				0
P-11				F
P-18				VF
P-19				0
P-20			VF	F
Pierre's Site				
Area C				F
Isolated firepit:				
P-17				0
Non-habitation:				
P-7				F
P-14			F	VF
Subtotals				
A	0	0	0	0
F	0	0	4	14
VF	0	0	4	4
0	0	0	0	3
Total No. of Sites	0	0	8	21

Explanation of symbols:

A - Abundant sherds with styles of indicated period. Site occupied during indicated period.

F - Very few sherds with styles of indicated period. Site occupied during indicated period.

VF - Very few sherds with styles of indicated period, or sherds with styles of conjectural temporal placement. Site may have been occupied during indicated period.

0 - No diagnostic ceramics.

ology within the period. Furthermore, the ceramics provide virtually no control over intraperiod trends.

The relatively small amounts of refuse (ceramic and otherwise) found on the sites do, however, provide one informative clue: presuming permanent occupation, settlement of the majority of sites could not have extended more than a few years prior or subsequent to the P-27 hearth dates, nor much beyond the 1124r date. Although a very few Late Pueblo III ceramics have been found associated with the Great North Road (Morenon 1977), none were seen in the survey area.

Styles and Quantities

The full range of styles encountered in the survey area is shown in Table 17 and Appendix B, Table 6. A Red Mesa-style variety carrying simpler decoration than the Red Mesa Black-on-white illustrated by Gladwin (1945) is present in moderate quantities at a number of Late Pueblo II and Early Pueblo III sites. Dogoszhi-style mineral and Sosi-style black-on-whites predominate at these sites and appear to be of the Cibola Series. Chaco-style black-on-white is also relatively abundant at Early Pueblo III sites. Carbon paint styles are also present in some quantity and appear more similar to McElmo-style black-on-white, Chaco variety, than to the San Juan styles. The Pierre's sites revealed very few redwares (generally Puerco Black-on-red or a related style) and no polychromes of the White Mountain redware series. Almost no incised utility sherds were noted.

The number of sherds found on the Pierre's sites falls between the massive quantities of ceramic material found at the Peach Springs sites and the scant remains at the Bi sa'ani sites. Two of the Chacoan structures (House A and B) have a large number of exposed surface sherds (Appendix B, Table 6), while P-6 with few surface sherds is probably seriously under-represented. The number of sherds estimated at small houses shows a wide range of variability, with most sites clustering in the 100-500 range. P-10 exceeds all other small houses, and possibly all the Chacoan structures, with an estimate of 100,000+ sherds. Limited use sites, as elsewhere, generally display very few sherds, the majority having less than 100 (Appendix B, Table 6).

Lithic Materials

Lithic remains are generally sparse at the Pierre's sites. Only four sites are estimated to have more than 100 flakes present on the surface (Appendix B, Table 9). Diversity of materials is also limited, with only a few types accounting for the bulk of the lithics sampled (Table 18).

Silicified Woods

The most common wood is a yellow jasper-like silicified wood, (#1151) accounting for 22% of all flakes (Table 18). This type is fre-

Table 18 Lithic material frequency totals

Material Type	Totals for survey area No.	Totals for survey area %	Percent of class	No. of sites
Cherts:				
1011	117	23	91	10
1040	-	-	-	-
1042	1	-	1	1
1050	-	-	-	-
1051	-	-	-	-
1052	-	-	-	-
1053	-	-	-	-
1060	-	-	-	-
1070	-	-	-	-
1072	7	1	5	3
1080	2	-	2	2
1090	1	-	1	1
1091	-	-	-	-
1425	-	-	-	-
(Class Subtotal)	(128)	(25)	(100)	
Silicified Woods:				
1112	68	13	19	13
1113	79	15	22	13
1120	10	2	3	6
1130	2	-	1	2
1140	75	15	21	17
1142	7	1	2	5
1151	114	22	32	14
(Class Subtotal)	(355)	(69)	(100)	
Obsidian:				
3510	-	-	-	
3520	2	-	100	2
Quartzite 4000:				
Fine	-	-	-	-
Medium	7	1	26	4
Coarse	20	4	74	8
Brushy Basin 2205	-	-	-	-
(Class Subtotal)	27	(5)	(100)	
Total	512	99		

quently encountered in the northern third of the Chaco Basin but is rare in the southern part. In general, it is uncommon in most of the San Juan Basin. This jasper-like wood apparently outcrops in the upper Kirtland Formation and in the Ojo Alamo Formation.

Woods in general are quite common (70% of all flakes), with dark (#1112), white (#1113), and chalcedonic (#1140) varieties all only slightly less common than the jasper-like wood. Abundant in-situ wood, mostly of poor quality, was noted in the area, including whole logs in the upper parts of the Kirtland Formation.

Cherts

Also abundant within the survey area (23%), but infrequent throughout the rest of the San Juan Basin, are fossiliferous chert cobbles (#1011) found in the conglomeratic units of the Ojo Alamo Formation. Besides the cobble cherts, the only nonwood chert to exceed 1% of the assemblage is the distinctive yellow-brown chert with black inclusions (#1072). Presently, the only known source of this material is from the Oso Ridge area of the eastern Zuni Mountains some 120 km to the south (Whitmore 1978). However, this type was noted at only three sites (Table 18) and comprised only 1.4% of the total assemblage.

Obsidian

Only two flakes of obsidian (#3520) were noted, both from the Valle Grande-Redondo Peak area of the Jemez Mountains, 125 km to the southeast.

Quartzite

Quartzite, found locally in cobbles in the Ojo Alamo Formation, is moderately abundant (5%).

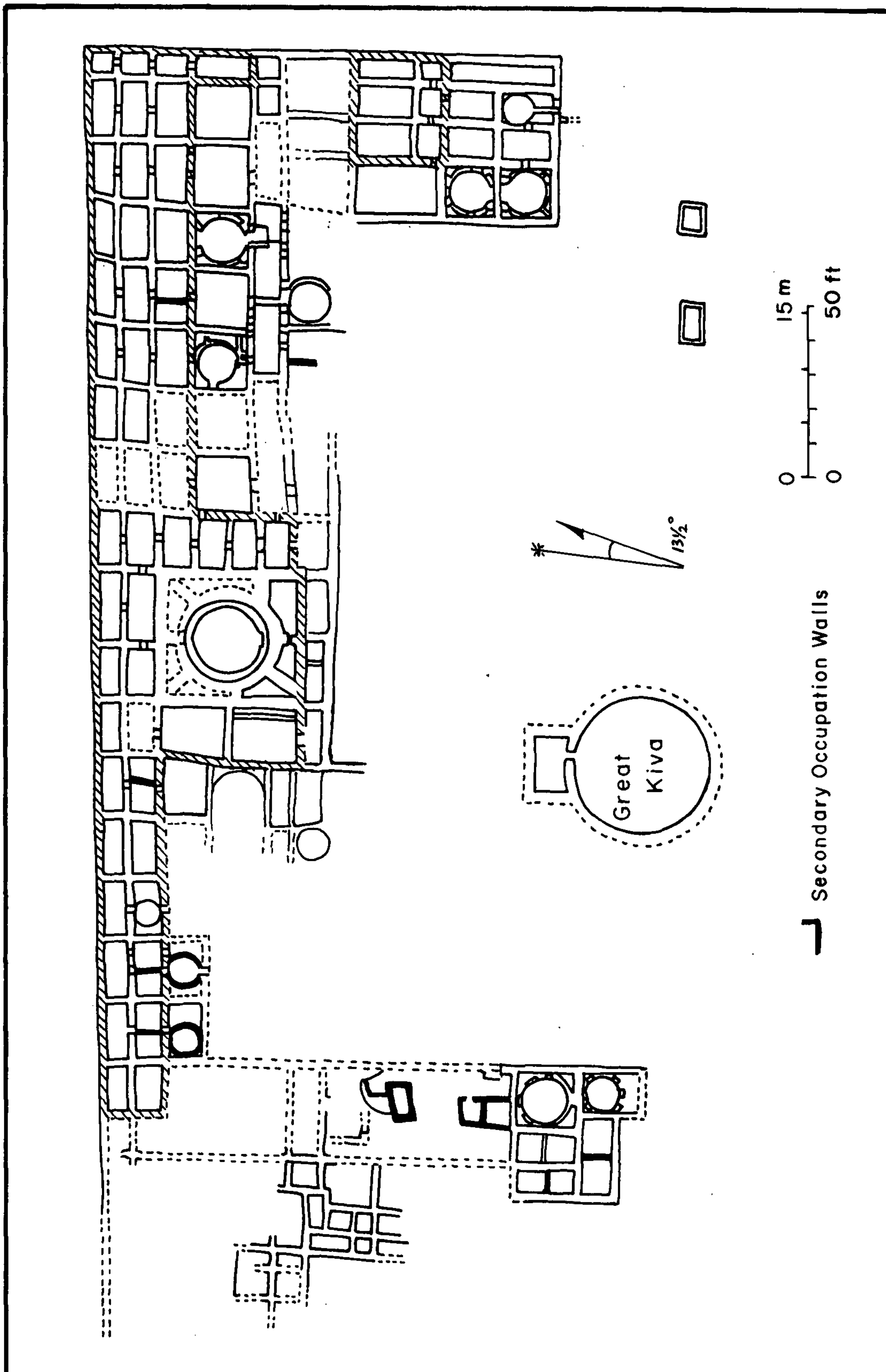

Figure 56. Salmon (after Irwin-Williams 1976, revised 1977).

5

THE RECONNAISSANCE AND LITERATURE SURVEY

In this chapter basic descriptive site information on 33 Chacoan outliers in the San Juan Basin is presented. Our original intent was to include all known outliers, but as sites continued to be identified, it became apparent that this would be impossible. As such this sample includes most Chacoan outliers previously identified in the literature as well as all other outliers that we had visited or were aware of in 1977.

The following discussion of sites is generally ordered according to their location, beginning with sites on the San Juan River and areas further north, then progressing southward to the Chaco Basin, and ending with outliers in the Rio Puerco West, Zuni, Rio San Jose and Mt. Taylor areas.

While it is the purpose of this chapter to present a range of descriptive data, some of this information is more appropriately presented in table form as part of the chapter 6 analysis. Accordingly, ecological zone and soil and agricultural potential data are presented entirely in chapter 6.

Salmon

This Chacoan structure is located on the first gravel terrace on the north bank of the San Juan River, southwest of Bloomfield, and southeast of Farmington, New Mexico (Figure 1). Elevation is 1,653 m (5,420 feet) above sea level.

No prehistoric roads have been positively identified in the Salmon vicinity, but it is generally supposed that the Great North Road, after entering the upper portion of Kutz Canyon, follows the wash bed to the mouth of Kutz Canyon, opposite Salmon (Lyons and Hitchcock 1977:118). Little or no remote sensing analysis has been performed in the Salmon area.

Site Remains

Chacoan Structure

Salmon Ruin is an E-shaped structure of approximately 175 rooms (Figures 56 and 57), possibly rising to three stories in some sections, with two stories in many other portions of the site (Irwin-Williams 1972:4-6). The mound rises 4-5 m, and a total floor area of 8,320 m^2 is estimated with second-story room areas included. Like many large Chacoan structures, an arc of rooms enclosing the plaza and connecting the ends of the southern wings is probably present.

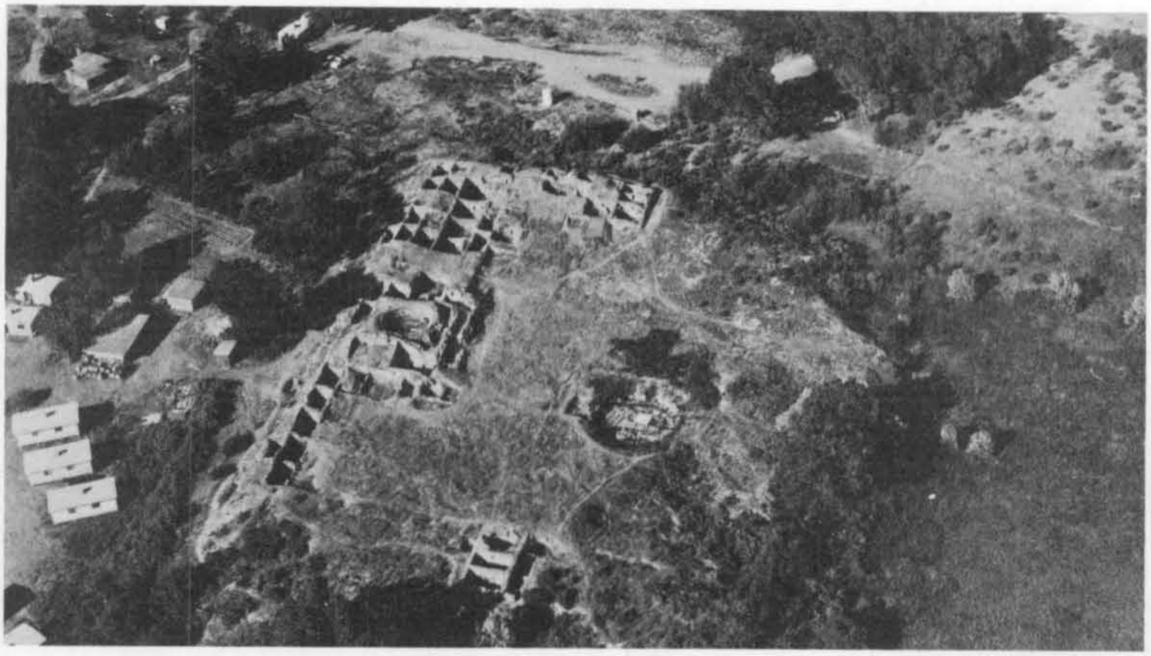

Figure 57. Salmon Chacoan structure after excavation by the San Juan Valley Archaeological Project.

The mean size of rooms at the site is approximately 18.5 m^2. Ceilings are high, although data on heights are not yet available. Masonry is entirely sandstone, with walls of core and veneer in the Chaco style.

Only two early kivas, a buttressed second-story "Chaco-style" kiva in the center of the site and a plaza great kiva are known. A substantial number of other kivas and many architectural alterations are the result of a subsequent thirteenth-century occupation of the site, probably following partial or complete abandonment by the original occupants (Irwin-Williams 1976).

Numerous dendrochronological cutting dates indicate that most of the Chacoan structure was constructed between 1088 and 1094, with some additional cutting dates between 1103-1107. Whether or not the timbers were stockpiled, the short date span suggests planned, large-scale construction. Remodeling is indicated by construction dates in the mid-1200s and especially by the reroofing of the great kiva (Irwin-Williams 1978:personal communication).

No trash mound is present today, but if refuse mounds were located south of the site, they may have been washed away by San Juan River floods.

Other Sites

Survey conducted in the area around Salmon is reported to have revealed a substantial number of adjacent Anasazi sites (Whalley and Yingst 1978:personal communication). It is not known whether Salmon is part of a community that includes these sites. Data on these are available at the San Juan County Museum at Salmon Ruin; however, they have not been examined due to time limitations inherent in this study. Personal observations by two of the authors and McKenna (1976:24) indicate that a large but poorly preserved site in the flats to the west and a small cobblestone ruin on a gravel hill directly to the north are the nearest partially contemporaneous sites. The latter site, with Cibolan Pueblo II and Early Pueblo III ceramics, is probably a small house (McKenna 1976:Addenda VI).

Ceramics

Ceramic frequencies from the early or "Chacoan" deposits at Salmon are not yet available, but overall frequencies for all ceramics recovered give some idea of the series affiliations and types represented. The great majority of the identified decorated ceramics found in situ and in refuse contexts at Salmon are San Juan wares (31%) characteristic of the Late Pueblo III period. The site's earliest occupational and trash strata do contain some Early Pueblo III decorated ceramics of Cibolan manufacture -- although, cumulatively, these account for only 2% of the total ceramic assemblage. Even during this initial occupation, local San Juan series ceramics, including such types as Mancos, Wetherill, and McElmo Black-on-white are predominant. Cibolan decorated types include Escavada, Gallup, Chaco, and Chaco-McElmo Black-on-whites (Franklin 1976; Yingst 1978:personal communication). Tusayan, Mogollon, and Chuskan intrusives account for slightly over 1%.

Lithics

The lithic assemblage recovered from Salmon is dominated by cherts and chalcedonies (35%). Washington Pass chert (#1080), which forms 1% of the assemblage, is the only known intrusive. Miscellaneous sedimentary materials account for another 13%; of these, less than 1%, including limestones, Nacimiento orthoquartzite, and Brushy Basin claystones, are identified as intrusives. Miscellaneous igneous materials, dominated by basalt, comprise another 20%. Here, obsidian is the only igneous intrusive, accounting for 1%. Miscellaneous metamorphic materials complete the assemblage, being second in frequency (33%) only to the cherts and chalcedonies.

Although the above frequencies do not allow individual examination of early versus late occupation material types and frequencies, a sample of early and late occupation units excavated up to 1976 suggests a higher occurrence of Washington Pass chert (n = 12, 6%) in the early, Chacoan stratigraphic units as opposed to late units (n = 1, <1%, Lawrence 1976). The sample size is so small, however, that such indications must be considered tentative at best.

Sterling

This Chacoan structure is located on the western edge of the alluvial terrace bordering the Stewart Canyon arroyo near its junction with the San Juan River south of Farmington and southwest of Bloomfield (Figure 1). Elevation is 1,616 m (5,300 feet) above sea level.

No prehistoric roads are known in the vicinity of the Sterling Ruin. Examination of aerial photo imagery has not been conducted to date.

Site Remains

Chacoan Structure

The Sterling site appears to be an E-shaped structure with an estimated 25 rooms and one early, Chaco-style kiva (Figure 58). The entire structure is one-story high, with a very rough estimate of 1685 m^2 for the floor area. Alluviation prevents an estimation of the mound height and makes it impossible to determine the scale of planning involved in the construction of the site. Walls are reported to be of core and veneer Chaco-style masonry (Figures 59 and 60) (McKenna 1977:

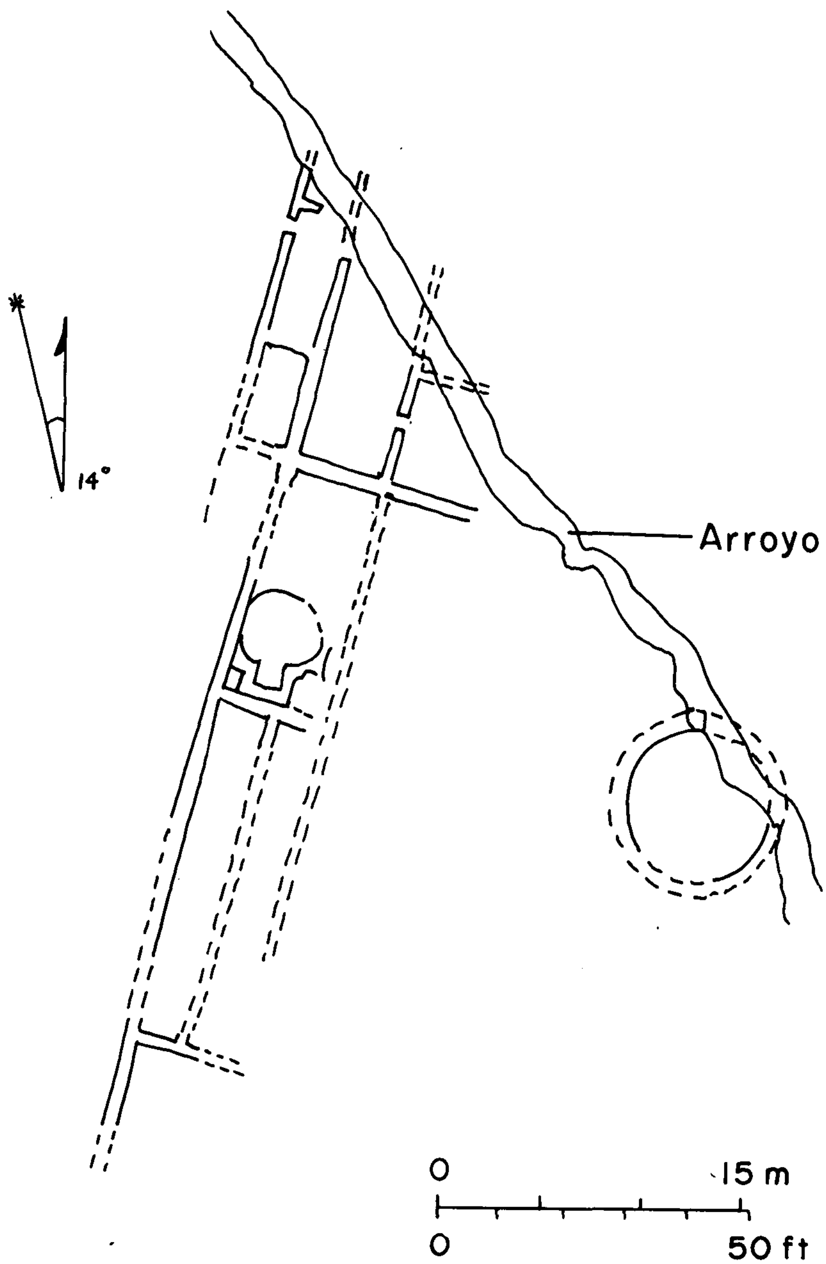

Figure 58. Sterling (after New Mexico Archaeological Society).

Figure 59. Sterling Chacoan structure. Eroded sandstone and cobble masonry in rooms excavated by New Mexico Archaeological Society under the direction of the San Juan Valley Archaeological Project.

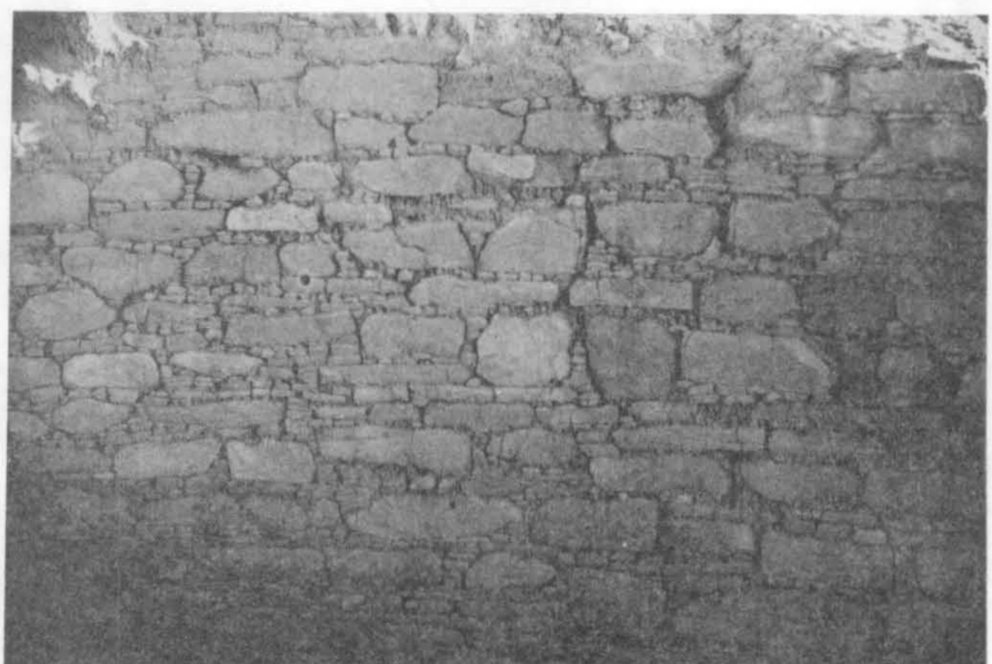

Figure 60. Sterling Chacoan structure. Chacoan masonry in partially excavated large kiva.

personal communication), although at least some walls are probably of simple or compound construction. Whalley and Yingst (1978) report the presence of Hawley's Type I masonry, and Red Mesa Black-on-white pottery, indicating initial occupation in Early Pueblo II. Ceiling heights are not known.

Erosion of the northern portions of the site has resulted in the destruction of an unknown number of rooms, and half of the Chacoan kiva has been washed away. Excavations under the direction of Cynthia Irwin-Williams tested two rooms, extra-structure areas, and the Chacoan kiva in addition to a later San Juan-style kiva. This latter kiva, as well as the bulk of the cultural material recovered from the test excavations, indicate a subsequent and substantial Late Pueblo III occupation.

Other Sites

The San Juan Valley Archaeological Project has recorded a number of other sites in the vicinity of Sterling (Whalley 1978:personal communication), but these records have not been examined. Also, it is not known whether these sites comprise a community which includes Sterling.

Ceramics and Lithics

Ceramic and lithic data recovered from this site during test excavations are unpublished. Whalley and Yingst (1978) do note the presence of both Red Mesa Black-on-white and Mesa Verde Black-on-white, indicating both Early Pueblo II and Late Pueblo III occupation. Occupation during intermediate periods is also presumed.

Site 39

This Chacoan structure and surrounding sites are located near the confluence of Barker Arroyo and the La Plata River, north-northwest of Farmington and south-southwest of La Plata, New Mexico (Figure 1). Elevation is 1,708 m (5,600 feet) above sea level.

Archaeological investigations have not documented any roads in association with Site 39, and, as of this writing, aerial photo imagery examination of the Site 39 area has not been conducted.

Site Remains

Chacoan Structure

Site 39 is an aggregation of numerous house mounds and refuse areas. A number of structures in the "site" were extensively excavated and trenched by Earl H. Morris in 1916 (Morris 1939). Within this cluster, only Building I, a 2.6 m-high mound, was completely excavated and proposed as a Chacoan structure (Figure 61). This building (Figure 62), a rectangular and symmetrical structure, was clearly built as a planned unit of approximately 40 rooms and two kivas. The two northern tiers of the house are thought to have been two-stories high. Including these second-story areas, a total floor area of approximately 730 m^2 is estimated.

Walls are of core and veneer and compound masonry, but they also utilize unshaped river cobbles for many interior walls and wall cores. Carefully shaped sandstone blocks with considerable chinking form the veneers, particularly on the outside walls (Morris 1939:52-53). The overall appearance of the masonry, as illustrated by Morris (1939: Plates 3, 7, 9, and 11), is closest to that of the Chaco Canyon McElmo houses and the McElmo masonry of the San Juan area.

Rooms in the structure have a mean size of 9.5 m^2, while the ceiling heights, if accurately reflected by a 2.3-m floor-to-viga span in one room, were high. Of the two kivas present, one has few distinguishing features while the other displays predominantly San Juan furnishings (Morris 1939:50-53).

North of the structure is a refuse mound believed to have been used in conjunction with it. Morris (1939:50-53) assigns an Early Pueblo III date to the structure on the basis of the house fill and refuse sherds, with occupation continuing up to the beginning of Late Pueblo III.

Other Sites

The aggregation of sites forming the Site 39 cluster appears to be the core of a substantial community. Deric Nusbaum's 1935 Carnegie survey data on file at the Laboratory of Anthropology, Museum of New Mexico, show sites along the mesa top to the north and south of Site 39, but collecting unpublished data on these sites was beyond the means of this project.

Within the Site 39 cluster, the group of rubble mounds and extensive refuse heaps to the north of Building I (Figure 63) display ceramics ranging from Basketmaker III to Late Pueblo III. They include a probable Pueblo II to Early Pueblo III great kiva (Figure 64) and at least four small houses and associated refuse areas also of probable Late Pueblo II to Early Pueblo III date (McKenna 1976; Morris 1939:54-55).

One additional site, Building VII, surveyed by Nusbaum in 1935 subsequent to Morris' excavations, was thought by Nusbaum to have some Chacoan architectural attributes. While portions of Building VII were constructed with Chacoan-structure architectural techniques, the Late Pueblo III San Juan pottery types associated with this portion of the

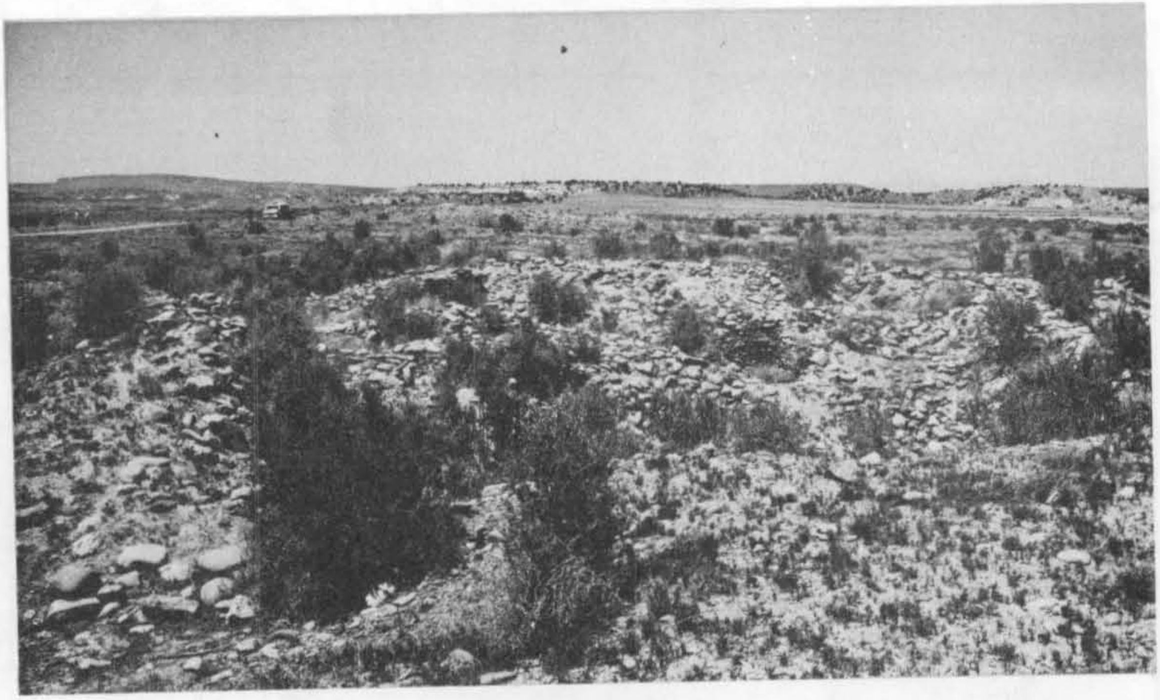

Figure 61. Site 39. Western portion of Chacoan structure (Building I). Most walls have collapsed since Morris' 1916 excavations, leaving little visible masonry.

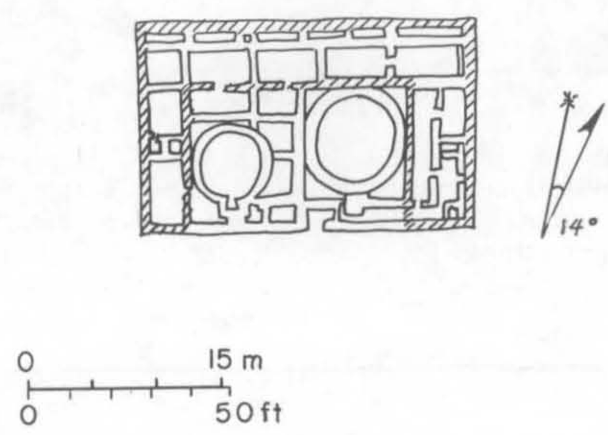

Figure 62. Site 39, Building I (after Morris 1939).

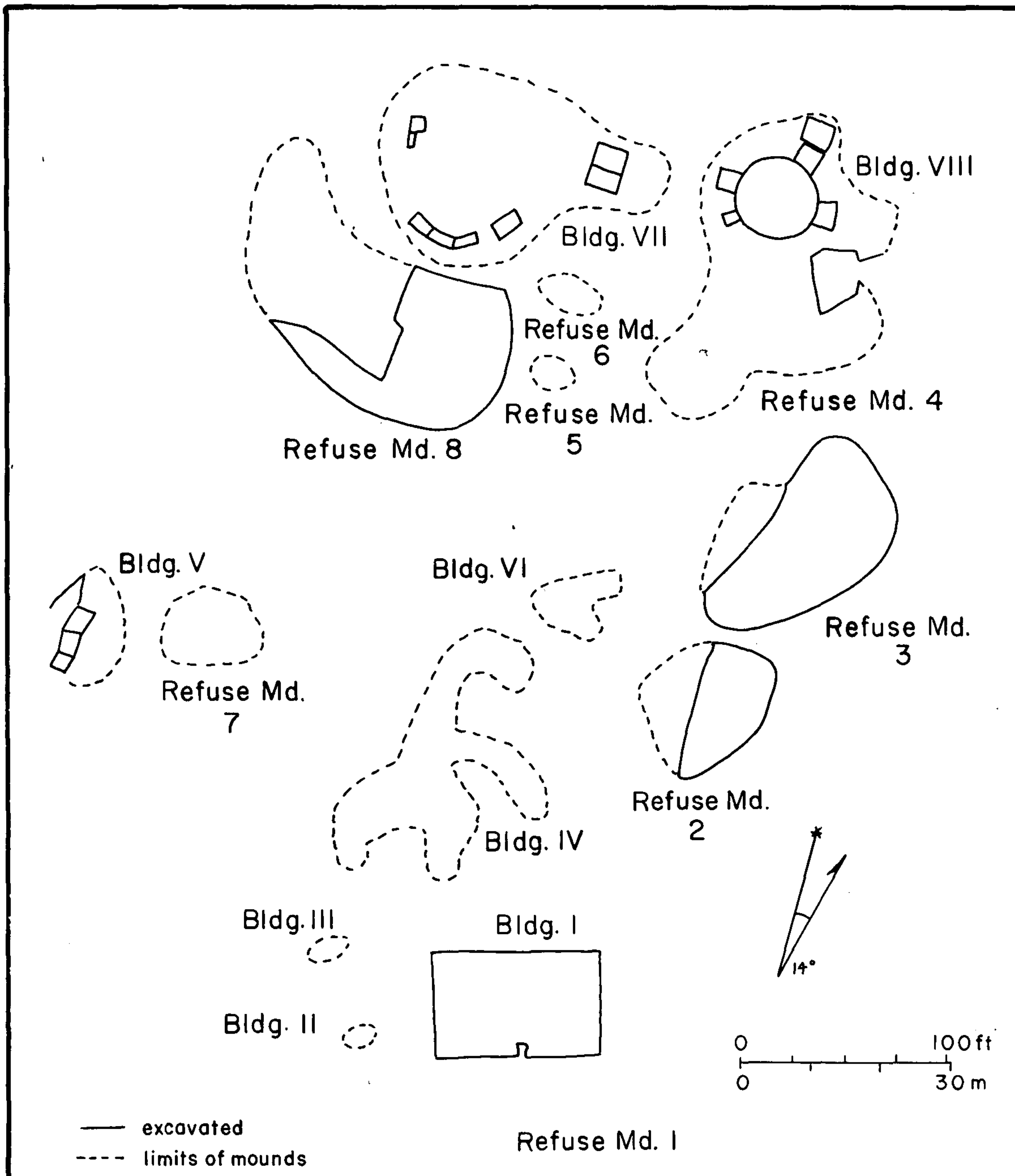

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Figure 63. Site 39, community nucleus (after Morris 1939).

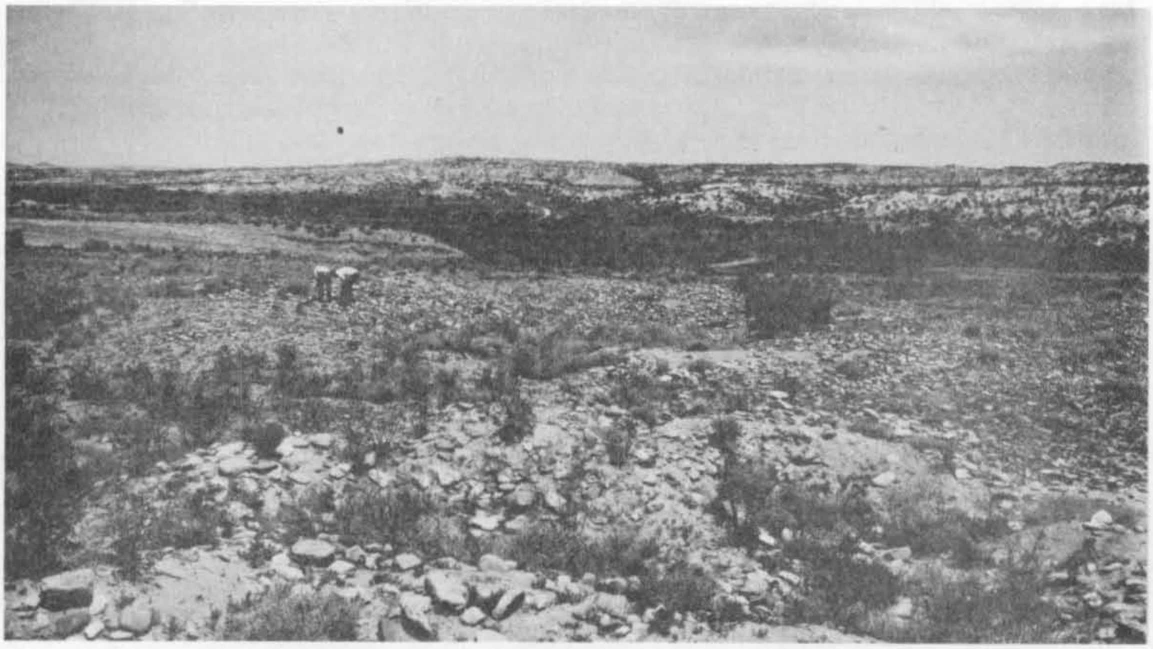


Figure 64. Site 39. Great kiva depression (Building VIII) from vicinity of Building VII. View is to the northeast up the La Plata Valley.

mound suggest construction subsequent to the occupation of Building I and other sites in the aggregation (Morris 1939:54-55).

Ceramics

Morris (1939:53) comments that he found Pueblo III Chacoan sherds on the floors and in the refuse-filled rooms of Building I. He recounts that in the refuse piles north of the structure he excavated sherds that in "quality of paste, surface treatment, and ornamentation, might have come from the dump at Pueblo Bonito" (Morris 1939:53). While this seems like strong testimony for a Chacoan origin of the Building I ceramics, recent analysis of ceramics recovered from test pits and surface collections from Site 39 indicate only minimal quantities of Cibolan ceramics (1%), although adequate testing of refuse mounds specifically associated with Building I has not been carried out (McKenna 1976). Rather, San Juan-series types comprise the bulk of the identifiable ceramics (12%) while Tusayan (<1%) and Chuskan series types (1%) occur in negligible quantities (McKenna 1976).

Lithics

No specific information on material types or frequencies of lithics recovered at Site 39 is provided, although Morris (1939:128) notes that jasper, quartzite, chalcedony, and obsidian are chipped-stone materials encountered throughout the ruins along the La Plata. He rules out river gravel as a potential source for the majority of this material, believing that little of it is amenable to manufacture. With the exception of the obsidian, all are thought to be local materials.

Site 41

This outlier community is located on a high gravel terrace above the west bank of the La Plata River, south of the Colorado-New Mexico border and north-northwest of La Plata, New Mexico (Figure 1). Elevation is 1,826 m (5,990 feet) above sea level.

Archaeological investigations have not documented any prehistoric roads in the vicinity of Site 41, nor have any aerial photo imagery examinations of the area been conducted to date.

Site Remains

Chacoan Structure

Site 41 is one of the largest aggregations of Anasazi sites on the La Plata River, including over 30 house mounds and associated refuse areas within less than 1 km^2. Prominent within this complex is a single D-shaped house mound 3-4 m high that is fronted on its southwest corner by an enclosed great kiva unit (Figures 65 and 66). Much of the structure is two stories high (Figure 67). It includes about 75 rooms and at least three kivas. Cumulatively, a total floor area of 2,875 m^2 is estimated. Potholes throughout the structure reveal rooms with a mean size of 9 m^2 and high-ceilinged rooms (exact height not known) with core and veneer walls of banded, Chacoan-style masonry.

Three charcoal (beam ?) specimens recovered from the backdirt of pothunter excavations have yielded dates of 944+r, 995+r, and 1011+vv, raising the possibility of early 1000s construction. Obviously, without more dates from controlled excavation, it is impossible to determine how many building periods were involved in the construction of the site or the scale of construction planning. That the structure had been abandoned by Late Pueblo III is suggested by the remains of a Late Pueblo structure that overlies portions of the earlier Chacoan structure.

Numerous refuse mounds and a constant scatter of debris surround the site, but no refuse mound definitely associated with the "Chacoan" occupation of the site has been identified.

Other Sites

The large number of closely packed sites within the Site 41 cluster clearly forms a community core area (Figure 68). Outside of the immediate area mapped by Morris (1939), additional sites extend to the north and south; but Nusbaum's 1935 survey data on these are unpublished. Included within the Site 41 cluster are Anasazi remains ranging in date from Basketmaker III to Late Pueblo III. During the Early Pueblo III period, at least 7 of the 30 small house sites were occupied in addition to the Chacoan structure. In view of the great deal of Late Pueblo III construction and reoccupation at Site 41 (Morris 1939:85-113), it is likely that a substantial number of other Early Pueblo III structures, once existent, were razed or remain totally obscured by the Late Pueblo III construction and debris.

Ceramics

Ceramics collected by the San Juan Valley Archaeological project from test and surface proveniences at Site 41 range from Basketmaker III to Late Pueblo III types. They are primarily of the San Juan ceramic tradition (12%)(McKenna 1976). Only a test trench immediately north of the Chacoan structure and another near a large kiva have revealed moderate percentages of Pueblo II and Early Pueblo III Cibolan ceramics (8.5 and 2%, respectively). Cumulatively, the Cibolan material derived from these trenches, in addition to all other Cibolan sherds recovered, comprise about 1% of the total ceramic sample. Traces of Tusayan and Chuskan ceramics are present, but together these do not even account for 1% of the ceramics recovered.

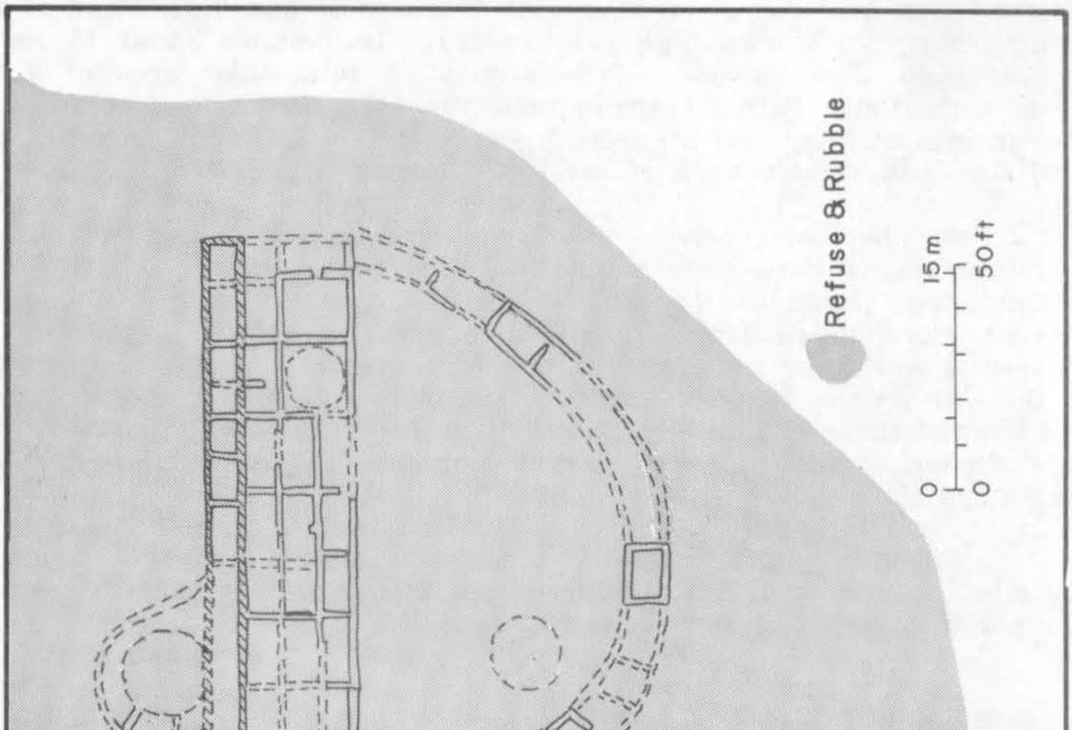


Figure 65. Site 41, Chacoan structure (after McKenna 1976).

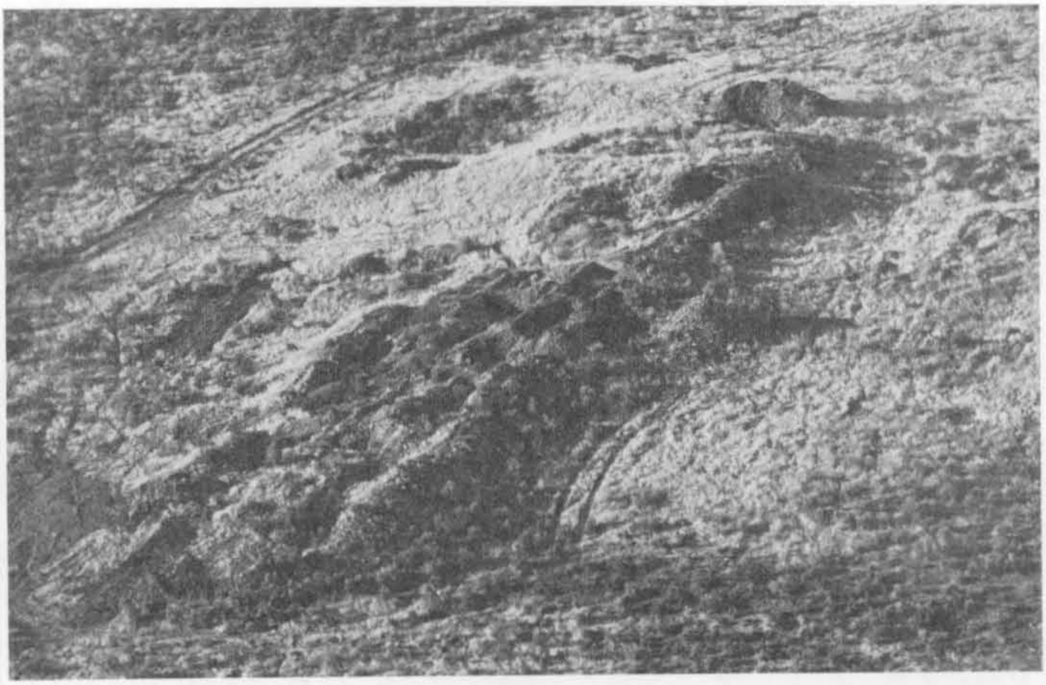


Figure 66. Site 41. Overview of the Chacoan structure with great kiva depression and plaza fronting the linear roomblock. Looking southwest.

Figure 67. Site 41. Partially excavated room in Chacoan structure. Square holes above doorway are primary beam sockets for first story roof/second story floor. Veneer stones are fire-reddened suggesting possible burning of structure.

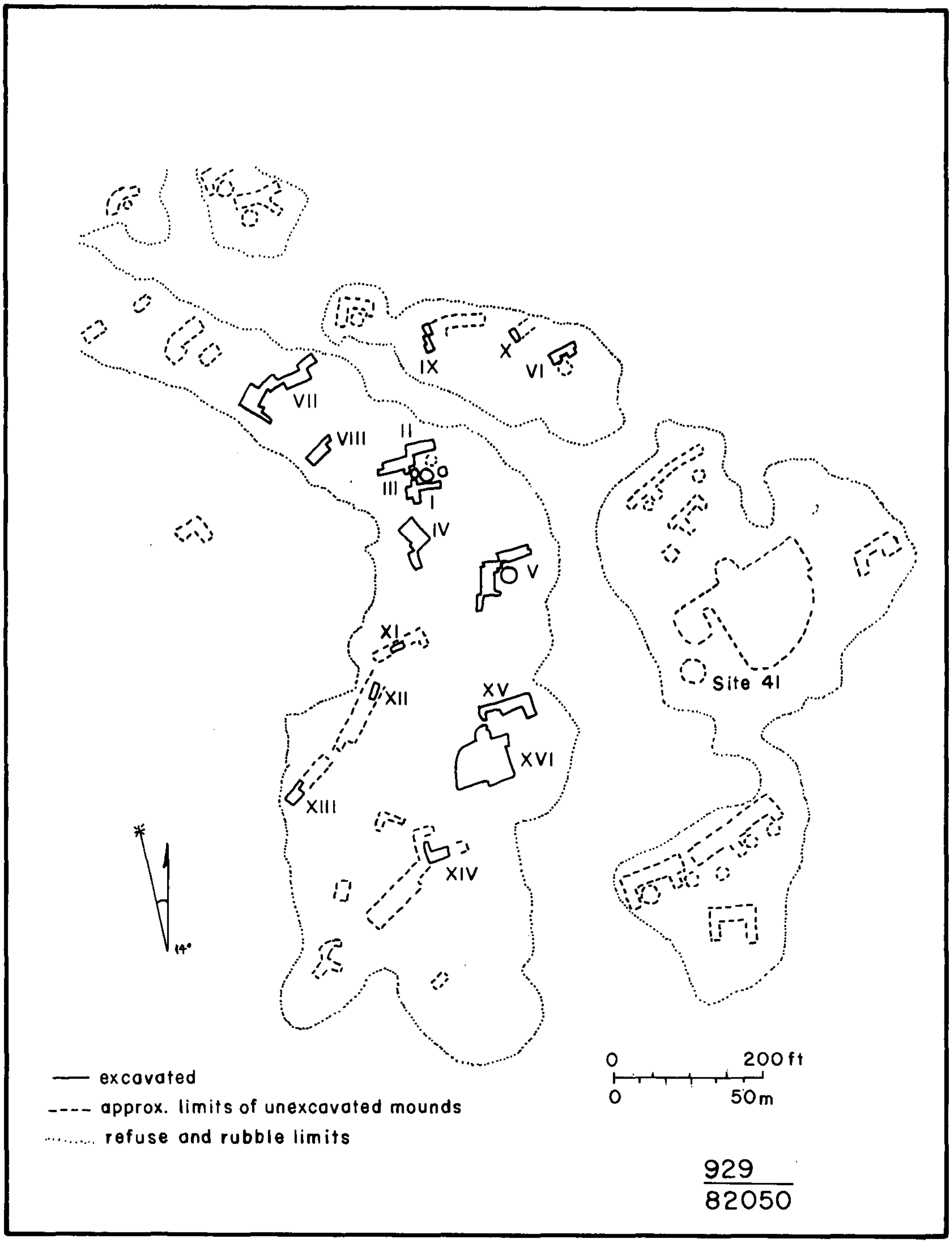


Figure 68. Site 41, community nucleus. Chacoan structure is located above Site 41 label (after Morris 1939).

Lithics

No information on material types or frequencies of lithics specific to Site 41 is provided by Morris (1939). The lithic materials Morris cites as characteristic of Site 41, and other sites on the La Plata, have already been mentioned in the Site 39 discussion.

Aztec

This Chacoan structure and surrounding sites are located on the first alluvial terrace north of the Animas River, north of Aztec and east of Spencerville, New Mexico (Figure 1). Elevation is 1,720 m (5,643 feet) above sea level.

Segments of a prehistoric road near the Aztec Chacoan structure have been reported since the first settlement of the area in the 1880s. Morris (1915:666) notes that this road was visible for a distance of 4.8 km, and he believed it led to a quarry site on Airport Hill, some 2 km to the west. Hastings (1960:72) reports on the most visible segment of this road, and a photograph in El Palacio (1916:52) is probably of the same segment described by Hastings.

Aerial photo imagery examination, not performed to date, is badly needed as continued settlement and ground disturbance of the Aztec area will eventually destroy any remaining prehistoric features.

Site Remains

Chacoan Structure

The Aztec West Ruin is a D-shaped structure with a low-curving wall that connects the southward-extending wings and encloses a large plaza (Figures 69 and 70). An estimated 405 rooms and 28 kivas (including both early Chacoan style and late occupation kivas) are present in addition to a centrally located great kiva. Walls are constructed of core and veneer, Chaco-style masonry. Ceilings range 2.9-3.4 m in height, and rooms have a mean size of 14 m^2. Portions of the site rise to three stories in height (8-9 m)(Morris 1919). Including these upper stories, a total floor area of 15,030 m^2 is estimated.

Numerous tree-ring dates (Robinson et al. 1974:57) indicate that most of the construction at the West Ruin occurred between 1110 and 1120. Although information on wall abutments and construction sequences is not available, the regularity of the layout and short span of the tree-ring dates suggest large-scale planning of the structure. After partial or complete abandonment, the West Ruin, like virtually all Chacoan structures north of the San Juan River, was occupied and remodeled in the mid-thirteenth century (Morris 1921:136).

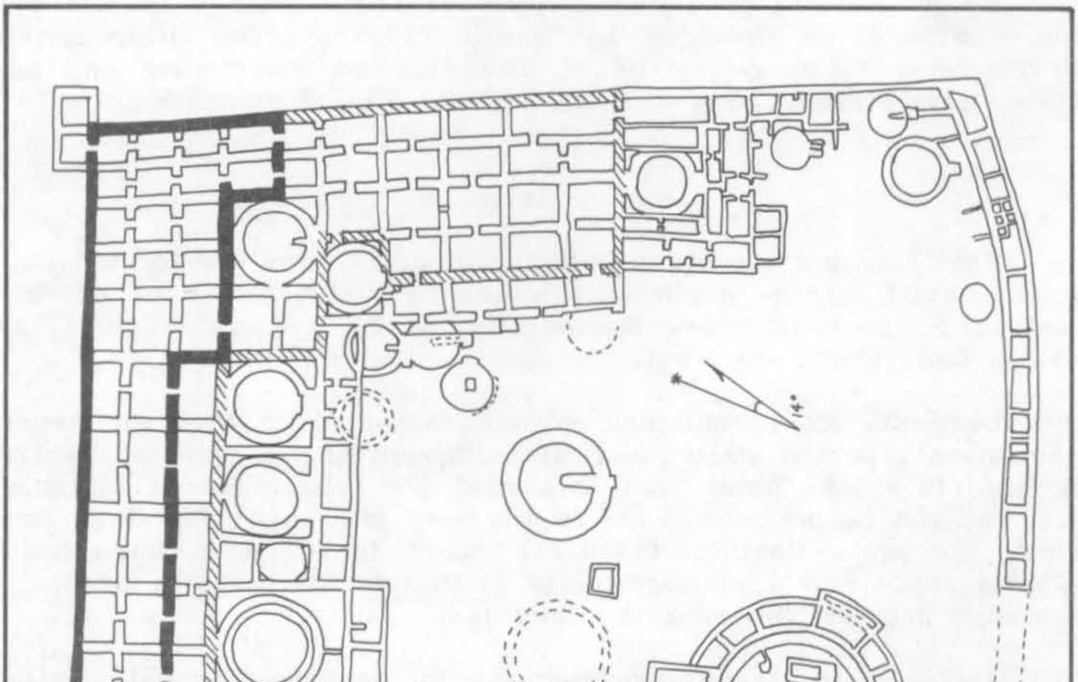


Figure 69. Aztec West (after Morris 1928).

Figure 70. Aztec West. Overview of Chacoan structure, with Hubbard Mound at lower left.

Other Sites

The Aztec West Ruin is the largest of several prominent structures composing a tight aggregation of 12 sites known collectively as Aztec Ruins (Figure 71), which are preserved today in a 27-acre (10.93 hectare) plot known as Aztec Ruins National Monument. Howe (1947) has noted the presence of approximately 90 smaller pueblos in a 2.5-km radius of the cluster preserved in the monument, but the majority of these structures have probably long been destroyed. As such, it is almost certain that the Aztec Ruins cluster was the core of a much larger Anasazi community.

Of the structures within the monument boundaries, most of those which have been partially or completely excavated date to the Late Pueblo III era; these include much of the Hubbard Mound, Mound F, and most of the small West Ruin Annex structures (Morris 1924a; Vivian 1959). Although the East Ruin was also certainly occupied during the Late Pueblo III period, as indicated by a 1240cL date and the predominance of Mesa Verde Black-on-white and other late ceramic types, a number of early twelfth-century cutting dates from the structure (ranging from 1115 to 1129) raise the possibility that it was built and occupied in Early Pueblo III. Although these early timbers could represent beams robbed from the West Ruin, as Richert (1964) argues, the fact that all nine dates are either at the late end of the West Ruin date continuum, or slightly later, suggests that they are in their original context and that construction of the East Ruin was begun as construction at the West Ruin neared completion.

It is true that virtually no Early Pueblo III ceramics have been recovered from the East Ruin, but it should be noted that many rooms in the West Ruin similarly revealed few or no traces of Early Pueblo III ceramics (Morris 1928). If the East Ruin was constructed during the early 1100s, then it is clear that there were two contemporary Chacoan structures, since the East Ruin has many morphological attributes of this site type (Richert 1964).

Structures of more certain contemporaneity with the West Ruin are known only incompletely. In this category are several early rooms in the Hubbard Mound (Vivian 1959), the Estes Arroyo Bridge site (Morris 1944; Robinson et al. 1974), the Adobe Ruin (Morris 1944), and the remains of a structure under the Annex area (Morris 1924a). The latter two sites also have some Chacoan architectural attributes. The Adobe Ruin is of particular interest because Morris (1944:438) claimed its ceramics were identical to those of the Chacoan portions of the West Ruin and because its walls were of core and veneer construction. The most unusual feature of this poorly known site was that many of its 30-50 rooms and two kivas were constructed of hand-molded adobe bricks.

The structure under the Annex area, razed prehistorically, was thought by Morris (1924a:257) to have been a "Chaco sandstone pueblo."

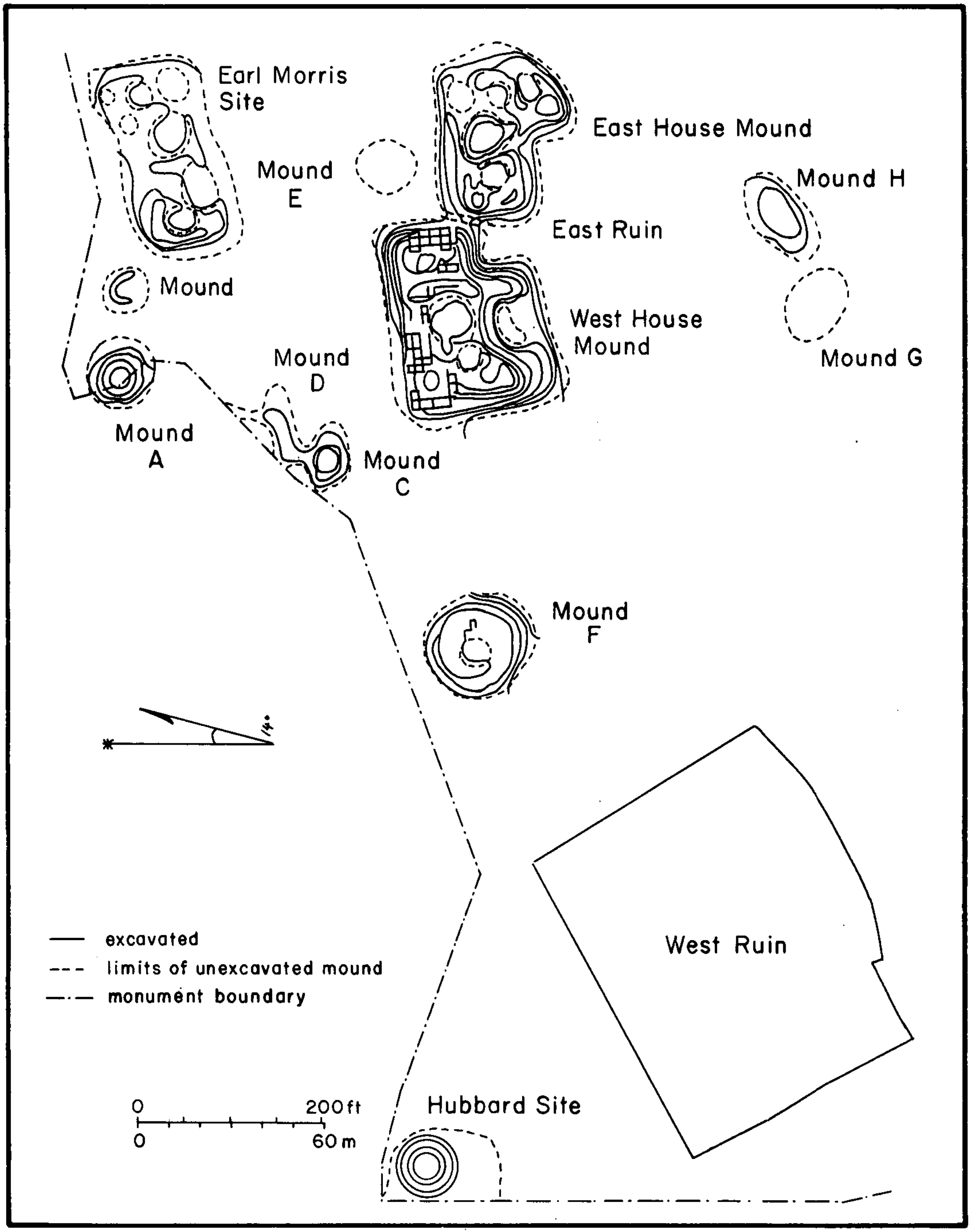


Figure 71. Aztec community nucleus (after Vivian 1959).

Several wall stubs and a kiva with Chacoan features were the only remains exposed by Morris. Located immediately west of the West Ruin, this site may have been a predecessor of the latter ruin.

Ceramics

Morris never presented a quantified, final account of the Early Pueblo III to Late Pueblo III ceramics recovered from the Aztec West Ruin, although he stated in his 1919 report that "about ninety-five percent of the pottery recovered was identical in every respect with typical Mesa Verde (San Juan) ware." The remaining five percent of the pottery showed "influences" from the Chaco, Tularosa, and Little Colorado areas. While the specimens from the two latter areas were thought to be imports, he deduced that the "Chaco Canyon type of vessels" were probably manufactured by members of the Aztec community (Morris 1919:106-107).

Vivian (1959:53) also concluded that most of the Chaco-like ceramics excavated at the Hubbard mound were locally made. But in the middle-level rooms of the Hubbard Mound, he did find intrusive Cibolan sherds that accounted for as much as 9% of the decorated ceramics from those levels. Given the spatial proximity and contemporaneity of the Hubbard Mound to the West Ruin, Cibolan types may account for a small percentage of the Aztec ceramic assemblage as well. This supposition is given some support by the recent analysis of a "large number" of unprovenienced sherds from the Aztec West Ruin by the San Juan Valley Archaeological Project. Although quantified results have not been presented, this analysis indicates that the same ceramic types occur in the same proportions at both Aztec and Salmon (Franklin 1976:118-119.)

Lithics

No quantitative discussion of lithic material types recovered from the West Ruin is presented by Morris (1919:32-35). Material types listed as most commonly occurring include quartzite, chalcedony, agate, and jasper. Obsidian was found in small quantities; it is the only obvious import. The remainder of the materials are believed to have been procured locally, especially from the wide variety of river cobbles found in the river and on adjacent gravel-strewn terraces and bluffs.

Chimney Rock

This outlier community is located on Chimney Rock Mesa between the Piedra River and Stollsteimer Creek, west-southwest of Pagosa Springs, Colorado (Figure 1). Elevation is 2,318 m (7,600 feet) above sea level.

Archaeological investigations in the Chimney Rock area have not documented any prehistoric roads to date. No aerial photo imagery studies have been conducted.

Site Remains

Chacoan Structure

On the highest mesa portion of Chimney Rock Mesa is Chimney Rock Pueblo, a rectangular Chacoan structure (Figures 72 and 73) two stories high, with an estimated 55 rooms and two kivas (Eddy 1977; Jeancon 1922; Jeancon and Roberts 1923, 1924; Roberts 1922). The mound rises to a height of 4 m; including the second-story rooms, a total floor area of 2,535 m^2 is estimated. The regular layout of rooms in the structure suggests large-scale planning, but construction sequences at the site are poorly documented, although at least two building intervals are indicated. Other architectural features include core and veneer walls, Chaco-style masonry, rooms with a mean size of 9 m^2, high-ceilinged rooms (2.1 m high), and one Chacoan-style kiva.

A single tree-ring cutting date of 1076 may be indicative of the initial construction at the site, while 17 cutting dates at 1093 provide more certain evidence of major construction (Eddy 1977).

Other Sites

The slopes and flanks of Chimney Rock Mesa hold seven site aggregation areas, each including small house sites, one or more great kivas, and a variety of limited use sites (Eddy 1977). Cumulatively, these sites form a large community (Figure 74) occupied from Early Pueblo II to Early Pueblo III (Eddy suggests calendar dates of 925-1125).

Ceramics

Although much of the Chimney Rock Chacoan structure has been excavated by Jeancon and Roberts (1923, 1924) and by Eddy (1977), little is known of the ceramic remains from this site. A sample of 950 Early Pueblo III sherds recovered from Eddy's excavation of Room 8 may be representative of the site as a whole, but this is debatable. Of the sherds recovered from Room 8, less than 1% are Cibolan, and seven of these eight sherds are from the same Chaco Black-on-white jar. Eight Tusayan Series sherds, two unidentified redwares, and the remainder of the intrusives account for 1%. Local San Juan series types (97%) comprise the great majority of the recovered sherds (Eddy 1977:42-44).

Similarly small percentages of Cibolan pottery (1%) are reported by Truell (1975:60-70) from Building 16, a small house site in the Chimney Rock community, but no further Cibolan wares were recovered in the excavation of an adjacent great kiva or at two other small house

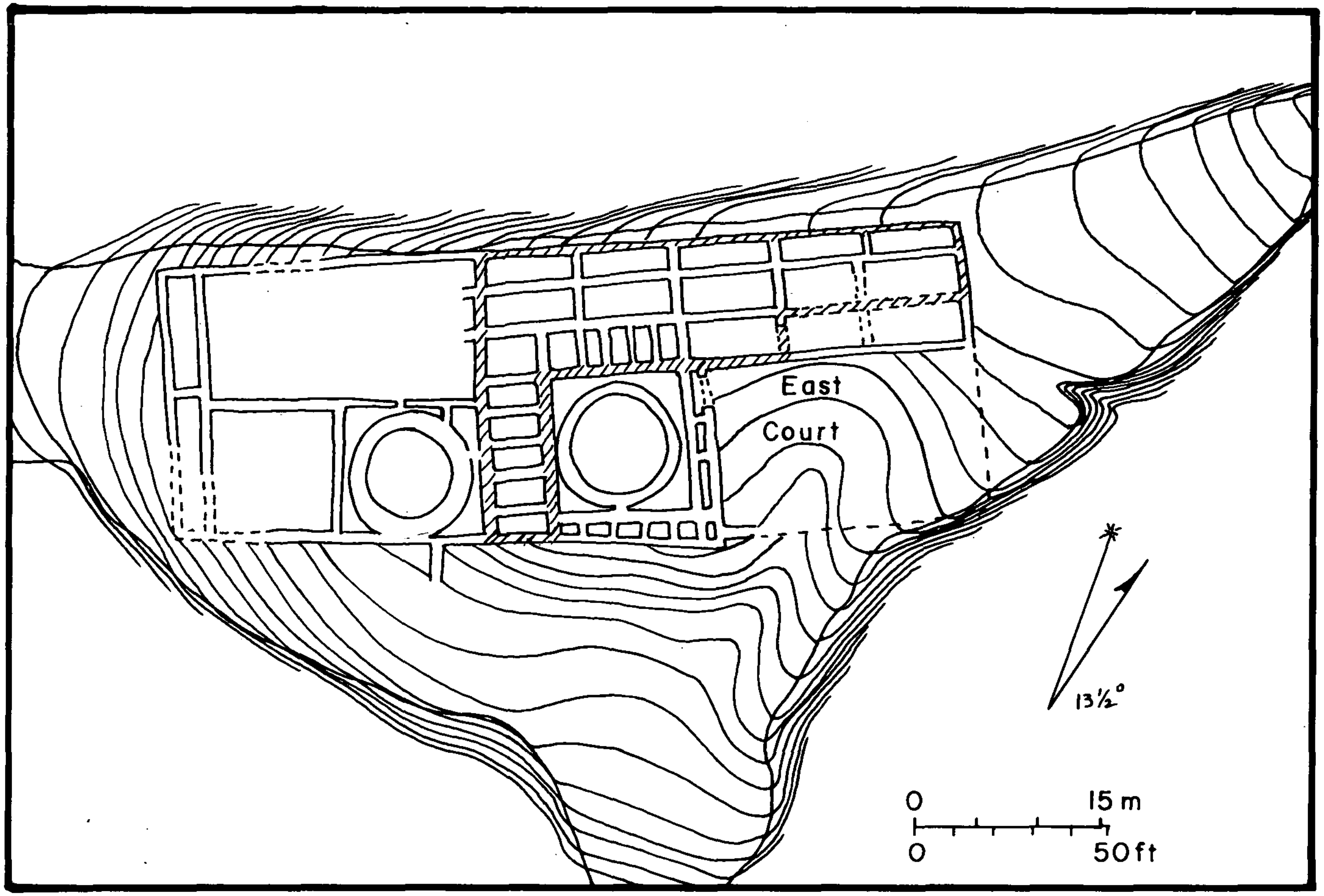


Figure 72. Chimney Rock (after Eddy 1977 and Jeancon and Roberts 1924).

Figure 73. Chimney Rock Chacoan structure after excavation by the University of Colorado, 1971.

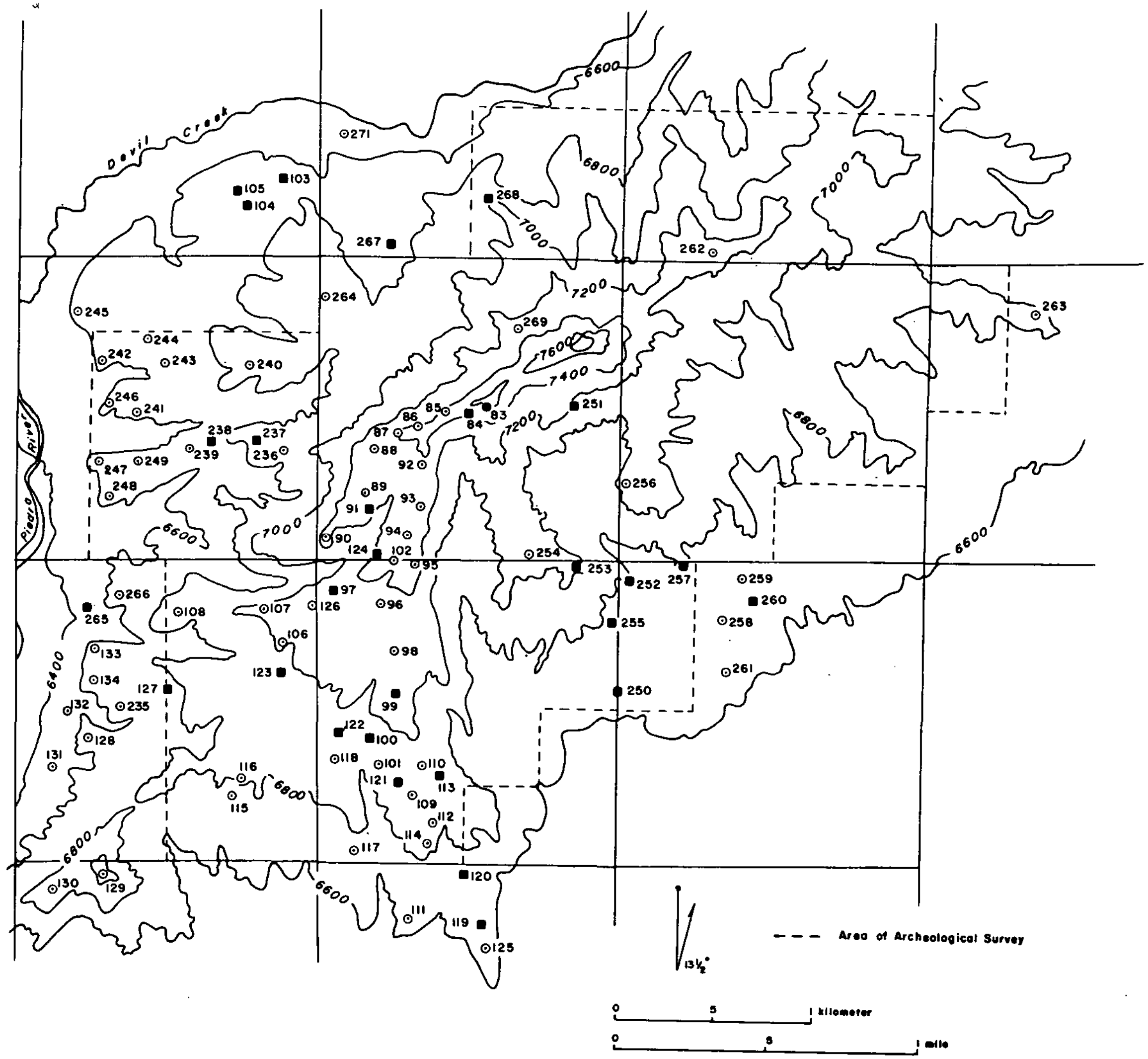


Figure 74. Chimney Rock community. Site 83 is the Chacoan structure (after Truell 1975a).

units (Eddy 1977; Truell 1975). Sherds collected during the survey of the Chimney Rock community include only two Cibolan sherds (<1%).

Accounting for virtually all other sherds recovered both in the excavations and survey are local San Juan series types, which range from Pueblo I types such as Bancos and Piedra Black-on-whites, to Pueblo II - Early Pueblo III types such as Mancos and Wetherill Black-on-whites. The rareness of McElmo Black-on-white and the complete absence of Mesa Verde Black-on-white is thought to indicate abandonment of the community by 1125 (Eddy 1977:26-27).

Lithics

Lithic material types recovered from the Chimney Rock Chacoan structure by Jeancon and Roberts (1923, 1924) and during recent testing by Eddy (1977) have not been reported. Some idea of lithic material types present in the Chimney Rock community is provided by Truell's (1975:131-137) excavations at Building 16 and the Structure 17 great kiva. Major materials reported are quartzitic sandstone (66%); cherts, jasper, and chalcedony (22%); basalt (4%); and granite (4%). All of these appear to have been derived from local cobble and gravel deposits. No intrusive material types are documented.

Wallace

This Chacoan structure is situated near Simon Draw, northeast of Cortez, Colorado (Figure 1). Elevation is 1,897 m (6,220 feet) above sea level.

Archaeological studies have not documented any prehistoric road or road-like features in the vicinity of Wallace Ruin. Aerial photo imagery of the area has not been examined.

Site Remains

Chacoan Structure

The Wallace site is a C-shaped, two story house mound with an estimated 73 rooms and five kivas (Figure 75)(Bradley 1974:personal communication). The 3-4-m-high house mound, including the second-story areas, has an estimated floor area of 1,080 m^2. The roughly symmetrical, regular layout suggests large-scale planning; but since only a small portion of the site has been excavated, the size of the construction units is not known.

Earliest construction at this structure, as represented in two excavated rooms, is believed to have occurred in Early Pueblo II (950-1000) by inhabitants who utilized Tusayan and Cibolan series ceramics

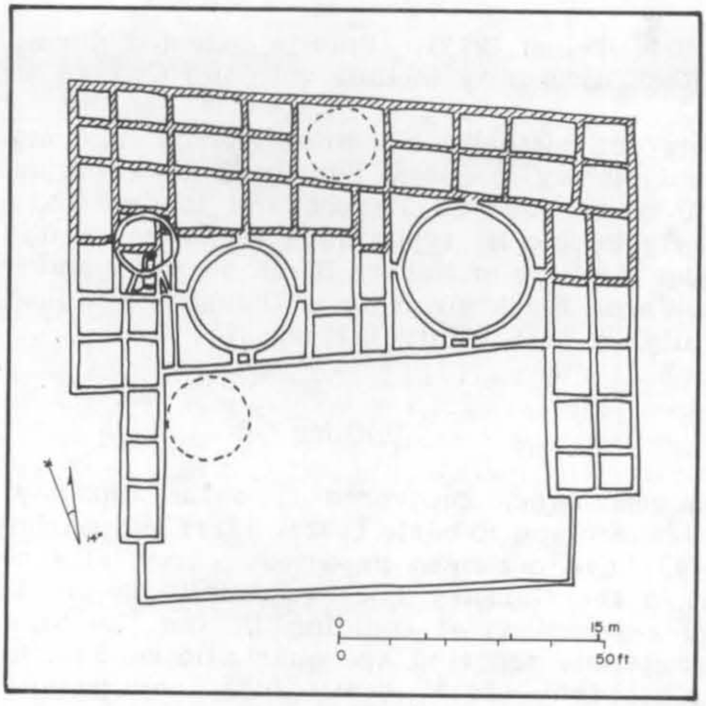


Figure 75. Wallace (after Bradley n.d.)

Figure 76. Wallace Chacoan structure. View of rooms and kiva excavated in northwest portion of site by Bradley.

and built simple slab masonry walls that were similar in appearance to the early Type I masonry of Chaco Canyon (cf. Bradley 1974:Figure 5; Hawley 1934:Plate IV, 1938). Later floors constructed over the initial living surfaces have a Late Pueblo II Cibolan ceramic assemblage. At this time, remodeling and further construction utilizing another style of simple, Type I masonry took place. A final building phase as represented by six excavated rooms and a kiva (Figure 76) constructed with compound masonry walls, was probably initiated during Early Pueblo III, bringing the Chacoan structure to its final form. Twenty-six dendrochronological dates from the kiva and five of these rooms are all vv's, but they appear to place construction in the last quarter of the 1000s or first quarter of the 1100s (Bradley 1979:personal communication). Ceramics associated with this phase of the site's occupation are primarily local San Juan series types (Bradley 1974, 1977-1979:personal communication).

Architectural attributes manifested at this structure include Chaco-like masonry styles, and, apparently during the second phase of occupation, high ceilings (the second-story floors of two two-story rooms appear to have been removed, resulting in a 2.5+ floor-to-ceiling expanse). In contrast, ceiling heights were low during both the primary and final construction phases (1.5 and 1.3-1.5 m, respectively). Room sizes range from moderate-to-small in size, with a very small mean room size of 5.5 m^2. The one kiva excavated to date contains San Juan-style features (Bradley 1977-1979:personal communication).

Other Sites

The Wallace Ruin is one of the major sites comprising what is known as the Lakeview group. (The Ida Jean Ruin and the Haney Ruin are the other two sites.) The presence of small house sites in the vicinity of Wallace and Ida Jean is reported both by Bradley (1978: personal communication), and Brisbin and Brisbin (n.d.). But little or no data on these surrounding sites have been collected, making it impossible to determine whether or not these sites and the Chacoan structures form a community. Small house sites adjacent to each Chacoan structure probably are in part contemporaries. In turn, ceramics and tree-ring dates indicate that Ida Jean and Wallace are also contemporary structures.

Ceramics

Since excavation of the Wallace Ruin is still in progress, quantified data and a complete list of ceramic types represented are not yet available. Although no specific types have been named, Pueblo II ceramics associated with the initial occupation of the site are Tusayan and Cibolan. Ceramics associated with later construction, upper floors, and fill of some rooms are primarily Cibolan and include such Late Pueblo II types as Red Mesa, Escavada, and Gallup Black-on-whites. In conjunction with the final construction phase at the site, the ceramic assemblage changes and is predominated by local San Juan series types, with Mancos Black-on-white initially dominant. Present in lesser quantities are Cortez and McElmo Black-on-white, along with Deadmans Black-on-red. Some Cibolan Chaco-McElmo is also present. Continued occupation of the site is indicated by the eventual dominance of McElmo Black-on-white and the appearance of Mesa Verde Black-on-white. Intrusives found at the site during the Early Pueblo III and Late Pueblo III intervals include Tusayan Polychrome, St. Johns Polychrome, Wingate and Puerco Black-on-reds and Chaco Black-on-white (Bradley 1974, 1977-1979:personal communication).

Lithics

No information is presently available on quantities and types of lithic materials recovered from the Wallace Ruin.

Ida Jean

This Chacoan structure is located on a ridge forming the west side of the valley drained by Simon Draw, northeast of Cortez, Colorado (Figure 1). Elevation is 1,918 m (6,290 feet) above sea level.

Archaeological investigations have not documented any prehistoric road or road-like features in the vicinity of the Ida Jean Ruin. Aerial photo imagery of the area has not been examined.

Site Remains

Chacoan Structure

The Ida Jean Ruin is a compact, E-shaped pueblo of two stories with approximately 55 rooms and two central, enclosed kivas (Figure 77)(Brisbin and Brisbin n.d.; Brisbin 1977-1978:personal communication). The house mound rises to 2.0-2.5 m; and, including the second-story room areas, a total floor area of 695 m^2 is estimated. Other architectural attributes include high ceilings (2.1 m in the only room with walls preserved to viga-socket height), Chaco-style kivas (Figure 78), and rooms with a mean size of 6.5 m^2. Walls are of core and veneer block masonry that is McElmoid in appearance. The most distinctive masonry in the site is present on the outside veneer of the west wall of the structure (Figure 79). Here, the remaining wall is composed of bands of large blocks of matched size and shape, except near the base of the wall where several courses of small tabular blocks form a decorative band that runs the length of the extant wall. Possibly the band encircles the outside house walls; but this is conjectural since the remaining walls were not exposed during Brisbin's excavations.

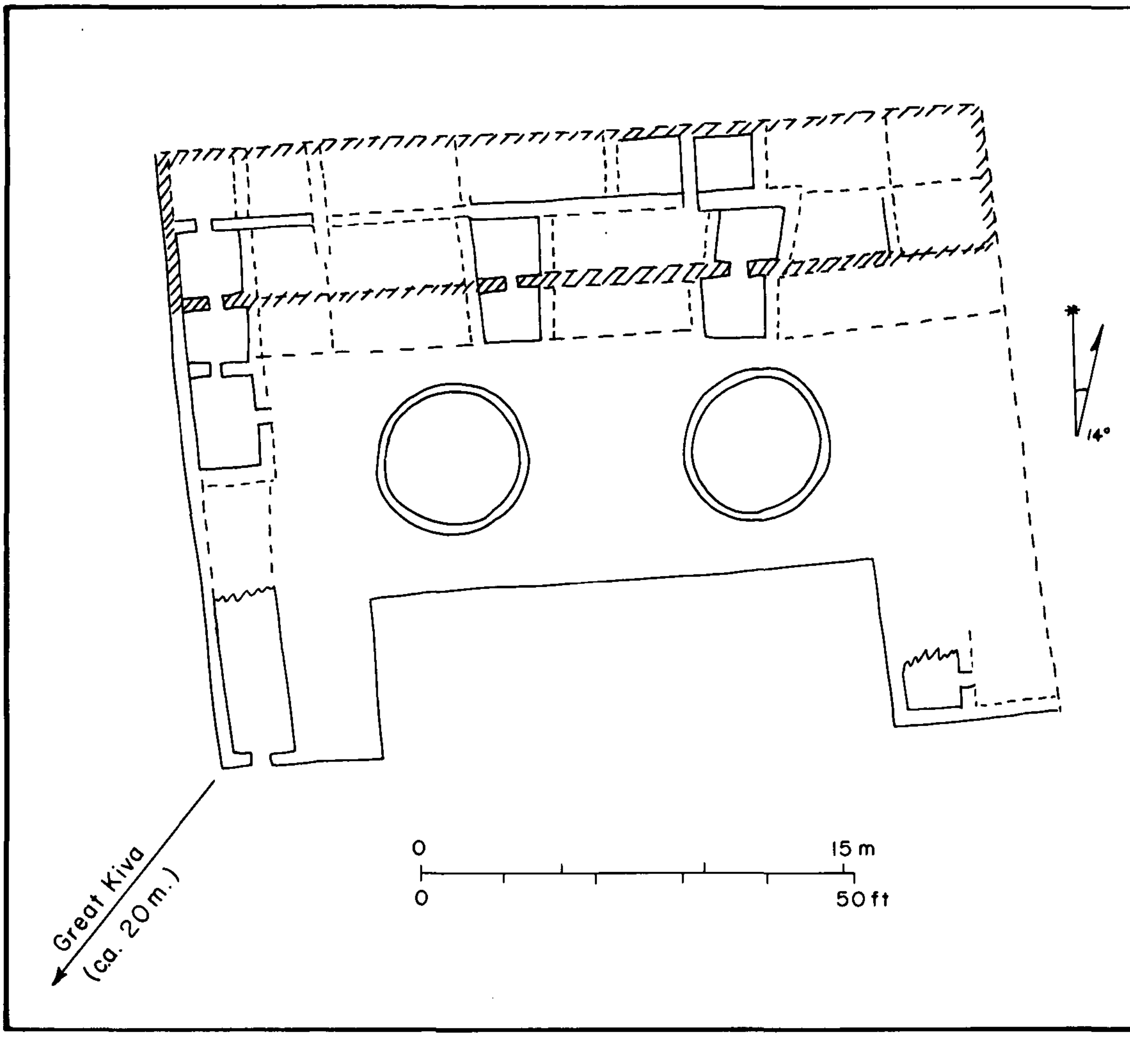


Figure 77. Ida Jean (after Brisbin and Brisbin n.d.).

Figure 78. Ida Jean Chacoan structure. Fine slab and block masonry in Chaco-style kiva. Note horizontal log pilasters and sub-floor vent.

Figure 79. Ida Jean Chacoan structure. Banded masonry on exterior west wall.

Dendrochronological specimens from one of the kivas have yielded 23 1124 cutting dates (Brisbin and Brisbin n.d.). In view of the architectural evidence that the site was constructed in one phase of activity (Brisbin and Brisbin n.d.), 1124 may have been the year during which much of the construction took place. If the site was constructed during one interval, this is clearly a case of large-scale construction planning.

Located some 20 m to the southwest of the structure is the depression of a great kiva.

Ceramics and Lithics

Quantified data on ceramics from the Ida Jean Ruin are not yet available. Almost all ceramics recovered from the site are, however, local San Juan series types of Early Pueblo III - Late Pueblo III date (Brisbin 1978:personal communication). Initially, the ceramic assemblage is dominated by McElmo Black-on-white, with small amounts of Mancos Black-on-white accompanying it. A few Cibolan intrusives including Escavada, Chaco, and Puerco Black-on-whites, with Wingate Black-on-red, as well as occasional Tusayan Black-on-red and Tusayan Polychrome sherds are present. Decorated types from the late occupational intervals of the site are dominated by Mesa Verde Black-on-white (Brisbin 1977-1978:personal communication).

Information on lithic materials is not yet available.

Escalante

The Escalante Chacoan structure is located on a low gravel hill that directly overlooks the south rim of the Dolores River Canyon west of Dolores and northeast of Lebanon, Colorado (Figure 1). Elevation is 2,196 m (7,200 feet) above sea level.

Archaeological studies have not documented any prehistoric road or road-like features in the vicinity of the Escalante Ruin. Aerial photo imagery of the area has not been examined.

Site Remains

Chacoan Structure

Escalante is a roughly squared one-story house of approximately 25 rooms and one intramural kiva (Figure 80). The mound rises 2.5-3 m, and the total floor area is estimated at 455 m^2. A second kiva, situated to the south of the house block, is believed to have been constructed during a later phase of occupation (Hallasi 1979:231-234). On the hillslope west of the house is a shallow accumulation of refuse, the only trash associated with the site. While the house layout is

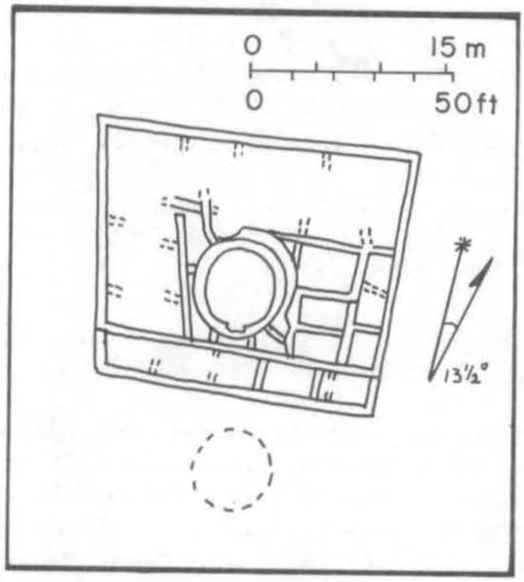


Figure 80. Escalante (after Hallasi 1979).

Figure 81. Escalante Chacoan structure. View of Kiva A after excavation by University of Colorado. Note Chaco-style southern inset, subfloor ventilator, and horizontal log pilaster.

somewhat symmetrical and regular, indicating obvious planning, wall construction sequence information suggests the site was built gradually over a considerable time span. Architectural attributes include core and veneer, compound, and simple masonry, high ceilings (ca. 2.3 m), and Chacoan-style kiva features (Figure 81)(Hallasi 1979:247). Stylistically, the masonry at the site does not conform to either the Chaco or McElmo styles since many walls are a mixture of unshaped slabs and blocks with only rough coursing and little banding. Rooms have a mean size of 9.5 m^2.

The ceramic assemblage associated with at least one room at this site indicates occupation may have taken place as early as 1075, although a somewhat later initial occupation date (ca. 1100?) is given more credence by Hallasi. Eight tree-ring cutting dates, one at 1124, and seven at 1129 are the earliest construction dates. A number of the remaining 28 v and vv tree-ring dates suggest subsequent construction in the late 1130s and perhaps the early 1140s. Following the initial occupation of the site, two subsequent occupations (dated on the basis of associated ceramics) are dated to ca. 1150 and ca. 1200. The abandonment interval between the last tree-ring dated construction and the first reoccupation was clearly short (Hallasi 1979:392-398).

Other Sites

At least a half-dozen small houses are known in the immediate vicinity of the Escalante Ruin, but present scant information does not allow the definition of a community. Some are presumed to have been built and occupied contemporaneously with the Escalante Ruin (Reed 1979:115). Only one of these sites, the Dominguez Ruin, probably occupied between ca. 1100-1150, has been investigated.

Ceramics

Almost all sherds from the excavated portions of the Escalante Ruin are Early Pueblo III San Juan series types (24%), the decorated types being predominantly Mancos and McElmo Black-on-white. The majority of the intrusive ceramics are of the Tusayan series (3%), while only traces of Cibolan sherds (<1%) are present. Although no breakdown of the percentage of sherds recovered from each occupation is provided, Hallasi does provide a breakdown of the occupational association of the intrusive sherds, indicating that 84% of the intrusives are associated with the initial occupation of the Chacoan structure. The successive second and third occupations have lower intrusive percentages (15% and 3%, respectively).

Lithics

Although the frequencies of lithic material types are not documented by occupational association, the majority of the materials recovered are believed to be representative of the primary occupation of the site. Of all lithic materials recovered, quartzite is the most common (62%). It is the predominant material used at the site. Miscellaneous cherts and chalcedonies account for another 20% while silicified wood (<1%), siltstone (6%), shale (<1%), limestone (<1%), sandstone (<1%), felsite (1%), and basalt (<1%) complete the list of locally obtained materials. Accounting for a final 10%, and the only intrusive material, is obsidian. Although not specifically identified, the Escalante obsidian may have been obtained from the Jemez Mountain, Grants Ridge, or Red Hill sources.

Lowry

The Lowry Chacoan structure is situated on the mesa tongue between the north and south forks of Cow Canyon, west of Pleasant View and southwest of Cahone, Colorado (Figure 1). Elevation is 2,049 m (6,720 feet) above sea level.

One feature at Lowry, originally recognized by Martin (1936:18) and labeled a "ditch," may be a prehistoric road segment. The ditch, approximately 30.5 cm deep and 4.5-6 m wide, passes through the site between the Chacoan structure and the great kiva. Beyond the site limits, it is visible for a half-mile to the north and south.

Both the apparent shallowness of this feature and its width compare with some of the Chaco Canyon roads described by Vivian (1972: 10-13). The width of this feature alone is almost enough to suggest it is not a ditch or canal, but this possibility cannot be eliminated without further investigation.

Aerial photo imagery of the Lowry area has not been examined.

Site Remains

Chacoan Structure

The early portions of Lowry Ruin form a roughly rectangular house with an estimated 34 rooms, three kivas and a great kiva (Figures 82 and 83A)(Martin 1936). Most of the house is thought to have been two stories high, and Martin (1936:36) suggests portions may have been three stories. The house mound rises to 3-4 m, and an estimated floor area of 870 m^2 includes the upper-story rooms. The site is clearly planned, but the size of the building units is relatively small, with several building phases responsible for the final layout. An overall plan to unify the various construction units, if it existed, appears to have been weak; the structure has more an appearance of a building that grew by uncoordinated accretion.

Core and veneer masonry is present throughout Lowry, and rooms have a mean size of 11 m^2 with some high ceilings (2.0-2.6 m). What

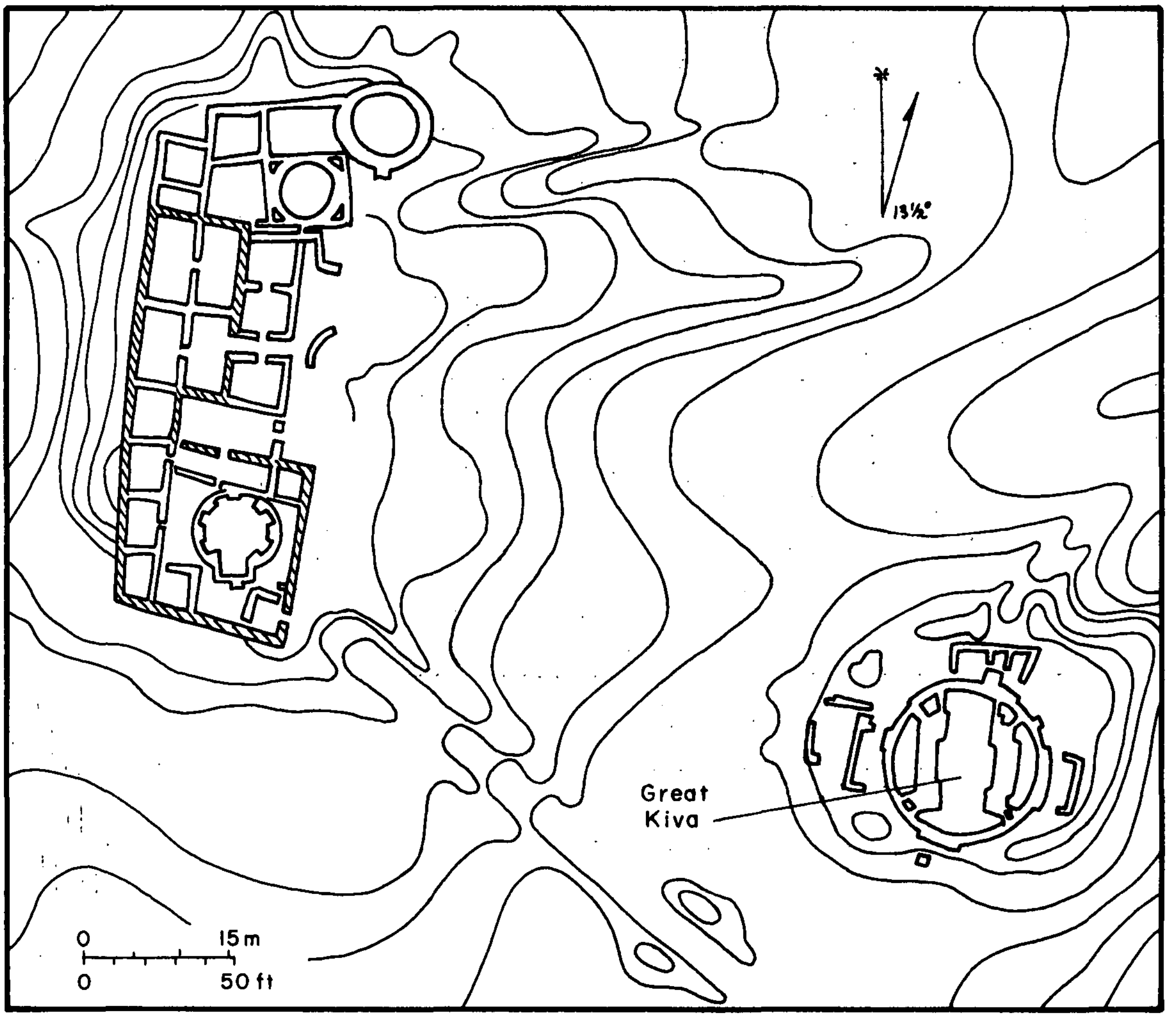


Figure 82. Lowry (after Martin 1936).

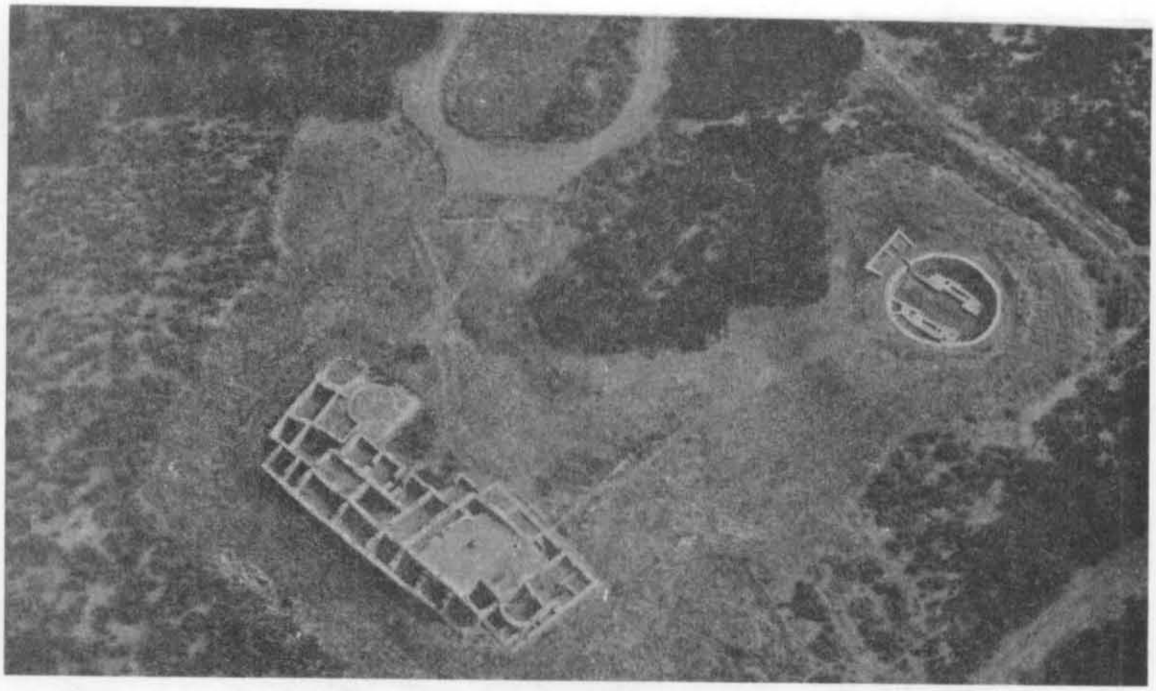


Figure 83A. Lowry Chacoan structure. Aerial view.

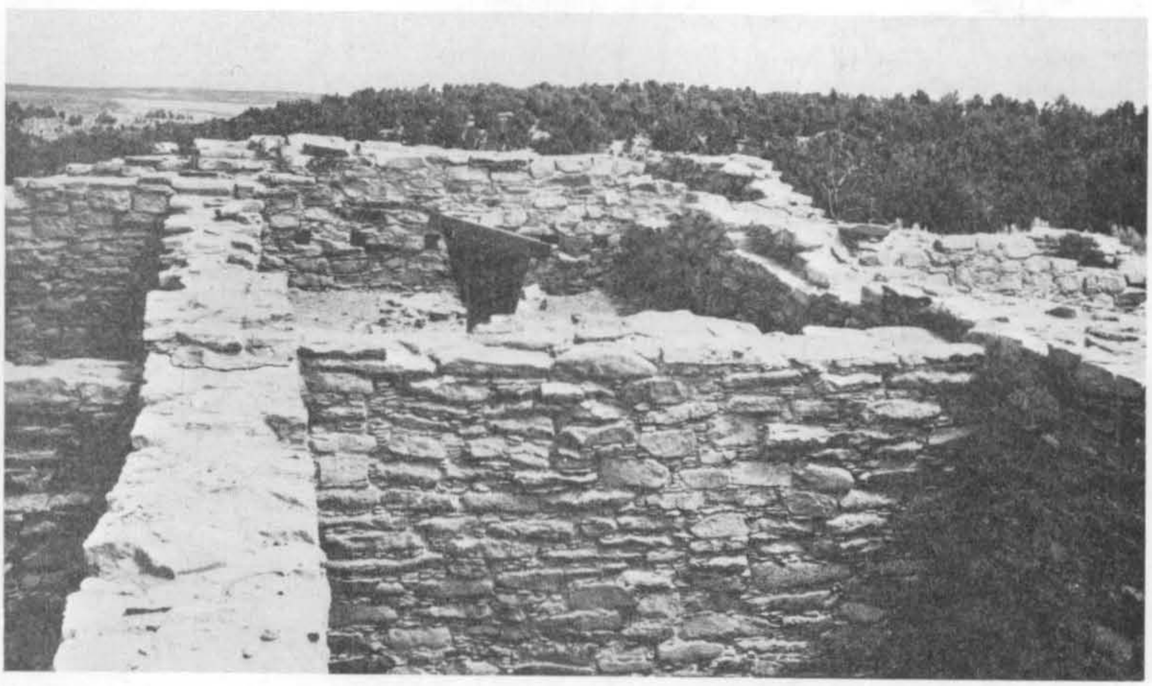


Figure 83B. Lowry Chacoan structure. Chaco-style masonry in Rooms 10 and 15. of original four-room nucleus.

Martin originally proposed as the primary Chacoan attribute of this site was the "Chaco" and "Chaco-like" masonry found in rooms of the first three construction intervals. While the masonry in the site does bear some resemblance to Chacoan masonry, particularly in the four original rooms (Figure 83B), the similarity is only general. Much of the masonry from the second to the fifth construction phase, including that in the great kiva, does not appear to vary substantially from the local San Juan "McElmo-"style masonry. Three excavated kivas associated with the early construction phases display primarily San Juan-style features.

Tree-ring dates place construction of the original nucleus at 1089-1090, with construction of the majority of the Chaco-like portion of the site and the great kiva between 1103 and 1110 (White and Breternitz 1976). Additional non-Chacoan construction took place in 1120, and the site was probably occupied until ca. 1150. At least some subsequent occupation during Late Pueblo III is indicated by the occurrence of Mesa Verde Black-on-white ceramics in the upper fill of some rooms (Martin 1936:204-205).

Other Sites

Numerous small house or "unit type" sites are known in the area of Lowry Ruin, but it is not known if these form an identifiable community associated with Lowry. Although specific information is not available, many of these sites were probably occupied contemporaneously with Lowry and during Late Pueblo II.

Ceramics

Martin (1936:102-111) provides quantified information on the Lowry ceramics from three stratigraphic test areas and from the floor levels of a number of rooms and kivas. In the attempt to focus on ceramics deriving from the early "Chacoan" occupation of the site, the frequencies and percentages presented have been compiled from two stratigraphic tests, 12 rooms, and two kivas of "Chacoan" depositional context, in so far as is known. The presence of some late types, however, suggests this effort has not been entirely successful.

Martin felt that Lowry had close ceramic ties to the Chacoan area, as illustrated by his identification of 16% of the stratigraphic test and floor-level sherds as Cibolan. Although these sherds were given Cibola-type names (Red Mesa and Wingate [later changed to Gallup] Black-on-white and Wingate Black-on-red), only Wingate Black-on-red (accounting for a minor percentage of the "Chaco" pottery) was clearly thought to be intrusive. Martin's uncertainty about the origins of Wingate, which makes up 84% of the Cibolan pottery, is reflected in his placement of it and Red Mesa Black-on-white as locally produced types in one section of his ceramic discussion (1936:79), even though he had separated them from the contemporary and analogous local type, Mancos Black-on-white. Ultimately, he concluded that "whether-or-not the Red

Mesa and Wingate Black-on-white wares were actually manufactured at Lowry and not introduced through trade, cannot be decided without a petrographic analysis of the pottery -- a task not yet started" (Martin 1936:114).

So the situation remains to this date. In view of the minor percentage that Cibolan intrusives comprise at most other northern Chacoan structures, however, it is to be suspected that petrographic analyses would reveal that a large percentage of Martin's Wingate is simply locally made Mancos Black-on-white with designs more closely identified with the Chaco area.

San Juan series types (29%) are the predominant ceramics in the stratigraphic test and floor levels, and would, of course, become only more predominant if most of Martin's Cibolan types were locally produced as well. Mancos and, later, McElmo Black-on-white are the predominant local types, although Mesa Verde Black-on-white makes its appearance in the latest strata. Tusayan types account for 6%; they include Black Mesa Black-on-white, Tusayan Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, and Sunset Redware (Martin 1936:80).

Lithics

The only chipped stone materials reported from Lowry are 10 chert projectile points and a crescent-shaped object of chalcedony (Martin 1936:54).

Yucca House

The group of structures cumulatively termed Yucca House is situated on the low, eastern slopes of Ute Mountain, immediately south of Aztec Divide, near the headwaters of Navajo Wash. Cortez is to the northeast and Towaoc is to the southwest (Figure 1). Elevation is 1,805 m (5,920 feet) above sea level.

No prehistoric roads or road-like features have been documented in the Yucca House complex. Aerial photo imagery of the area has not been examined.

Site Remains

Chacoan Structure

The two main units at Yucca House are the Lower and Upper Houses. Within the Upper House, a single rectangular rubble mound approximately 1,190 m^2 and 4.5 m high has long been proposed as a Chacoan structure (Figures 84 and 85) (Hayes 1981; Morris 1921, 1939:204; Vivian 1970b). Two stories encompassing a total of about 40 rooms are estimated. Two kivas are present in the center of the house, and a smaller third kiva may be indicated by a depression in the southwestern corner of the

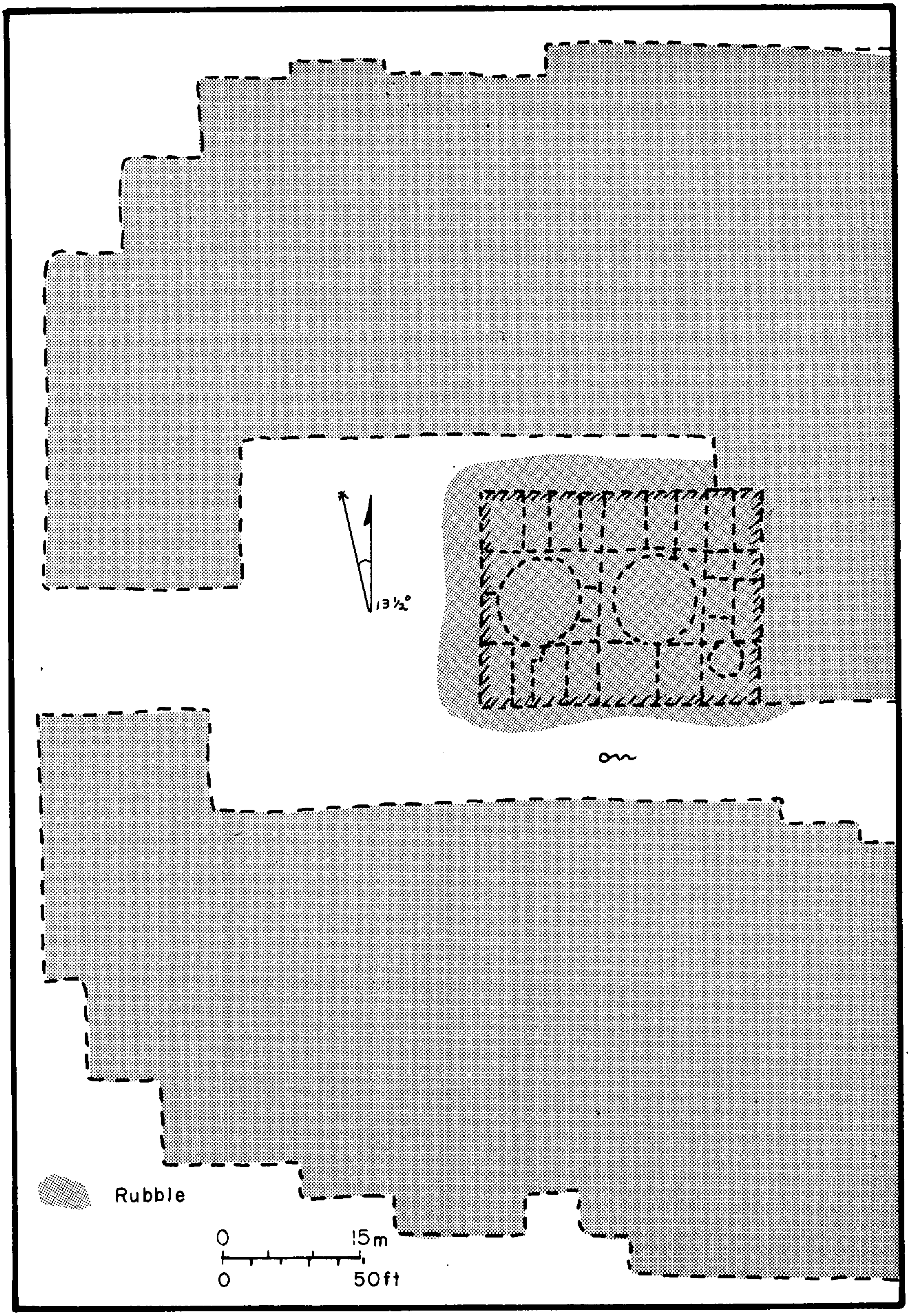


Figure 84. Yucca House. Proposed Chacoan structure is rectangular block in figure center (base after Holmes 1878 and Fewkes 1919).

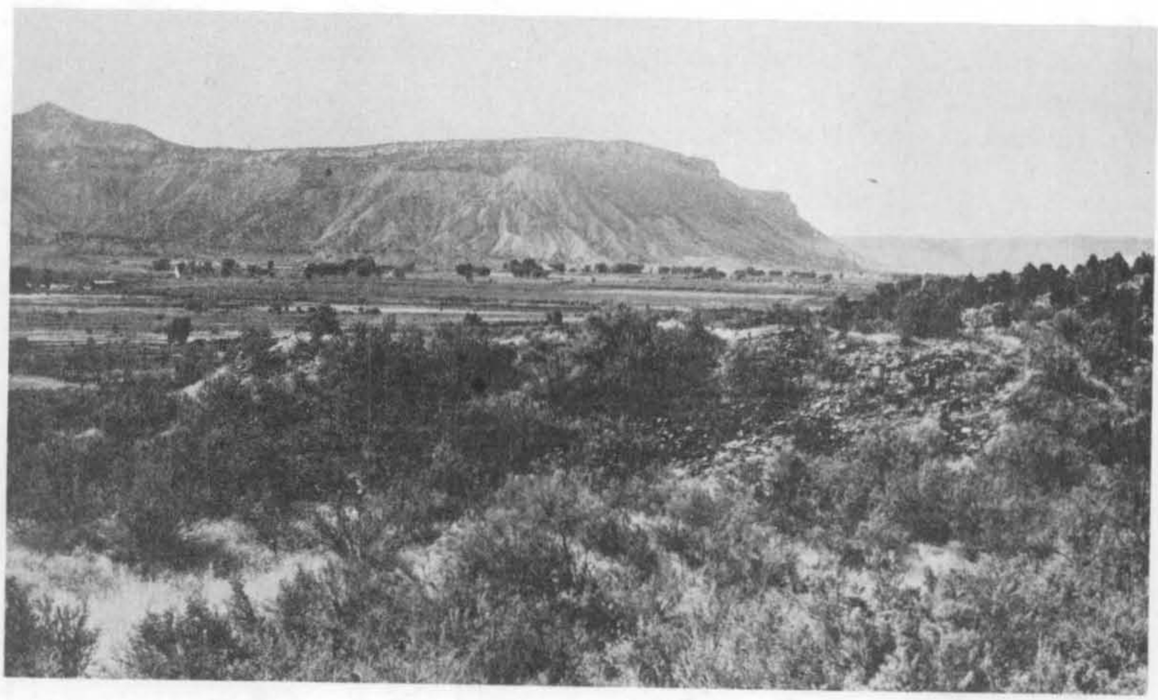


Figure 85. Yucca House Chacoan structure.

structure. The masonry is probably core and veneer and employs a distinctive tabular limestone from the Juana Lopez member of the nearby Mancos Shale. The loose rubble that covers the site prevents any accurate assessment of site planning or other architectural details.

Although the surrounding portions of the Upper and Lower houses appear to date to the Late Pueblo III period, as suggested by layout, architecture, ceramics, and three tree-ring dates (1163+++vv, 1229vv, and 1263vv) of unknown provenience (Robinson and Harrill 1974), the occupation span of the proposed Chacoan structure is unknown.

Other Sites

The remainder of the Upper House, in addition to the Lower House, are the only other documented sites. Additional sites may be present, but the lack of survey prevents determination of whether a community is present.

Two possible great kivas, one each with the Lower and Upper Houses, may also be associated with these Late Pueblo III structures.

Ceramics and Lithics

No information on Yucca House ceramics or lithics is available.

Hogback

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of the community and to Figures 86 and 87 for a plan and photograph of the Hogback Chacoan structure; for a narrative discussion see Marshall et al. (1979).

Twin Angels

This Chacoan structure is located on a cliff promontory overlooking the west bank of Kutz Canyon arroyo, south of Bloomfield and northwest of Angels Peak, New Mexico (Figure 1). Elevation is 1,817 m (5,960 feet) above sea level.

No preserved prehistoric road segments are known at the present time in the vicinity of the Twin Angels structure. However, it is suspected that roads were once present, for the Great North road is generally assumed to have utilized the main Kutz Canyon wash channel as a road bed from a point 6.5 km south of Twin Angels (where the road enters Kutz Canyon) to the mouth of Kutz Canyon on the south bank of the San Juan River, opposite Salmon (Lyons and Hitchcock 1977). The location of the Twin Angels structure, less than 50 m west of the main

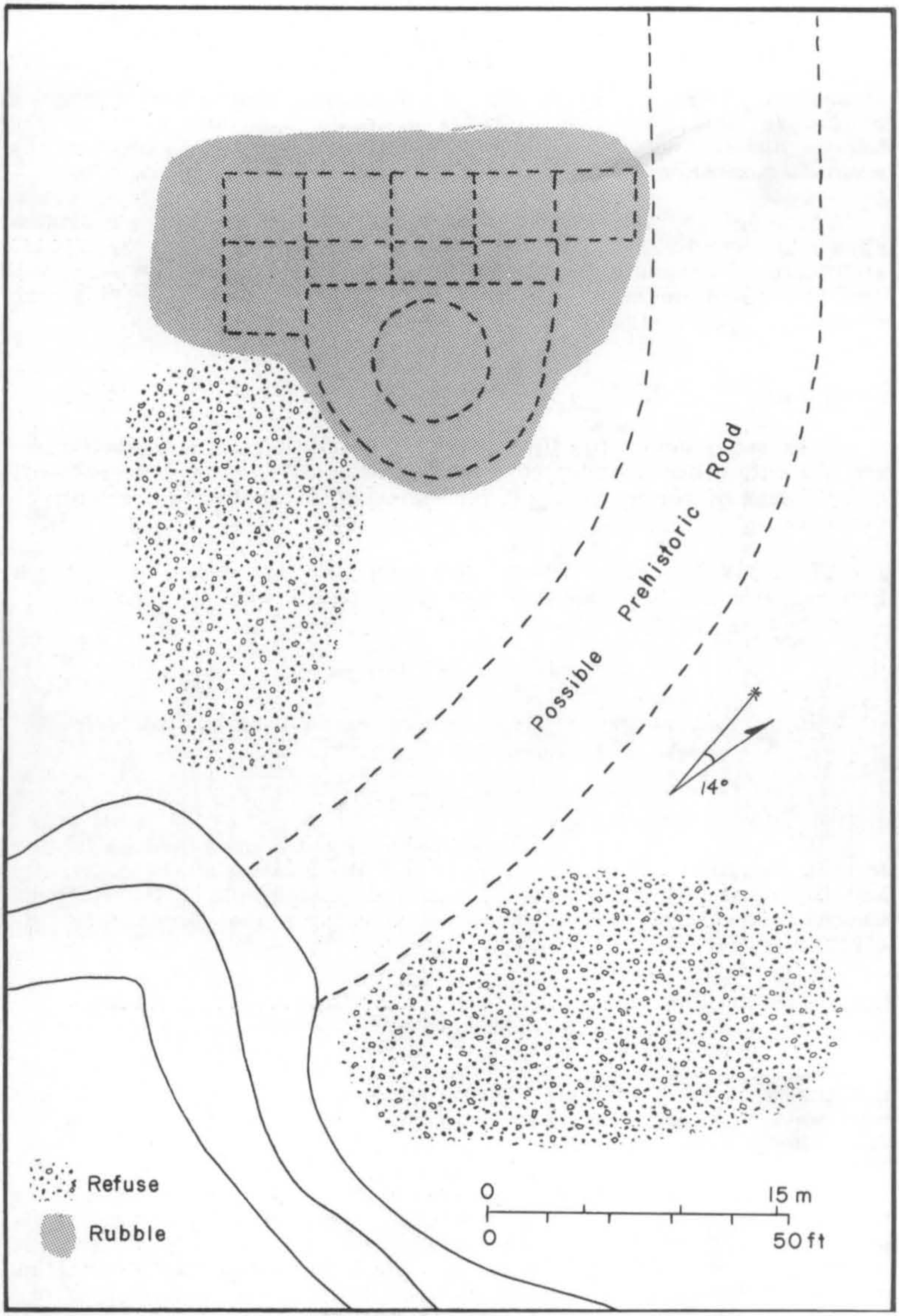


Figure 86. Hogback.

Figure 87. Hogback Chacoan structure. Small, 10 room structure has 2 m mound height, suggesting a single story. View to northwest toward Hogback.

wash channel, suggests the site was closely associated with the presumed road.

Aerial photo imagery of the Twin Angels area has been examined, but no possible road segments are visible. In view of the highly eroded terrain, this is not surprising (Obenauf 1980).

Site Remains

Chacoan Structure

Twin Angels is an L-shaped, one-story structure of 17 rooms and two kivas (Figures 88 and 89). The mound rises to 2.5 m, with a total floor area of 270^2 estimated. An examination of the regular layout of the site suggests the large roomblock may have been constructed during a single planned construction phase. But since data on wall construction sequences have not been reported and no tree-ring dates have been obtained, this is conjectural. Whether the small four-room block to the east was constructed previously, contemporaneously, or subsequently is also unknown.

Because the site was partially excavated by Morris in 1915, a number of rooms are open, revealing core and veneer masonry of Chacoan style. Rooms have a mean size of 12.5 m^2, and standing walls of 1.2-1.5 m in conjunction with substantial debris suggest that the ceilings were probably high. The single excavated kiva (Figure 90) has some Chaco-style features (Carlson 1966).

Ceramics associated with the house mound and talus trash below (Carlson 1966; McKenna 1976) clearly indicate Early Pueblo III to Late Pueblo III occupation.

Other Sites

On the promontory caprock immediately west of the Chacoan structure are two associated structures, both indicated by low rubble mounds of qualitatively poor, friable sandstone. One facing the south promontory edge is U-shaped and measures 9 x 9 m. The type of site this mound represents is unknown, although its shape is similar to Chacoan shrines described by Hayes and Windes (1975).

On the northern edge of the promontory is a more substantial but more reduced rubble mound that may include four to six rectangular rooms and a kiva. It is not known whether either structure is contemporary with the Chacoan structure.

Ceramics

Ceramics recovered from Morris' room excavations (Carlson:1966), as well as from recent room and talus trash tests by the San Juan

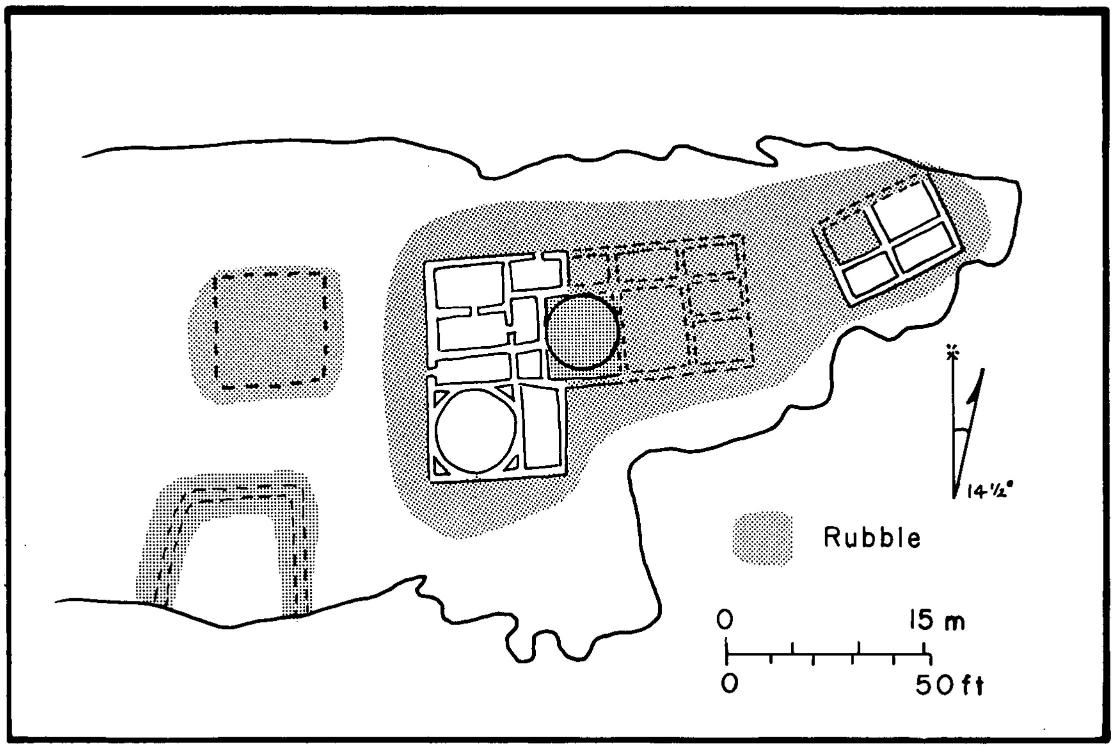


Figure 88. Twin Angels (after Carlson 1966).

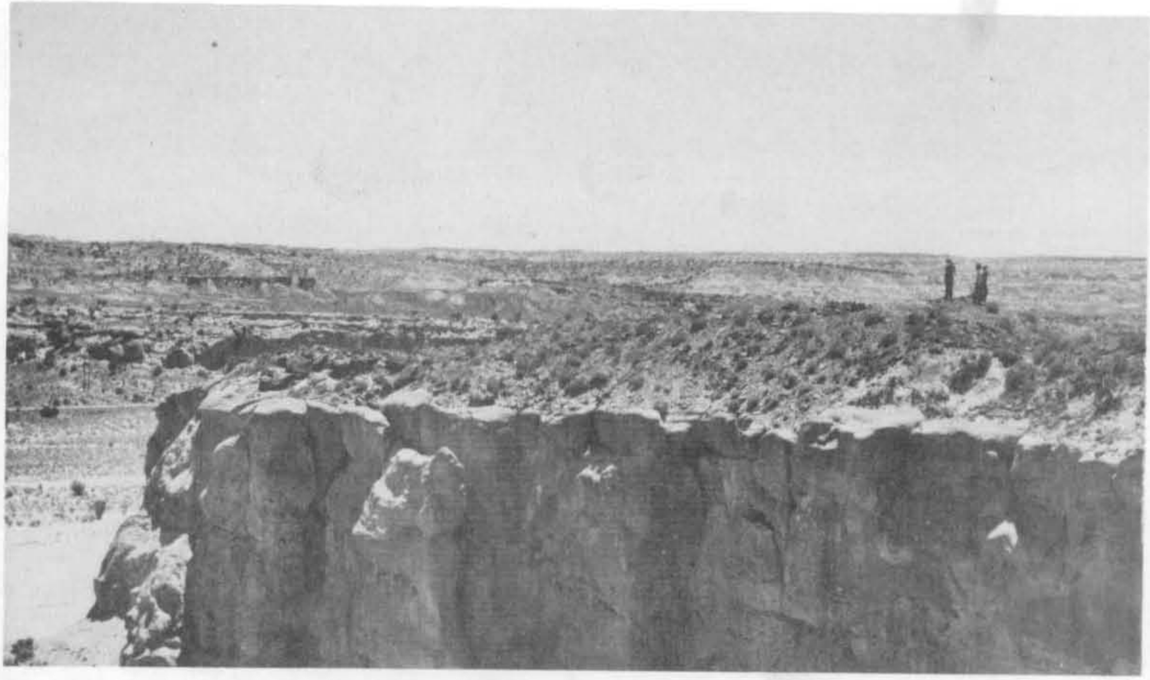


Figure 89. Twin Angels Chacoan structure. Rubble mound covers top of promontory. View to southeast.

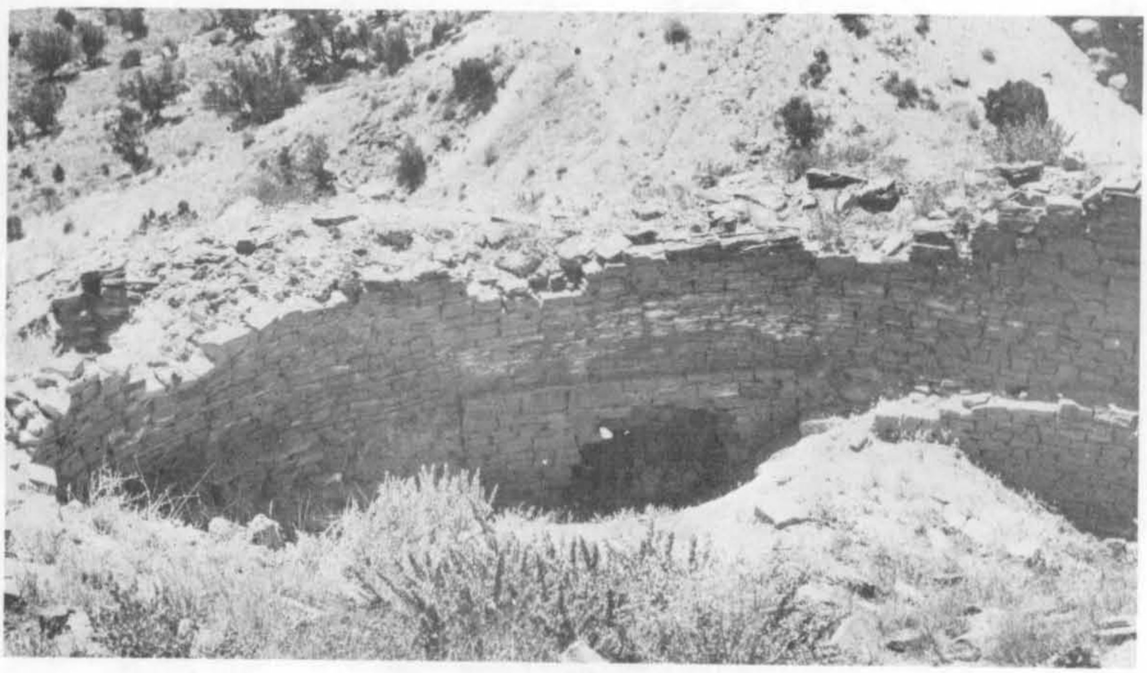


Figure 90. Twin Angels Chacoan structure. Detail of masonry in southern portion of kiva excavated by Morris in 1915.

Valley Archaeological Project (McKenna 1976), have produced sherds of Cibolan (11%), San Juan (16%), Mogollon (2%), and Chuskan (3%) ceramic series. The Cibolan wares are of Early Pueblo III date and are the predominant series in the talus trash. San Juan series sherds embrace both the Early Pueblo III and Late Pueblo III intervals, but they occur in the highest percentages in room contexts -- indicating a Late Pueblo III San Juan ceramic tradition occupation, extending to perhaps 1250-1275 (McKenna 1976:11).

Lithics

Only one specimen of chipped stone, a rhyolite or felsite knife, is reported by Carlson (1966) from Morris' 1915 excavations. While the Twin Angels Chacoan structure yielded little material culture as a whole, the apparent absence of chipped stone probably is more reflective of Morris' collection techniques than indicative of a virtual absence of chipped stone materials.

Halfway House

Halfway House lies on a slight knoll on the western slope of an unnamed tributary drainage of Gallegos Wash. The site is south-southwest of Huerfano Trading Post and southeast of Carson Trading Post, New Mexico (Figure 1). Elevation is 2,013 m (6,600 feet) above sea level.

On the ground, and on aerial photo imagery, segments of the Great North Road (Lyons and Hitchcock 1977; Morenon 1977) are clearly visible east and north of Halfway House. The road is most discernible to the immediate east of the house mound, where it is visible as a wide and shallow swale. The swale continues a number of meters north of the house mound but gradually becomes less distinct. After the road passes east of the house, it appears to curve westward around the southeastern corner of the house, thereby swinging into the area south of the house. Although not visible on the ground, aerial photos indicate the road makes another curve to resume its north-south orientation (Obenauf 1980).

Site Remains

Chacoan Structure

Halfway House is a barely visible rectangular house mound, one story in height, with an estimated 12 rooms (Figures 91 and 92). Because aeolian deposits enshroud the mound, its height is difficult to estimate, but a height of about 2 m is probable. The total floor area of the site is estimated at 145 m^2. No kiva depressions are visible, but the presence of one or two kivas may be conjectured. The sandy soil that nearly covers the house does not allow an assessment of construction planning at the site; but even if the structure was planned and built as a single unit, it clearly did not involve large scale planning.

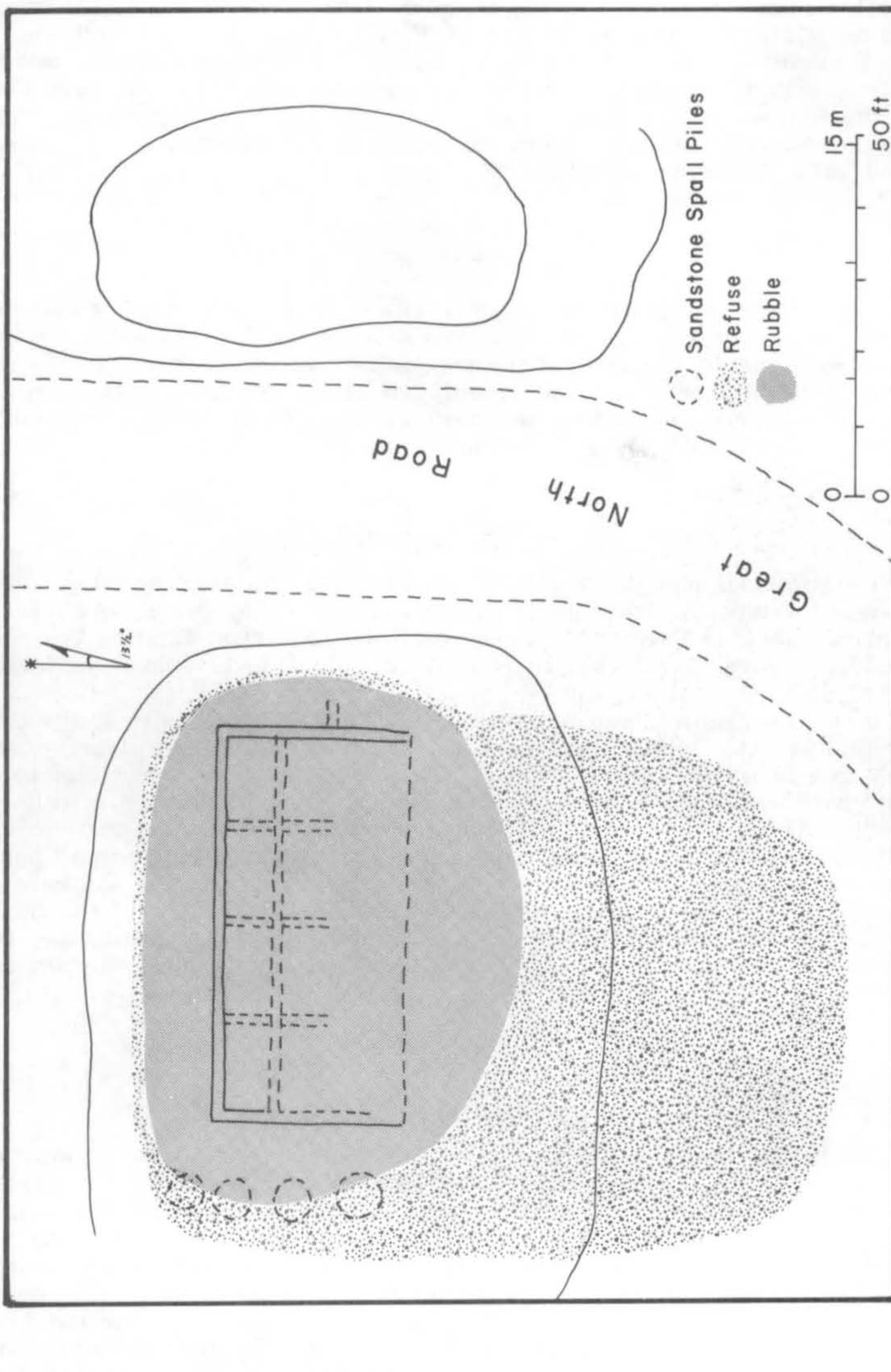


Figure 91. Halfway House.

Figure 92. Halfway House. View of rubble mound looking north.

Architecturally, little comment is possible, although limited trenching by unknown persons around the margins of the mound has exposed core and veneer masonry of Chacoan style. Room sizes cannot be accurately determined.

Other Sites

Reconnaissance in the immediate area of Halfway House has not revealed any associated sites, and it is our impression that few or none are present.

Ceramics

Less than 20 decorated sherds were found during our reconnaissance, a factor due in part to the aeolian sand that covers the site and in part to extensive collecting by those who preceeded us. The few diagnostic sherds found were Late Pueblo II and Early Pueblo III types, although sherds of the former period were so few that occupation during Late Pueblo II is seen as unlikely in view of the general sparsity of Pueblo II ceramics at other sites associated with the Great North Road. Since we did not tabulate the sherds examined, the exact percentage of Cibolan sherds present is not known, although Cibolan types were predominant.

Lithics

Only a half-dozen lithics were found on the site surface. These included silicified wood, quartzite, and dark-brown chert. The latter material was not noted at other sites in the Chaco Basin and could be from the San Juan River area. The other specimens are locally derived.

Pueblo Pintado

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 93 and 94 for a plan and photograph of the Pueblo Pintado Chacoan structure. See Figure 95 for sites in the Pueblo Pintado community.

Greenlee

This Chacoan structure is situated on a low mesa top overlooking a western tributary valley of Fajada Wash. The site is southwest of Chaco Canyon National Monument Headquarters and northwest of Red Mountain (Figure 1). Elevation is 1,945 m (6,380 feet above sea level.

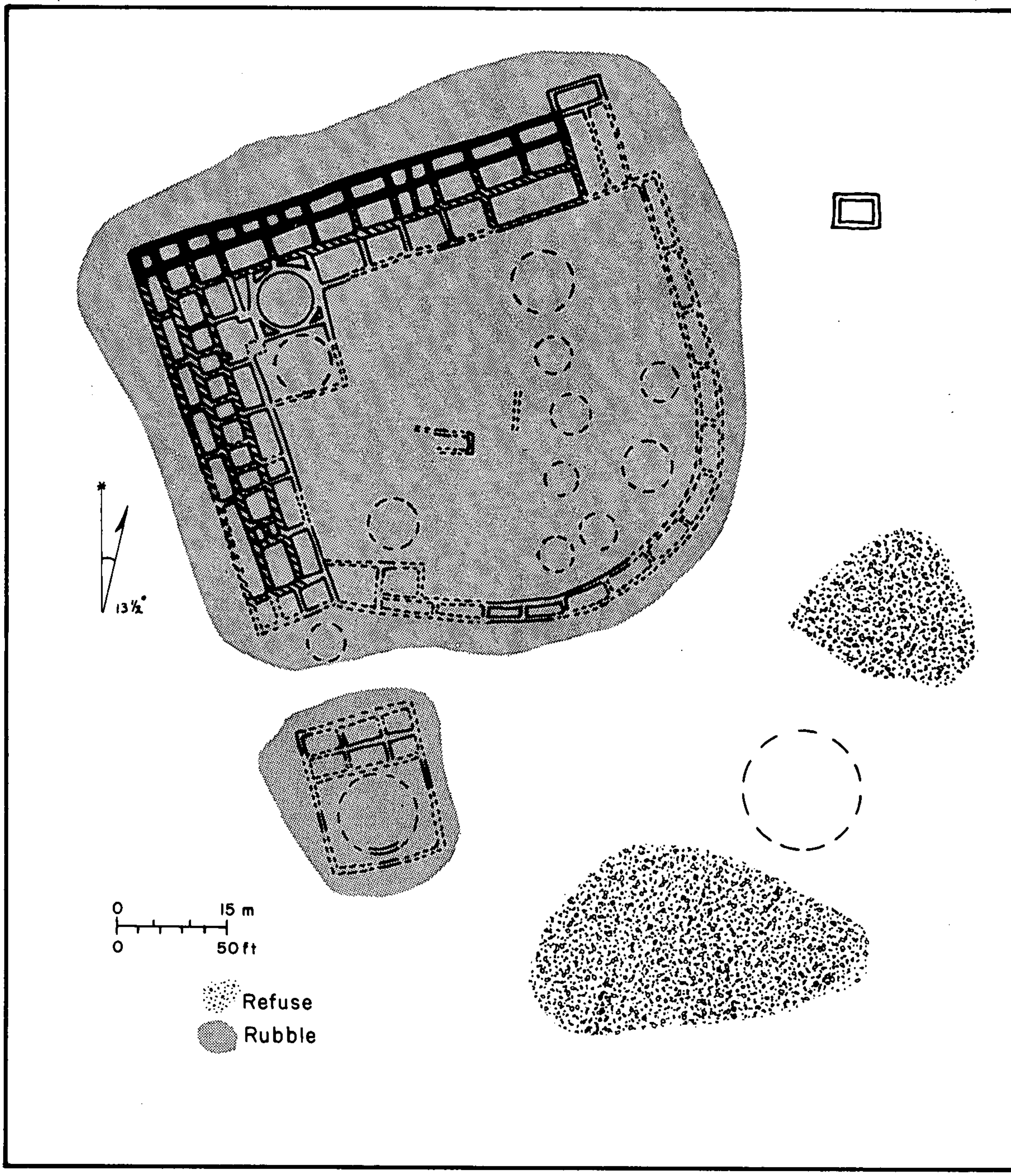


Figure 93. Pueblo Pintado (after NPS photogrammetric map 1973).

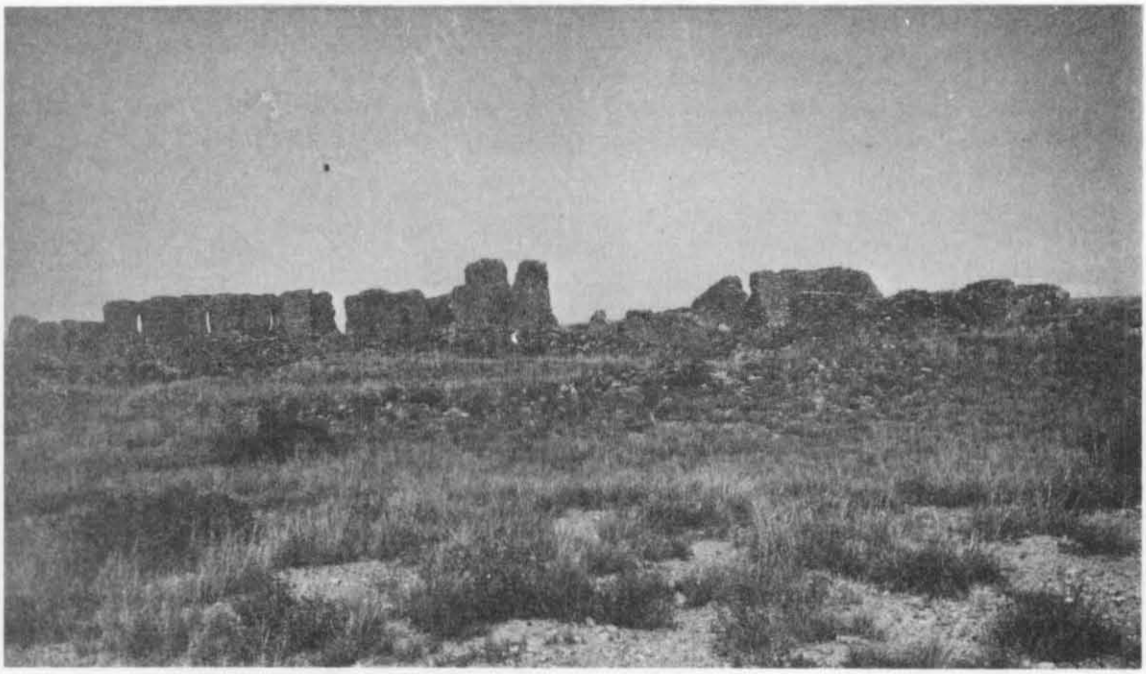


Figure 94. Pueblo Pintado. Second story walls of west roomblock. Large enclosed plaza is partially visible in foreground.

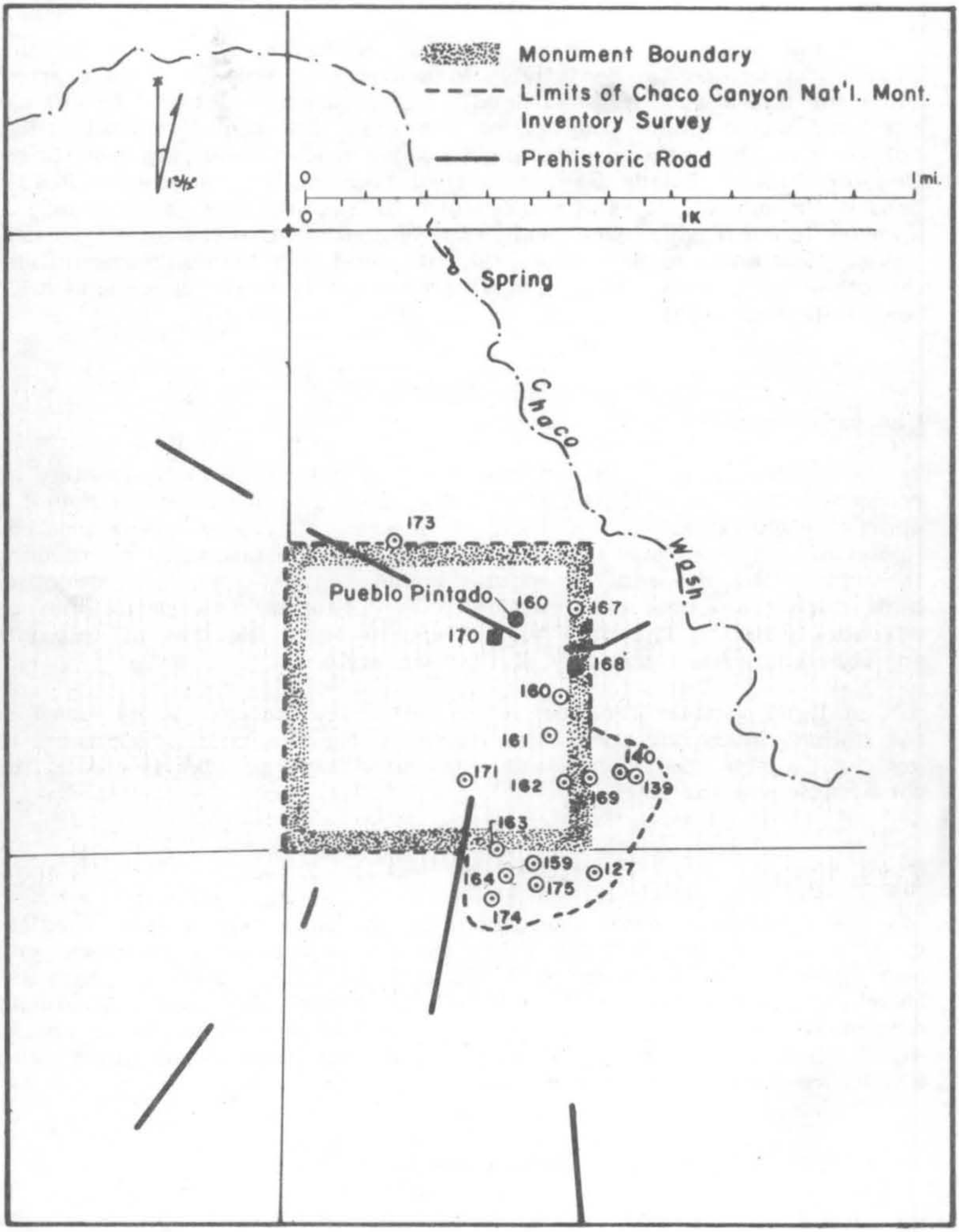


Figure 95. Pueblo Pintado community (after NPS archaeological survey map, 1973).

A low swale in the mesa ridge approximately 75 m east of this Chacoan structure was tentatively identified as a possible road segment when the house was first examined. Subsequently, Obenauf (1980) has examined aerial photo imagery of the area and tentatively identified (pending further ground checking) a major road. Extending from Chaco Canyon through Fajada Gap, this road (termed the "Southeast Road") passes Greenlee. It continues south to Seven Lakes Wash where it appears to bifurcate. One branch leads southeast to the San Mateo-Mt. Taylor area and the San Mateo, El Rito, and Kin Nizhoni communities; the other leads westward to Kin Ya'a where it joins the major southwest road (Obenauf 1980).

Site Remains

Chacoan Structure

Greenlee is an L-shaped one-story structure of approximately 15 rooms and one kiva (Figures 96 and 97A, B). The height of the mound is approximately 2 m, and a total floor area of 255 m^2 is estimated. Rooms have a mean size of 9.5 m^2. Although the similarity of masonry throughout the site and the regular layout suggest a planned structure built during a single construction phase, this is little more than an educated guess. The only visible architectural features of this site are core and veneer masonry of Chacoan style.

A light scatter of refuse is present a few meters to the south of the mound, indicating occupation during Early Pueblo III. A number of low spall piles that surround the site may be debris from the construction of the site.

Other Sites

No other sites have been noted on the mesa top in the immediate vicinity of Greenlee, but the valley bottom slopes to the northeast and east appear to be scattered with small house sites. Some of these are clearly of Pueblo II-III date, although they have not been individually examined. Not enough is known of their occupational spans or spatial distribution to determine whether or not they form a community with which Greenlee may be associated.

Ceramics and Lithics

While no collection or systematic examination of sherds at the Greenlee structure has been made, casual examination of sherds on the site surface indicates Cibolan types of Early Pueblo-III date.

No data on lithic materials associated with this site have been collected.

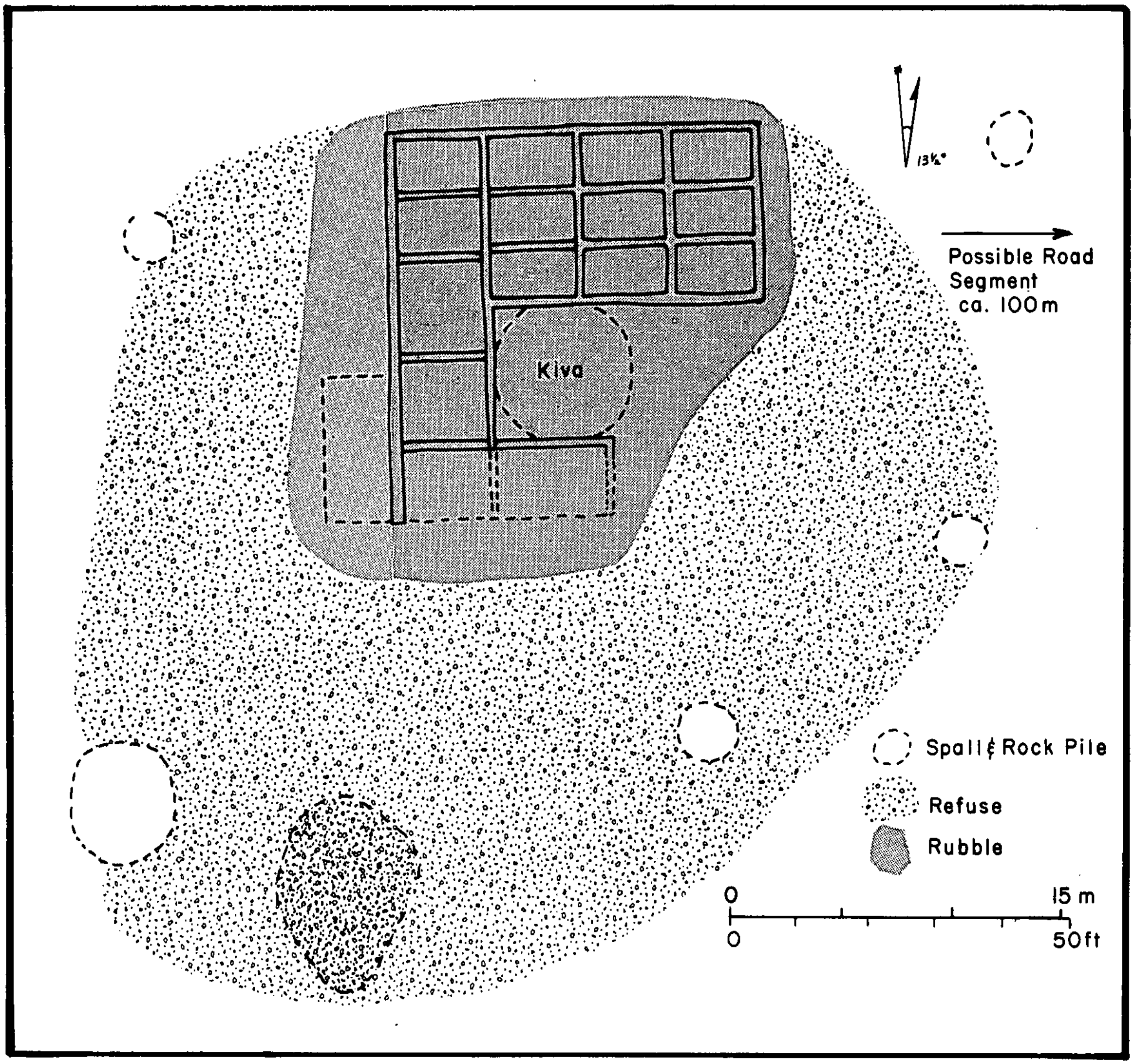


Figure 96. Greenlee.

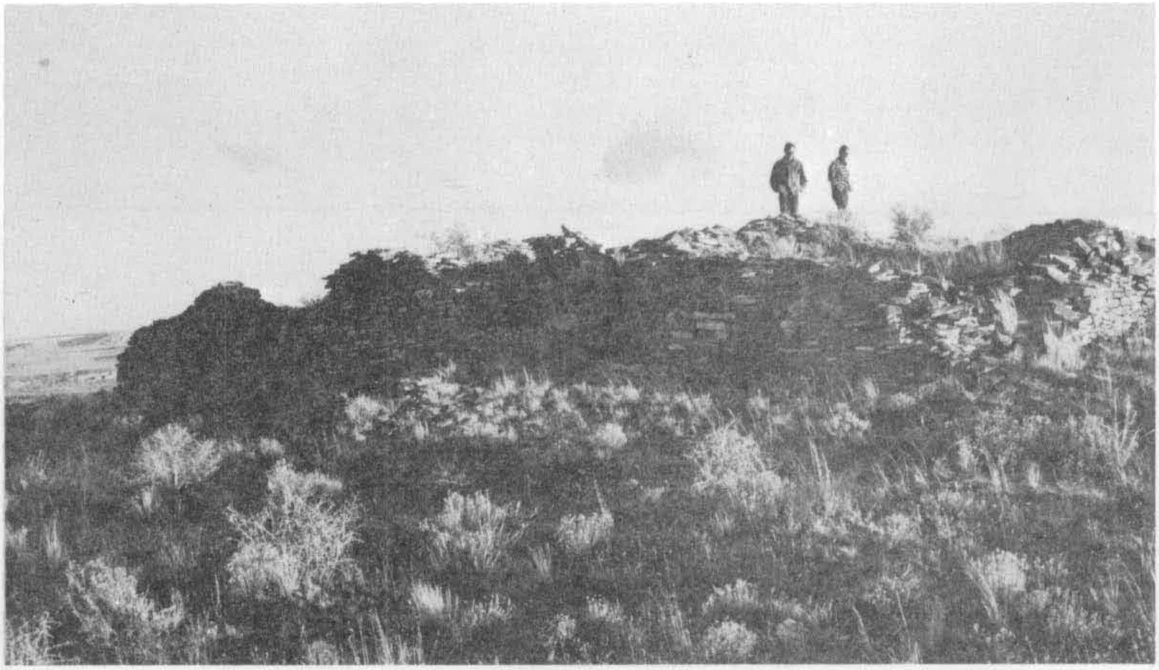


Figure 97A. Greenlee Chacoan structure. View of standing remnants of north wall.

Figure 97B. Greenlee Chacoan structure. Detail of large block masonry in east exterior wall.

Upper Kin Klizhin

This Chacoan structure is located on the east valley slope of Kin Klizhin Wash, southwest of Chaco Canyon National Monument Headquarters and northwest of Red Mountain (Figure 1). Elevation is 1,933 m (6,340 feet) above sea level.

Segments of a major prehistoric road, the Southwest Road, are visible both on the ground and on aerial photo imagery. They have been documented from the South Gap of Chaco Canyon onward to Kin Ya'a, some 34 km to the southwest (Lyons 1973; Lyons and Hitchcock 1977; Obenauf 1980). Although no segments are identifiable immediately around the Upper Kin Klizhin structure, segments to the north and south indicate that the main road passes the structure several hundred meters to the west. A bifurcation of the major road 1.3 km south of the structure results in a branched road, the bearing of which would lead directly past the eastern side of the Upper Kin Klizhin structure. Quite possibly this branch functioned as a site access route, similar to that at Kin Ya'a. If so, the branch probably rejoins the main road a short distance to the north.

Site Remains

Chacoan Structure

Upper Kin Klizhin is a sand-obscured rectangular structure with two stories and an estimated 25 rooms (Figures 98 and 99). One slight depression indicates the presence of a kiva, but obscuring rubble effectively conceals any others that may be present. The height of the mound is 2.5-3.0 m, with a total estimated floor area of 470 m^2. The accumulation of debris does not permit an assessment of planning or the scale of construction units at the site.

With the exception of core and veneer Chaco-style masonry, specific architectural attributes of this site cannot be determined.

Other Sites

Limited reconnaissance along the ridge top forming the western boundary of the valley (1-1.5 km southwest of the Chacoan structure) has located a number of small house mounds of Pueblo II-III date, and it seems likely that the lower valley slopes hold others. Not enough is known of the occupational spans of these sites or of their spatial distribution to determine whether or not they form a community with which the Upper Kin Klizhin structure is associated.

Ceramics and Lithics

A nonrandom, grab analysis of sherds on the surface of Upper Kin Klizhin indicates a predominanace of Cibolan Late Pueblo II-Early

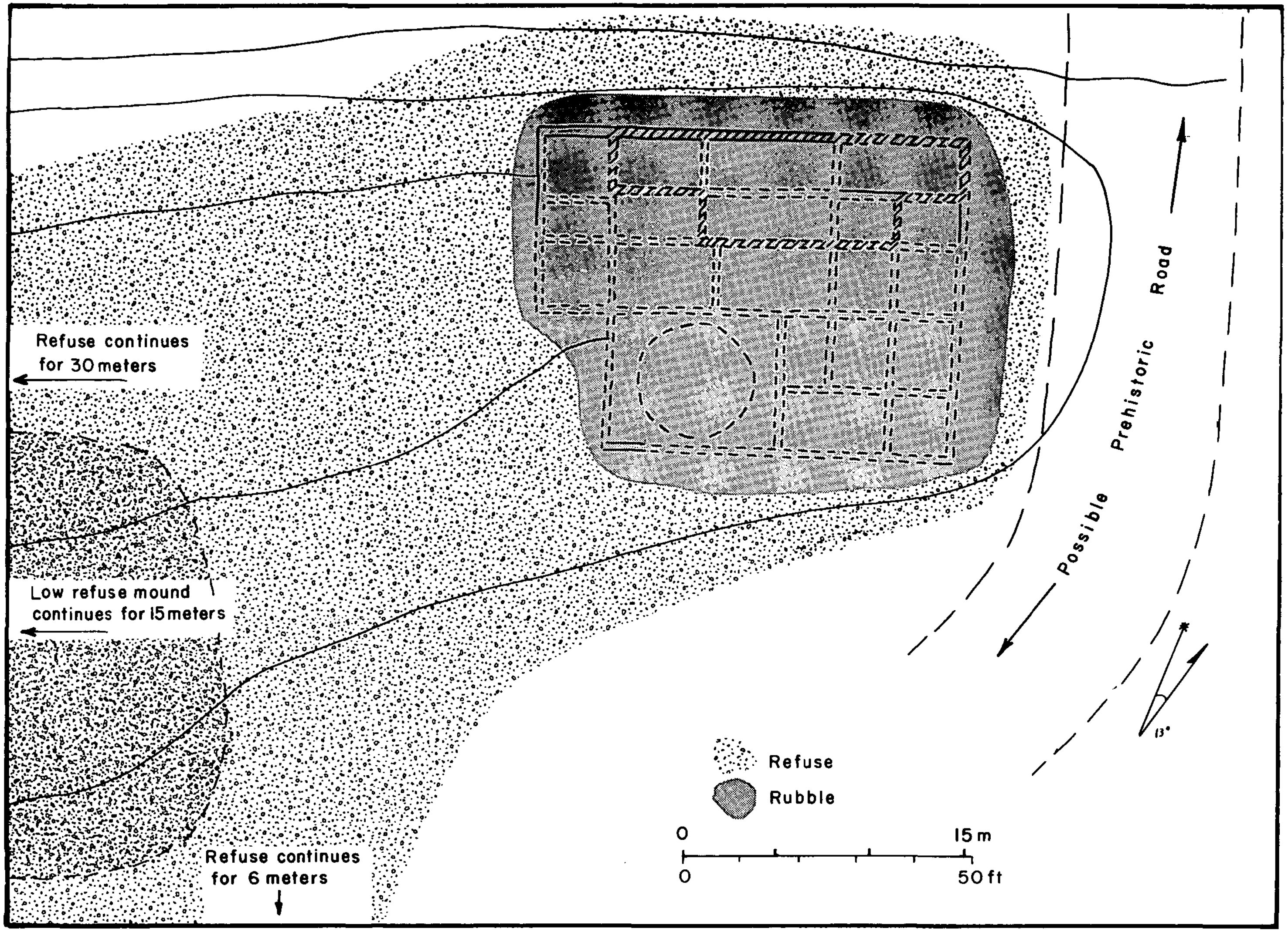


Figure 98. Upper Kin Klizhin.

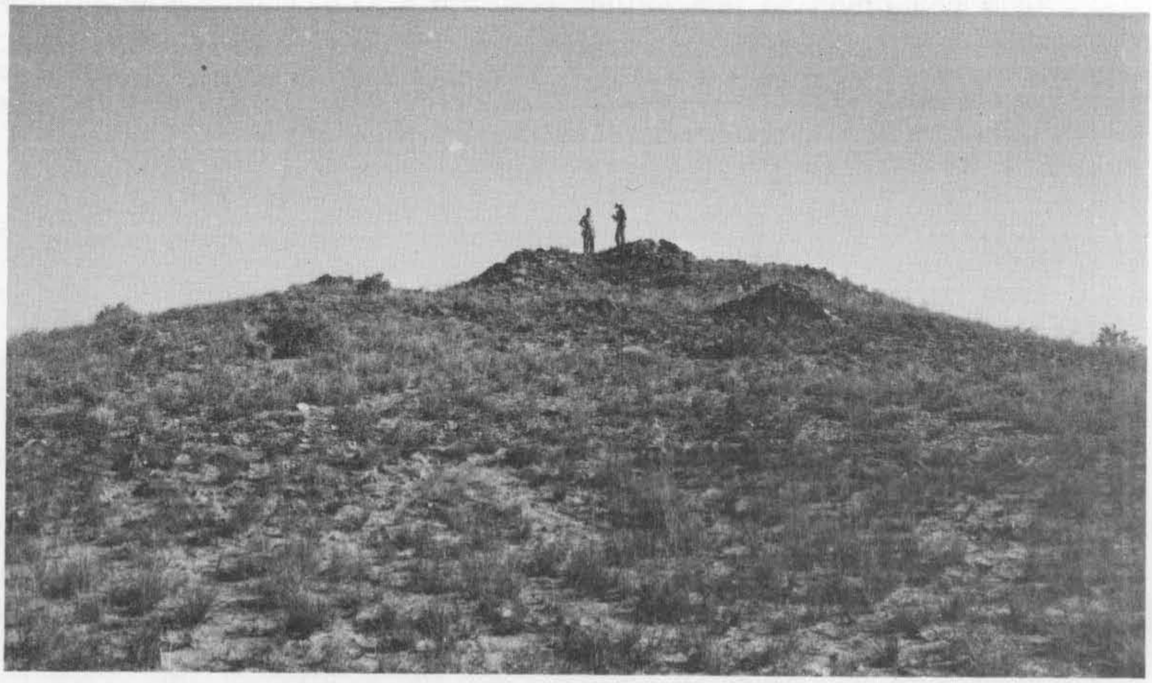


Figure 99. Upper Kin Klizhin Chacoan structure. House mound rubble as seen from refuse area to south.

Pueblo III types (70%), with some Chuskan, trachyte-tempered sherds (4%) of the same temporal intervals.

Seven varieties of locally available silicified wood account for 59% of the lithics examined in a nonrandom grab sample from the site surface. Cherts and chalcedonies cumulatively comprise another 33%. These are local materials except for yellow-brown chert (#1072) which accounts for 5%.

Bee Burrow

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 100 and 101 for a plan and photograph of the Bee Burrow Chacoan structure. See Figure 102 for sites in the Bee Burrow community. For a narrative discussion, see Marshall et al. (1979).

Kin Ya'a

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 103 and 104 for a plan and photograph of the Kin Ya'a Chacoan structure. See Figure 105 for sites in the Kin Ya'a community. Figure 106 provides an aerial photograph view of the immediate Kin Ya'a area. For a narrative discussion, see Marshall et al. (1979).

Muddy Water

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figure 107 for a photo of the largest of three Chacoan structures. For a narrative discussion, see Marshall et al. (1979).

Dalton Pass

This Chacoan structure is located on a low mesa knoll on the western slope of Dalton Pass Canyon, northwest of Dalton Pass Trading Post and southeast of Standing Rock Trading Post, New Mexico (Figure 1). Elevation is 2,074 m (6,800 feet) above sea level.

Although aerial photo imagery of the Dalton Pass area has been intensively examined, no prehistoric roads have been identified. If roads were present in the area prehistorically, flooding, alluviation, and modern distubances have obliterated them (Obenauf 1980).

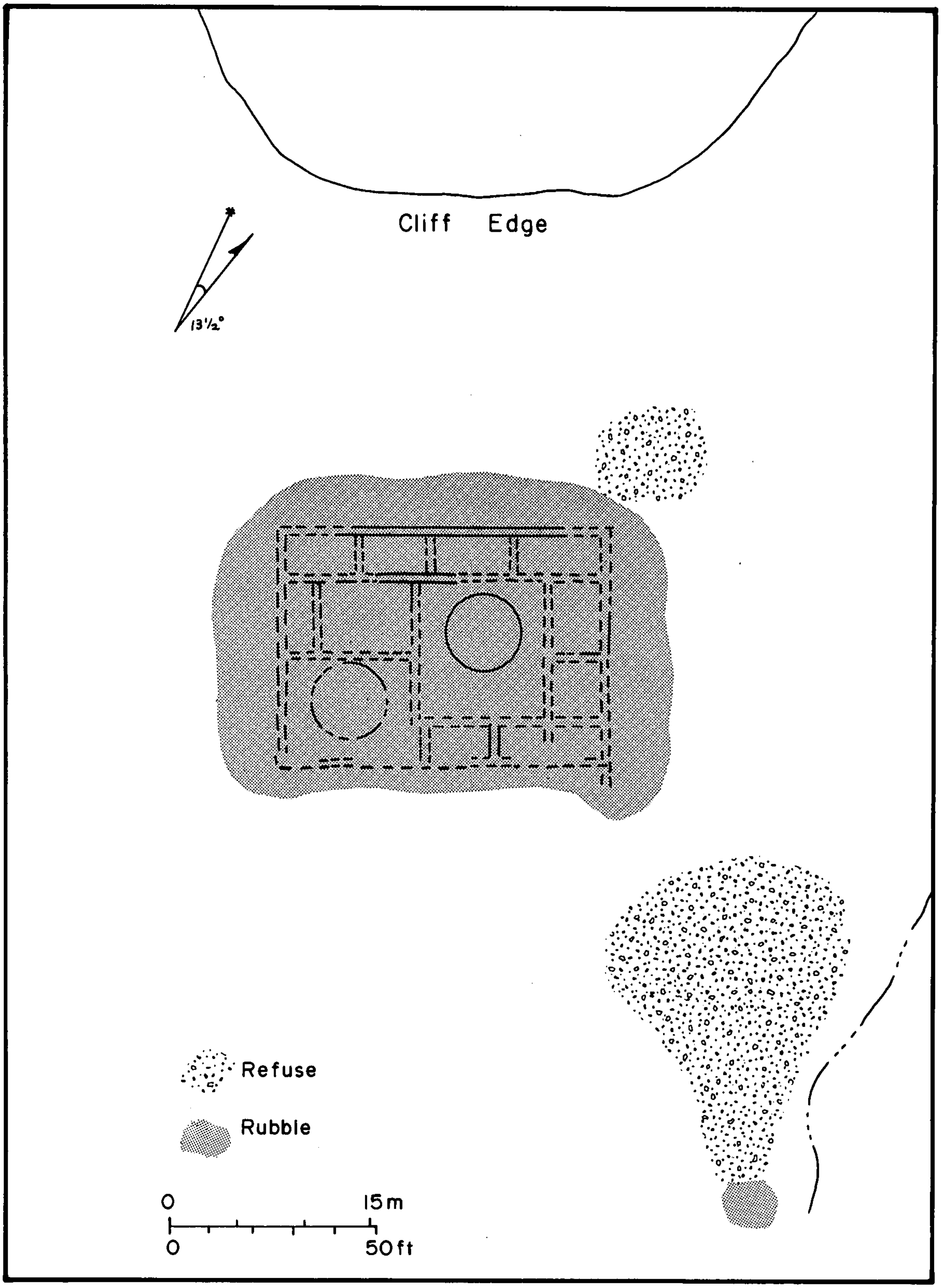


Figure 100. Bee Burrow (after O'Laughlin 1980).

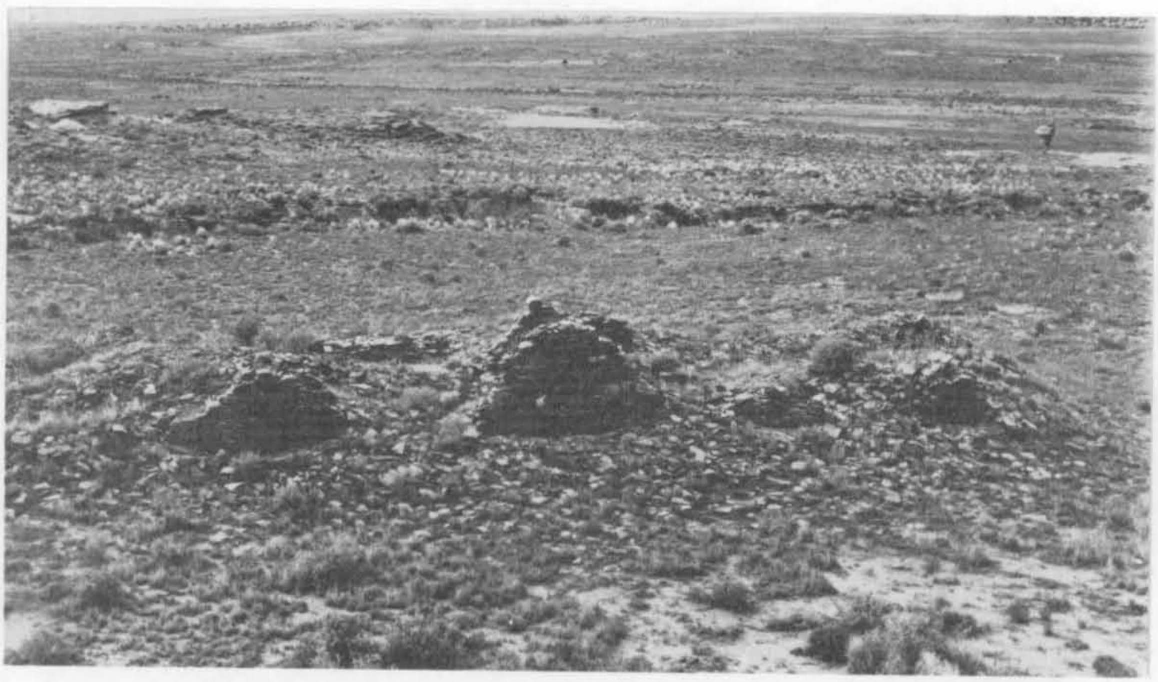


Figure 101. Bee Burrow Chacoan structure. Standing remnants of north wall.

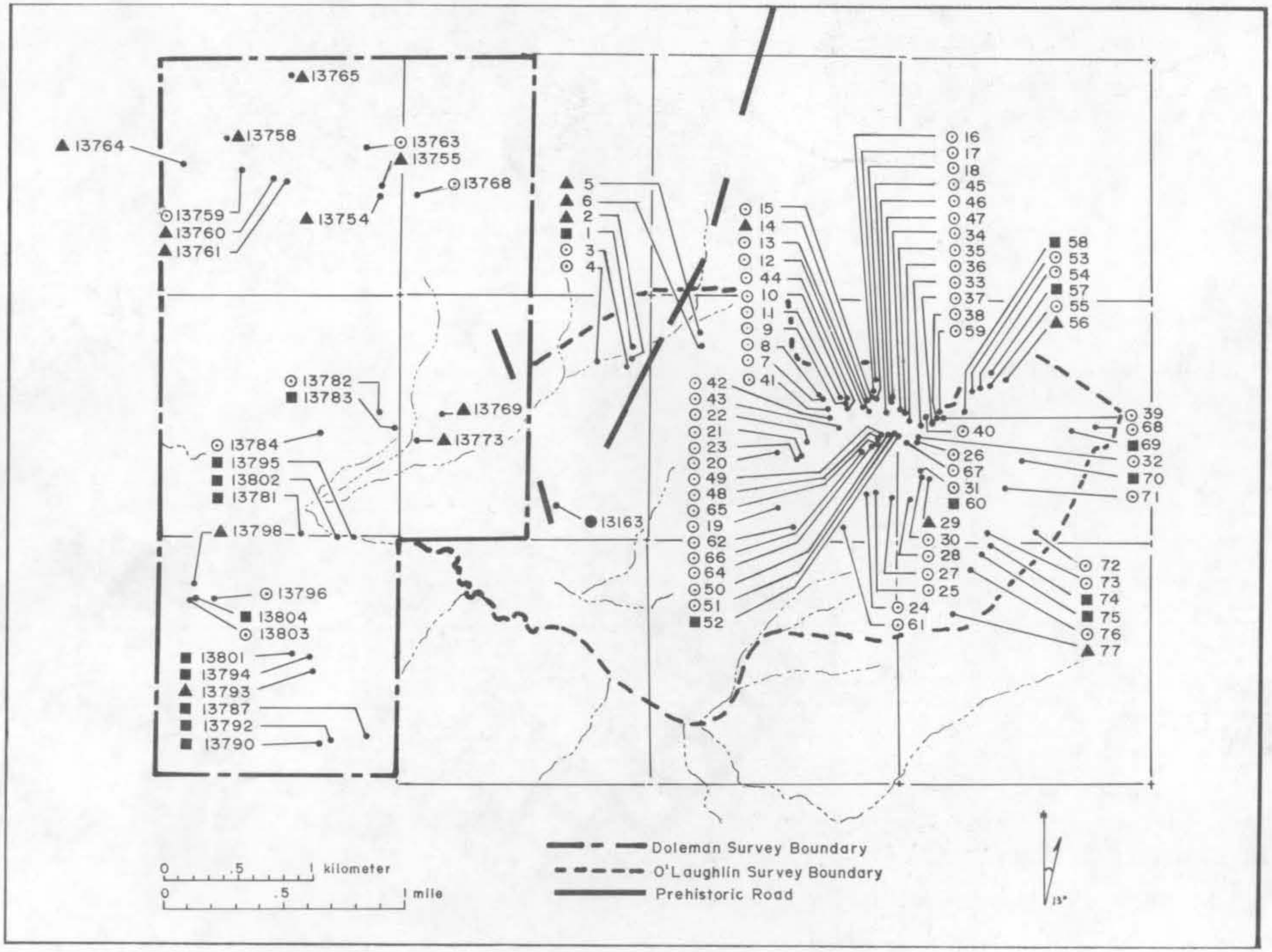


Figure 102. Bee Burrow community. Site 13163 is the Chacoan structure (after Doleman 1976 and O'Laughlin 1980).

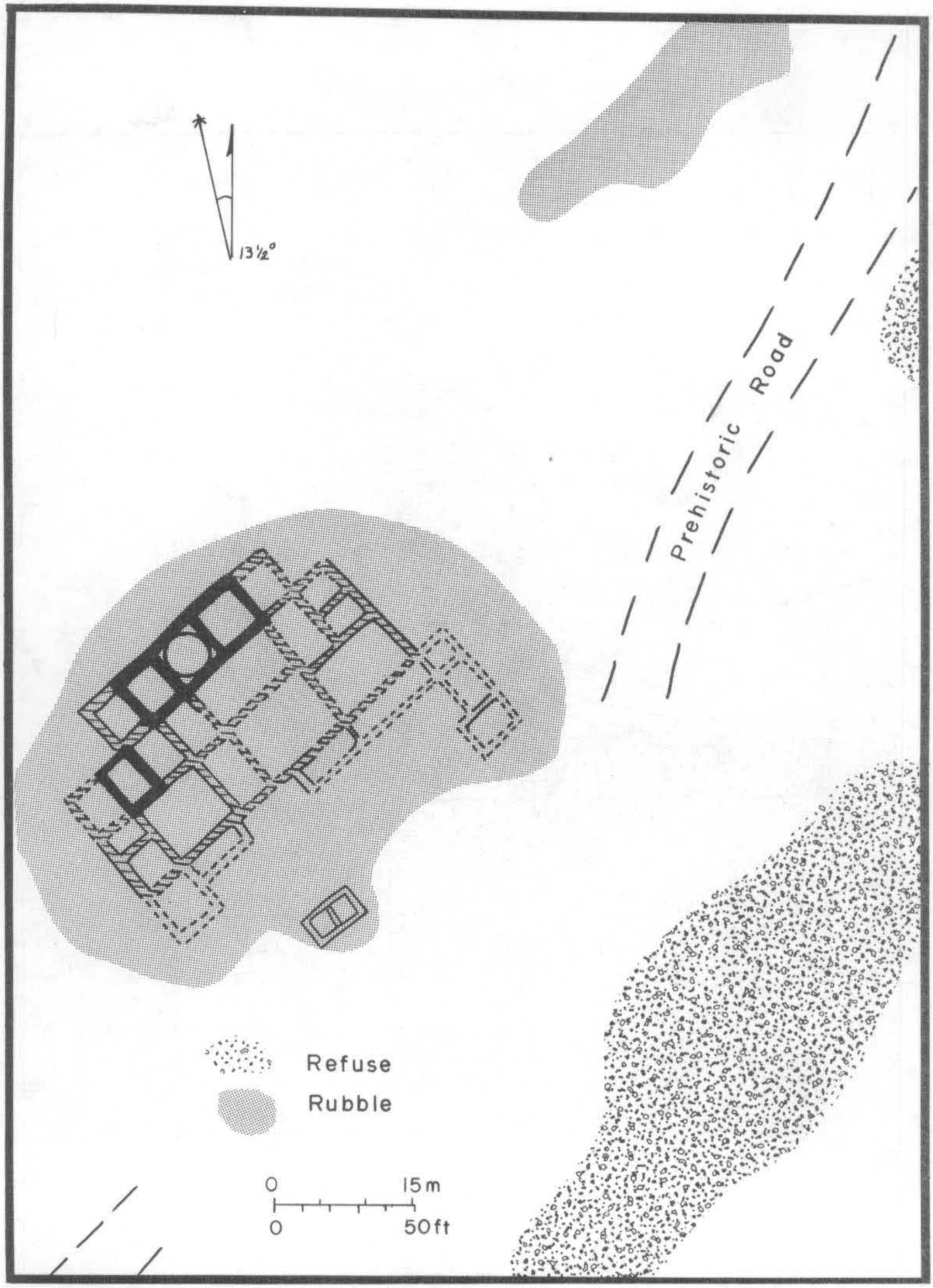


Figure 103. Kin Ya'a (after NPS photogrammetric map 1973).

Figure 104. Kin Ya'a. Looking south to four-story tower kiva and north wall of structure.

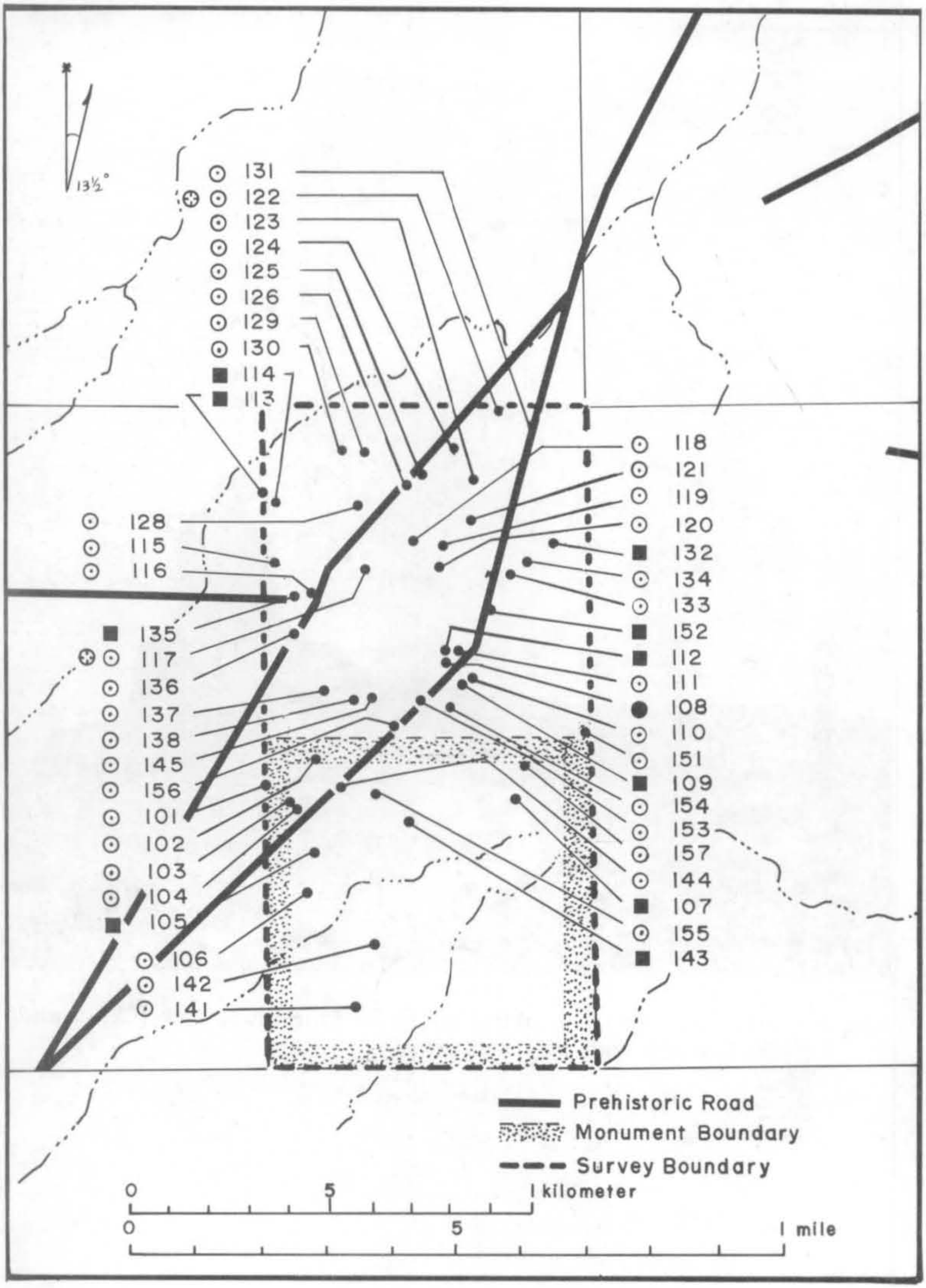


Figure 105. Kin Ya'a community (after NPS archaeological survey map 1973).

Figure 106. Kin Ya'a. Aerial of Chacoan structure vicinity. Pointers indicate prehistoric Southwest Road and Kin Ya'a bypass road. Great kiva depression is visible at photo upper center.

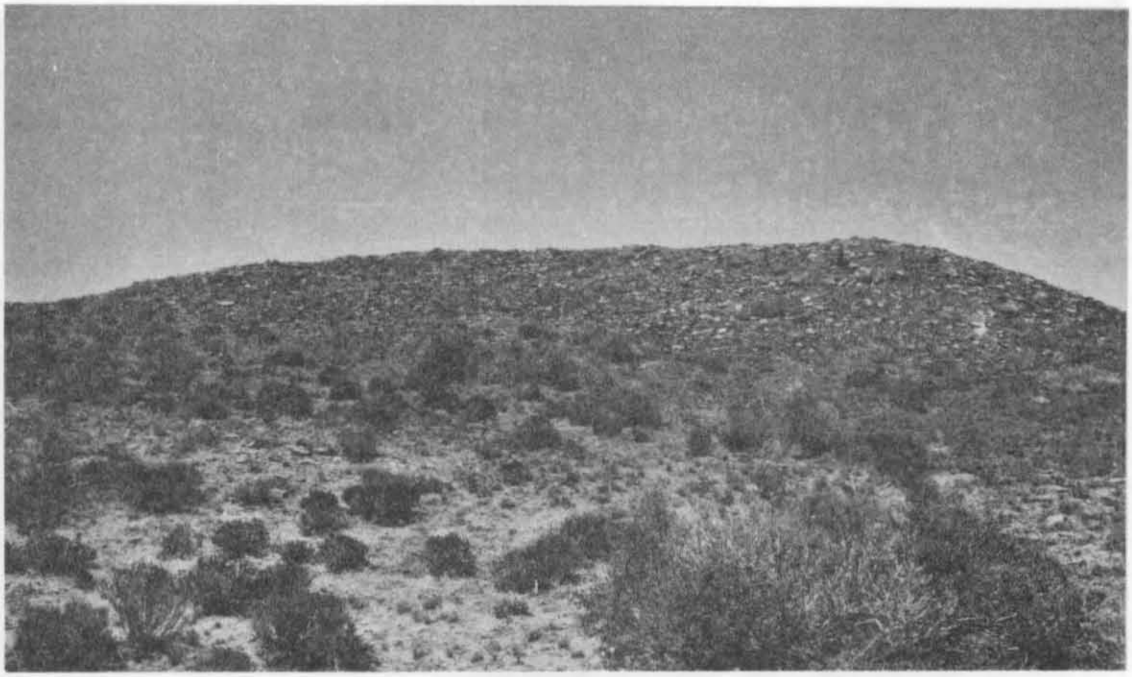


Figure 107. Muddy Water. Largest Chacoan structure (LA 10595) of Muddy Water community. House mound is 4 m in height with two stories estimated.

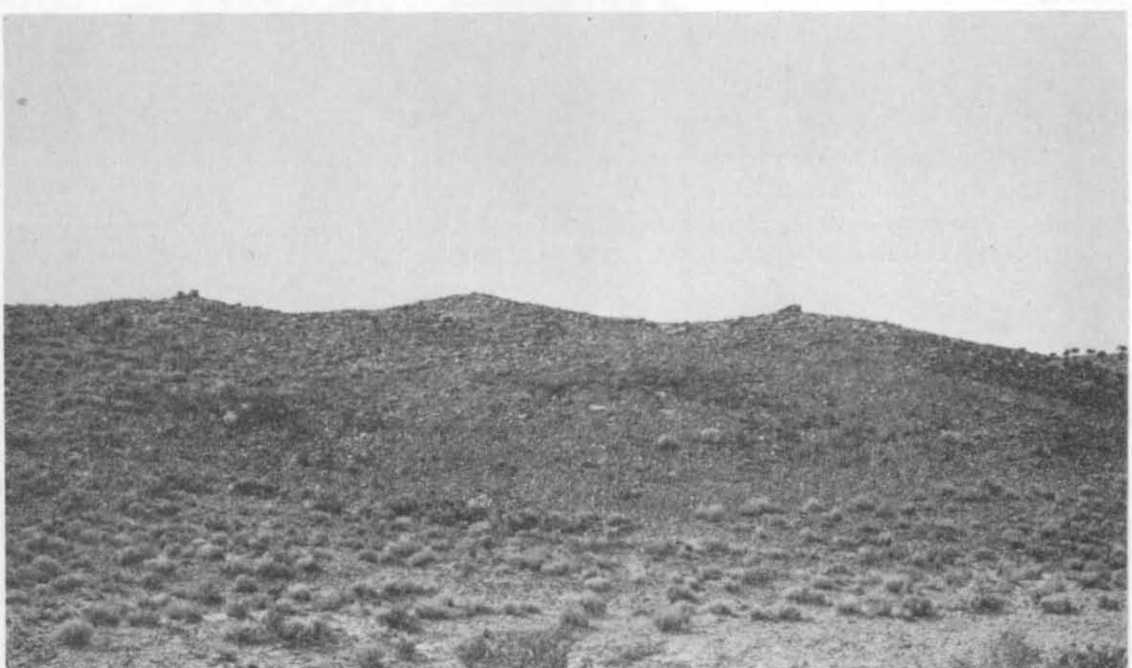


Figure 108. Dalton Pass Chacoan structure. Refuse mound in foreground fronts enclosed plaza and rubble house mound.

Site Remains

Chacoan Structure

The Dalton Pass Chacoan structure is a rectangular house with a mound approaching 3 m in depth. The mass of loose stone rubble that litters the surface makes it difficult to evaluate features in the site (Figure 108), but it appears to have two stories with approximately 20 rooms and two intramural kivas. A small plaza area fronts the house on the southeast and may contain another small kiva as well as a great kiva (Figure 109). Including the upper-story areas, a total floor area of 825 m^2 is estimated. The scale of planning at the site and the number of construction units involved cannot be determined.

Other architectural attributes are similarly difficult to determine, although core and veneer or compound walls are suggested by the thick mass of rubble. A heavy scatter of trash covers the north, east, and southern slopes of the knoll.

Other Sites

Approximately 20 m southwest of the Chacoan structure, on a higher knoll of the same ridge, is a large bowl-shaped declivity that may be a great kiva depression. The absence of masonry rubble and sparseness of associated ceramics render this identification tentative.

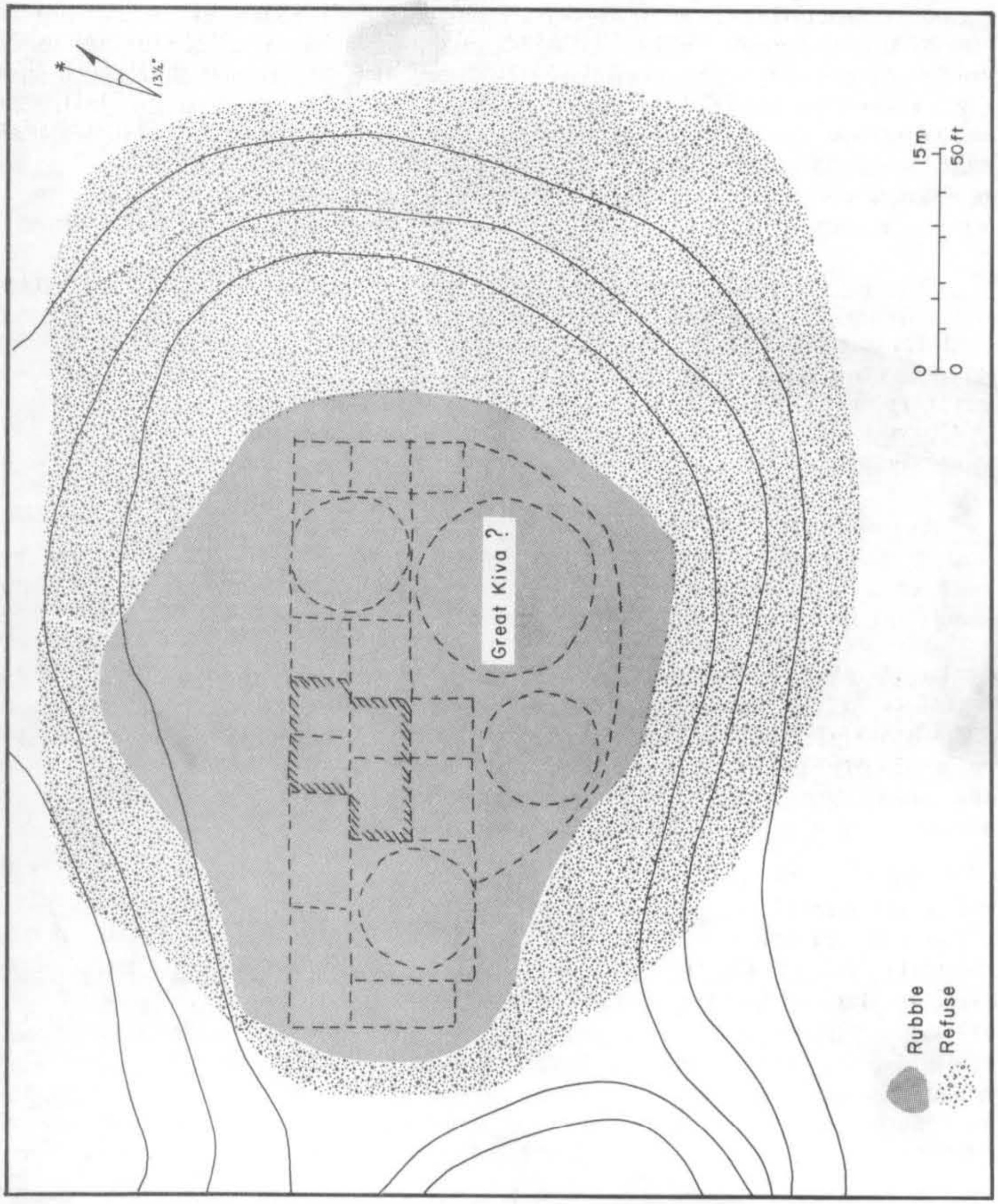
Very brief reconnaissance of the Dalton Pass valley slopes, 1-2 km northeast of the Chacoan structure, indicates the presence of a number of Pueblo II-III house and refuse mounds. Additional small house sites are probably present along the valley margins of much of the Dalton Pass area, but until systematic survey of the area is undertaken, the definition of a community will not be possible.

Ceramics

Surface ceramics at the Chacoan structure are dominated by Cibolan series types, primarily of Late Pueblo II - Early Pueblo III date. The few Early Pueblo II sherds present are probably not indicative of occupation during this early period. A few San Juan and Chuska series types were also observed. Since no tabulation of the sherds examined was made at the time of reconnaissance, quantification is not possible.

Lithics

An _in situ_ analysis of surface lithics, selected in grab fashion, shows silicified wood comprises 83% of the sample, with dark shades of wood (#1112) being most common (39%). Only three chert specimens were noted, with one fossiliferous chert (#1011), one Washington Pass (#1080), and one Pedernal chert (#1090) each accounting for 4%. One


13½°
15 m
50 ft
0
0
Great Kiva ?
Rubble
Refuse

piece of obsidian (#3510), probably from the Grants Ridge area, completes the sample. With the exception of Washington Pass chert, obsidian, and possibly Pedernal chert, all other materials were probably obtained locally.

One material type that was unexpectedly absent is yellow-brown chert with black inclusions (#1072). Based on the percentages encountered at nearby Chacoan structures (Peach Springs [21%], Standing Rock [14%], and Muddy Water [33%]), it was expected that this distinctive type would comprise a moderate proportion of the sample. Its apparent absence is probably more a reflection of the small sample size (n = 23) than of its actual presence or absence.

Kin Klizhin

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 110 and 111 for a plan and photograph of the Kin Klizhin Chacoan structure. See Figure 112 for sites in the Kin Klizhin community. For a narrative discussion, see Marshall et al. (1979).

Kin Bineola

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 113 and 114A, B for a plan and photographs of the Kin Bineola Chacoan structure; for a narrative discussion, see Marshall et al. (1979).

Standing Rock

Data pertaining to this outlier community are presented in tabular form in chapter 6. Refer to Figure 1 for the location of this community and to Figures 115 and 116 for a plan and photograph of the Standing Rock Chacoan structure. See Figure 117 for sites in the Standing Rock community. For a narrative discussion, see Marshall et al. (1979).

Grey Hill Springs

Data pertaining to this outlier community are presented in tabular form in chapter 6. Figure 1 shows the location of this community and Figure 118 pictures three of the central Grey Hill Springs structures. For a narrative discussion, see Marshall et al. (1979).

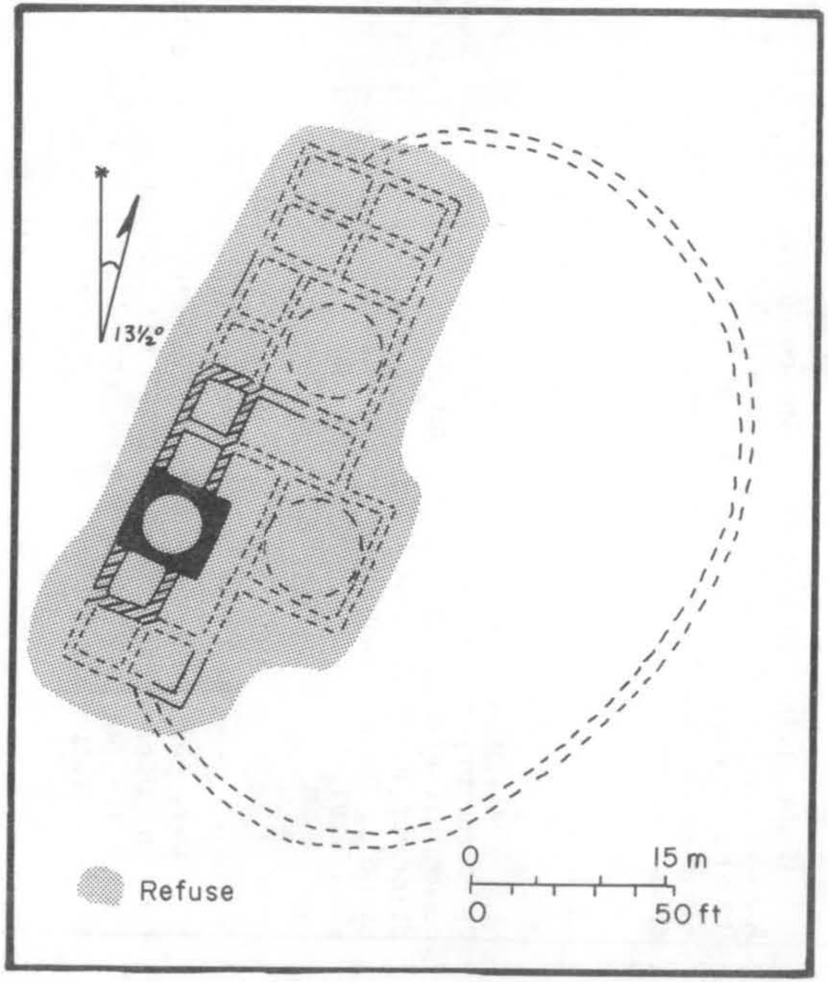


Figure 110. Kin Klizhin (after NPS photogrammetic map 1973).

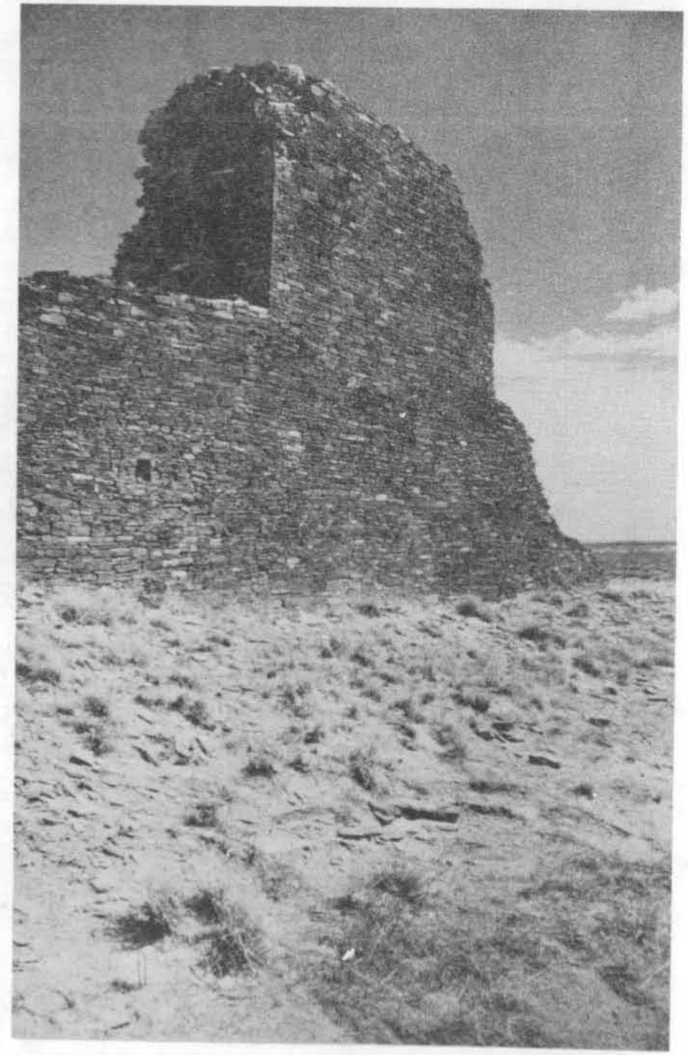


Figure 111. Kin Klizhin. West exterior of three story tower kiva.

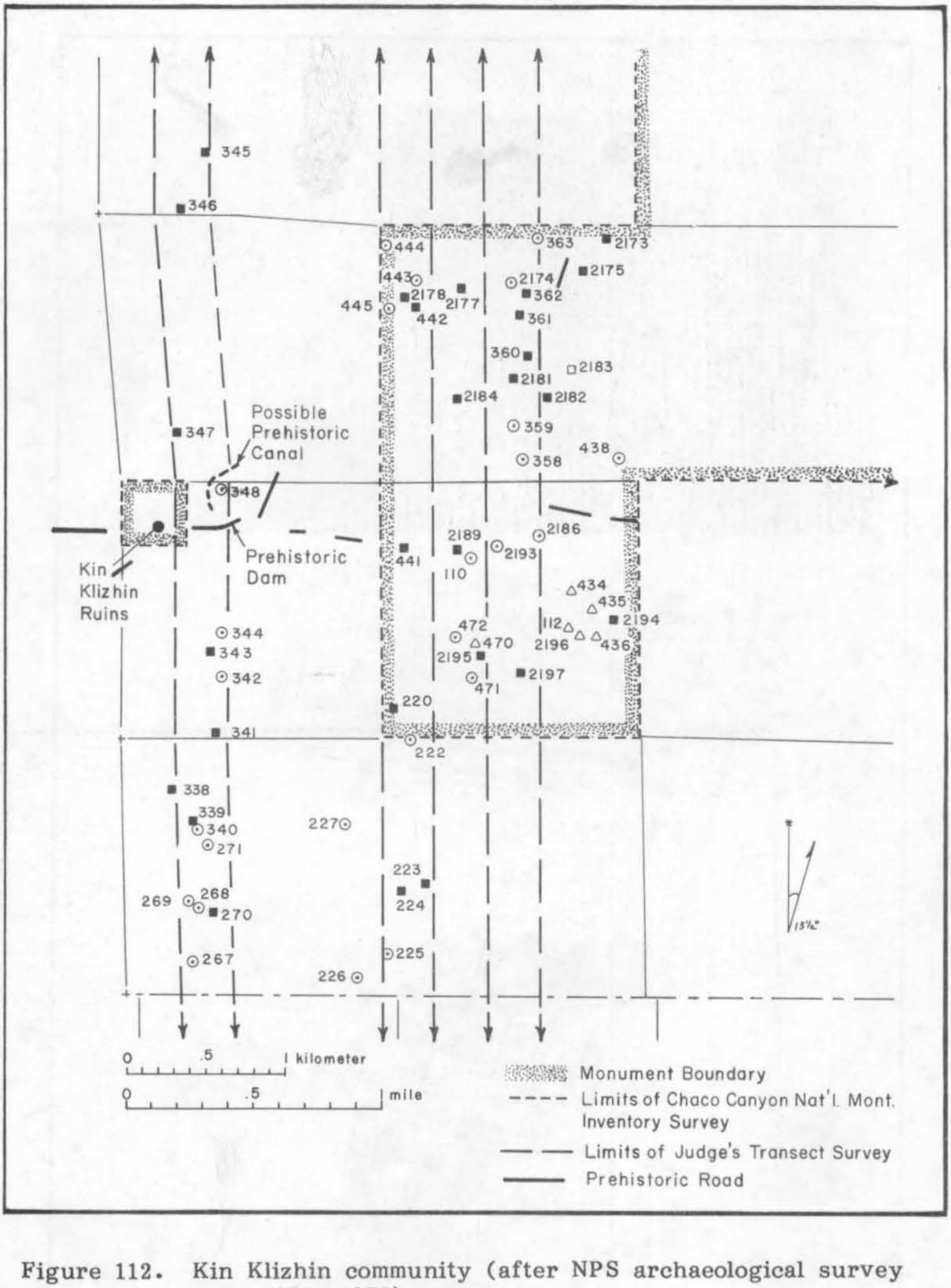


Figure 112. Kin Klizhin community (after NPS archaeological survey maps 1971, 1973).

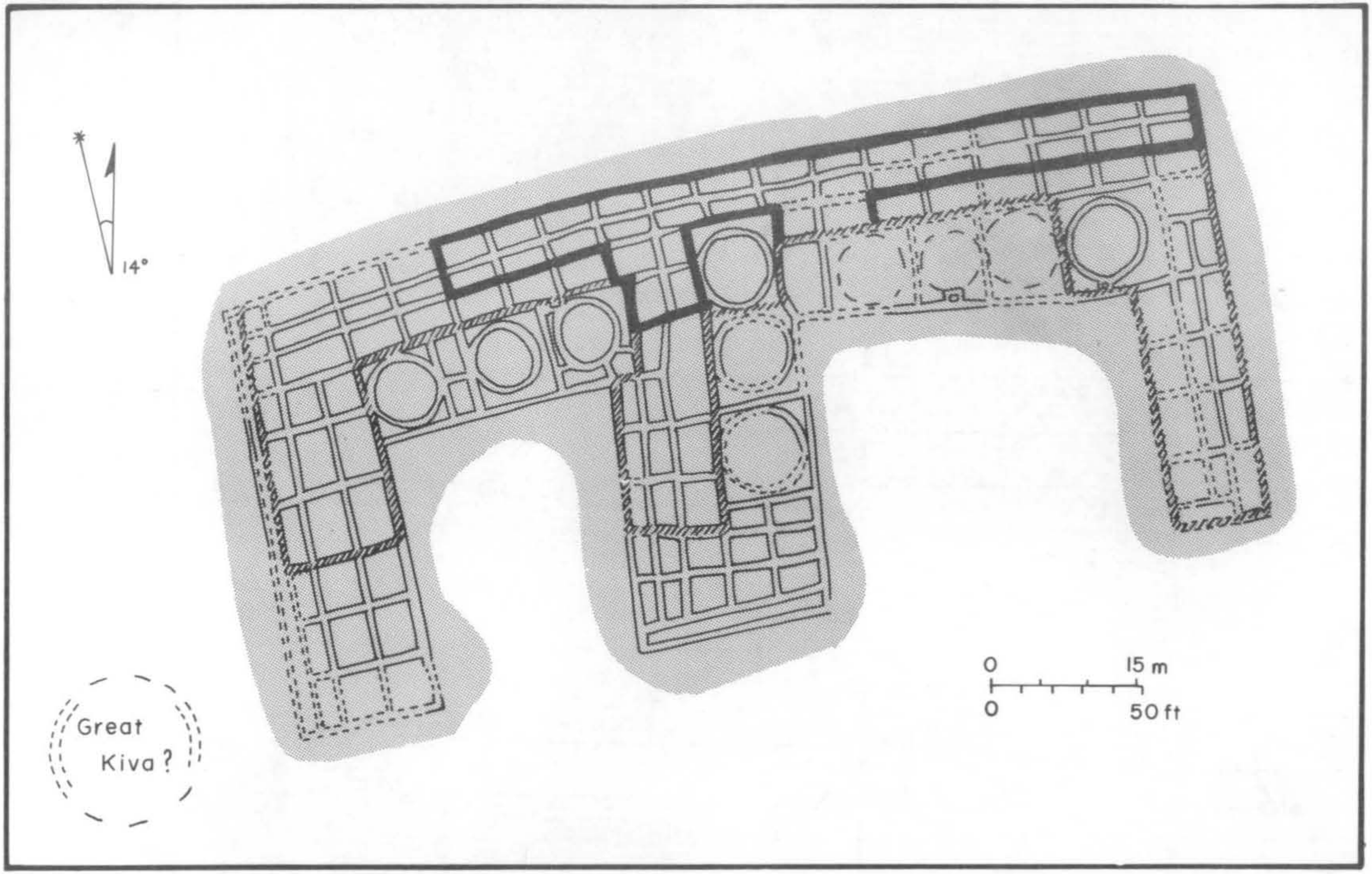


Figure 113. Kin Bineola (after NPS photogrammetric map 1973).

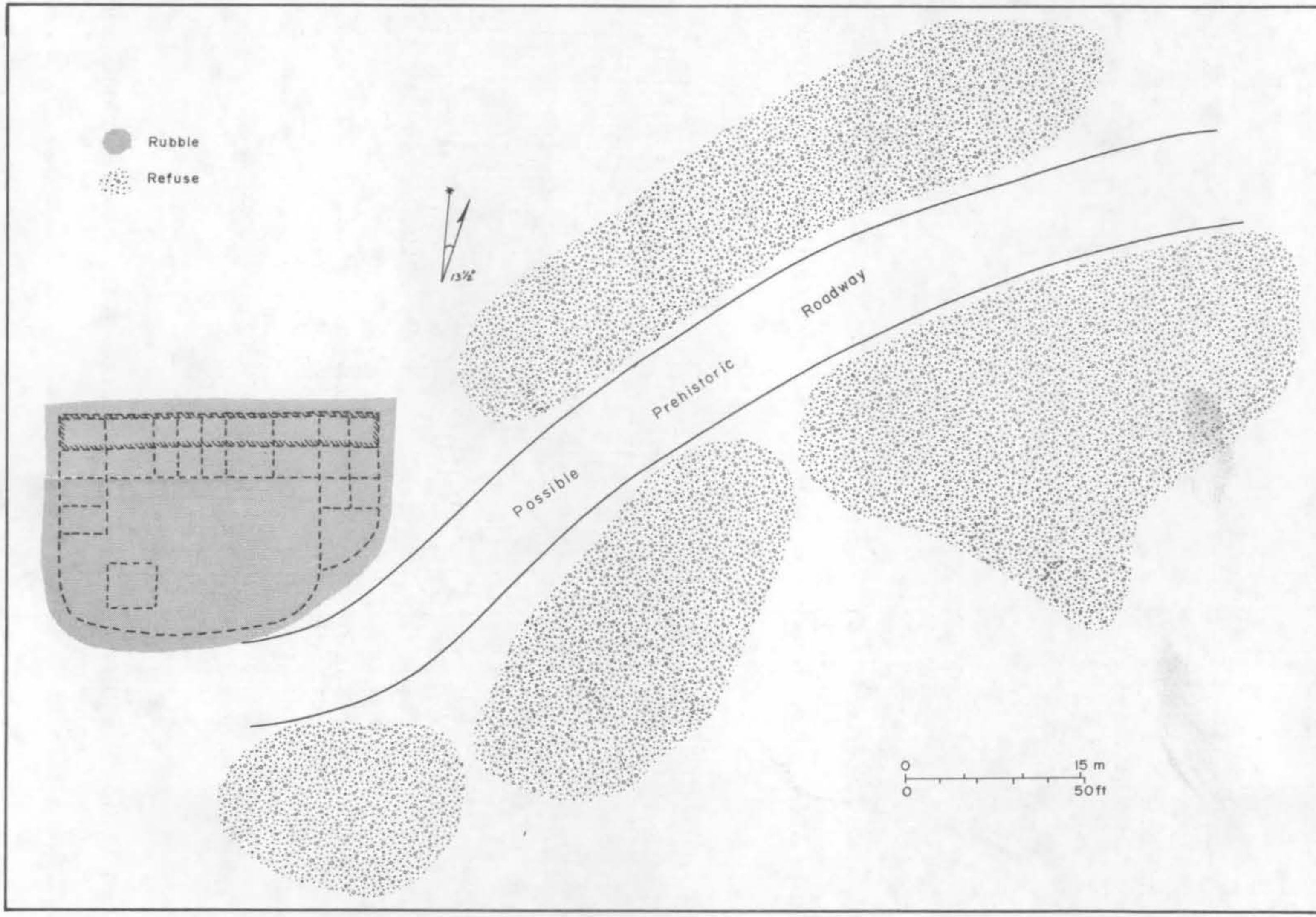


Figure 115. Standing Rock.

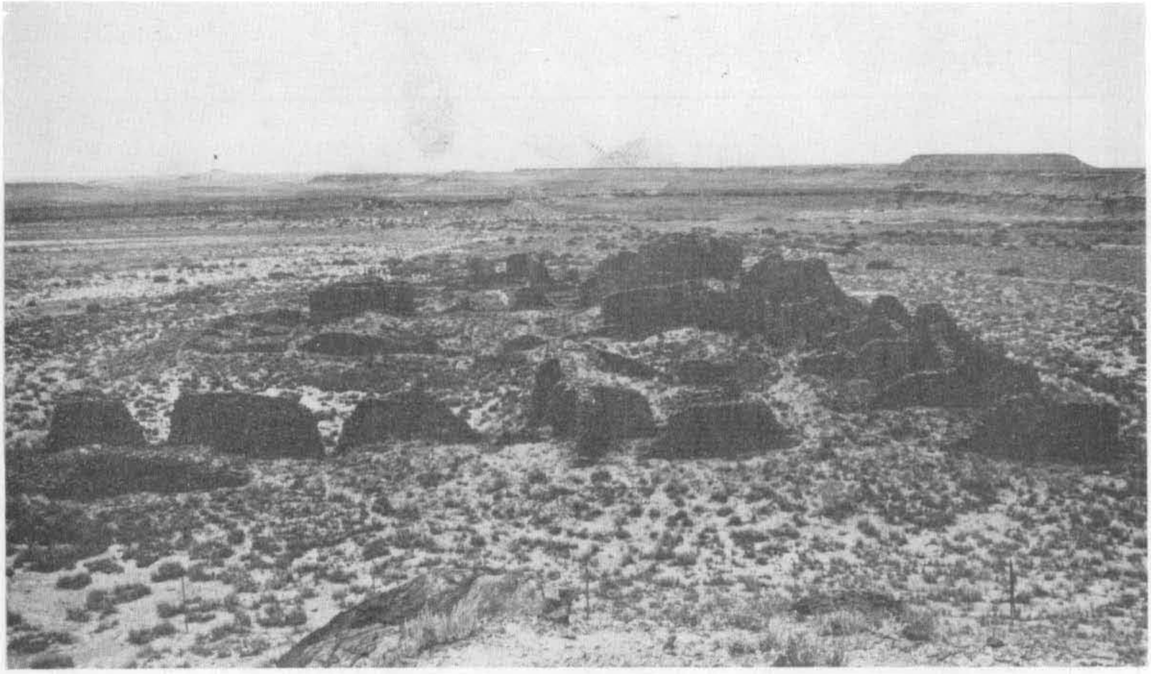


Figure 114A. Kin Bineola. Looking west from east edge of the ruin.

Figure 114B. Kin Bineola. Second and third story masonry along north exterior wall.

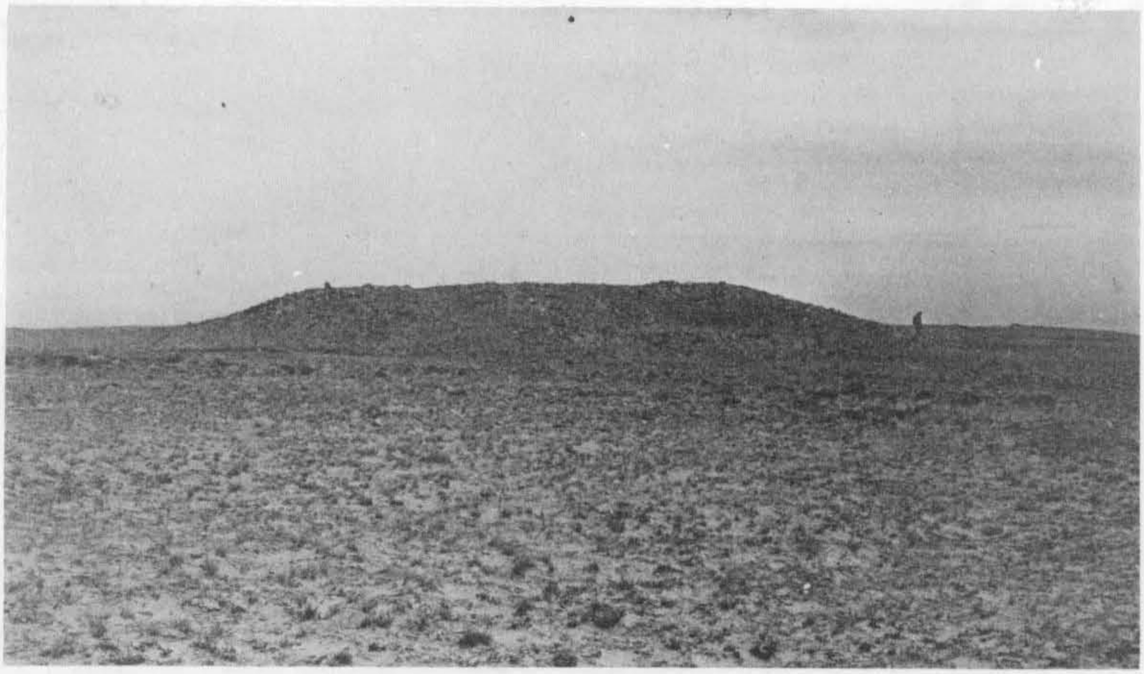


Figure 116. Standing Rock Chacoan structure. Mound rises to 4 m in height, with two stories estimated.

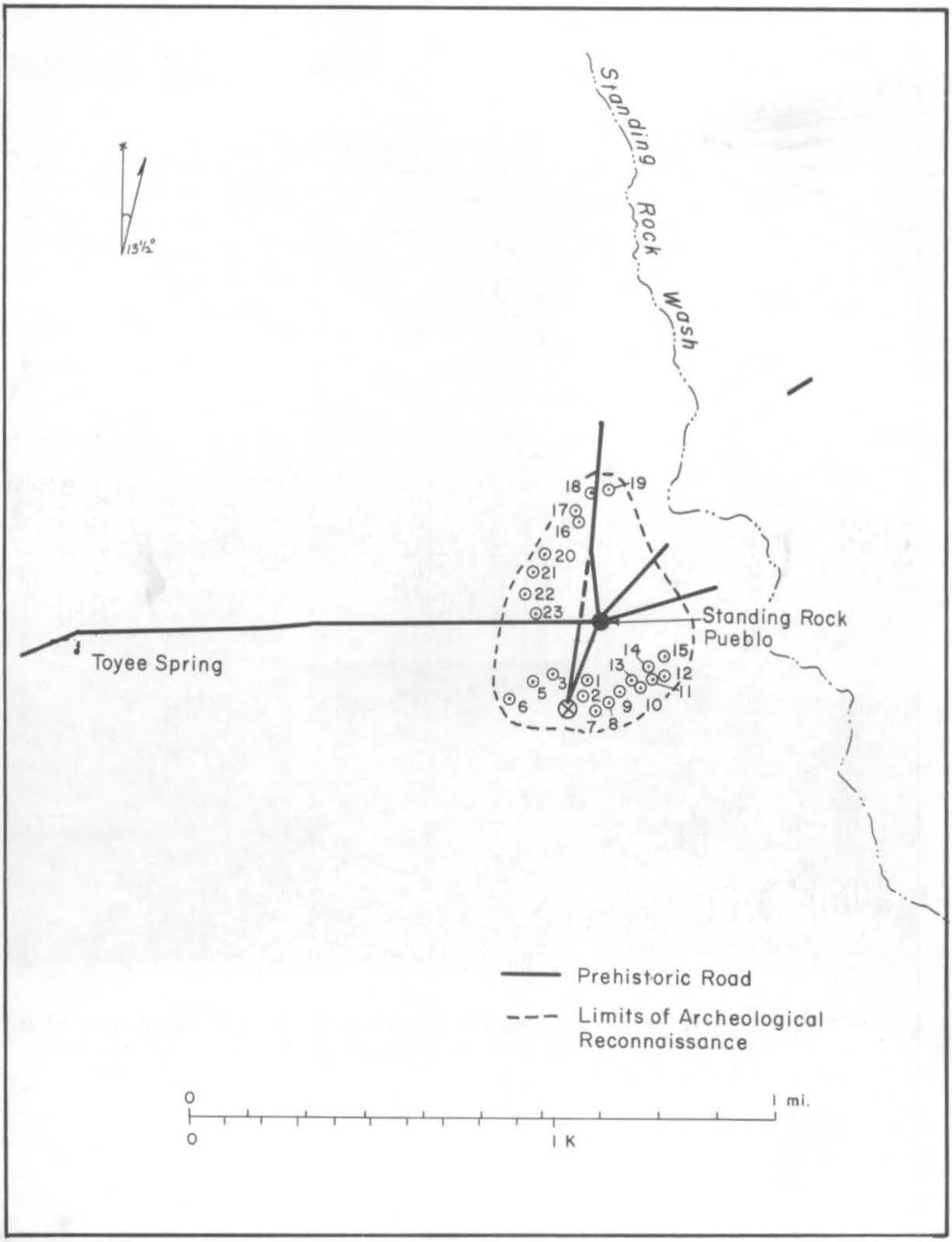


Figure 117. Standing Rock community.

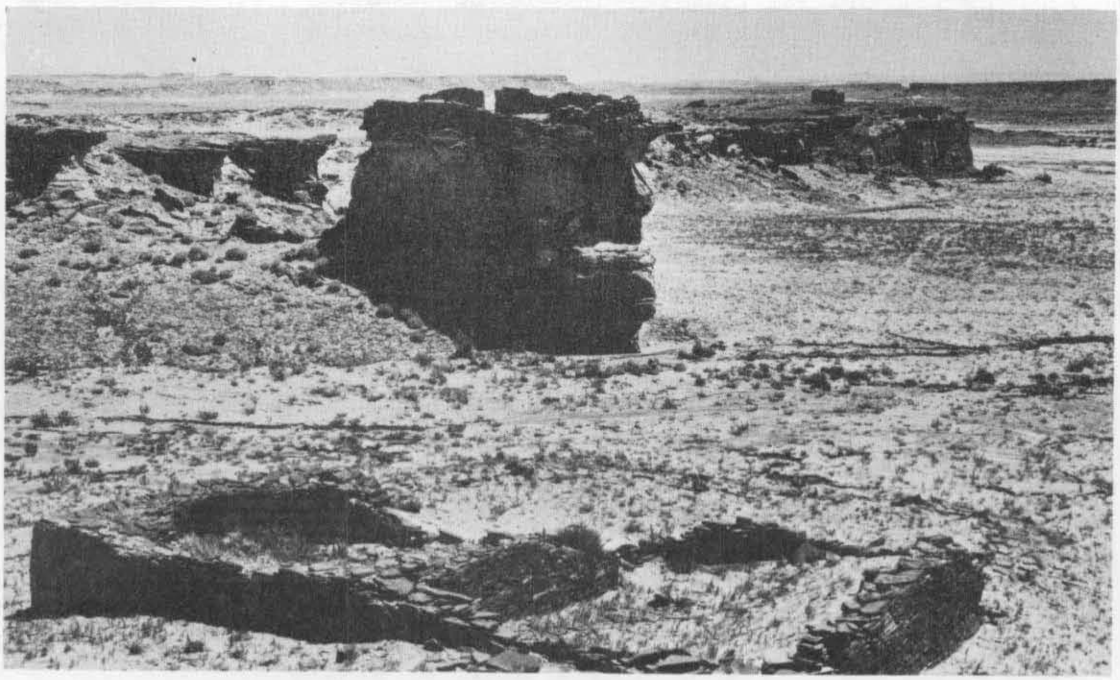


Figure 118. Grey Hill Springs. Small kiva unit in foreground, with walled structure on mesa pedestal and isolated room in background. View to southeast.

Skunk Springs

Data pertaining to this outlier community are presented in tabular form in chapter 6. Figure 1 shows the location of this community and Figures 119 and 120 illustrate the Chacoan structure. For a narrative discussion, see Marshall et al. (1979).

Casamero

Data pertaining to this outlier community are presented in tabular form in chapter 6. Figure 1 shows the location of this community and Figures 121 and 122 picture the Casamero Chacoan structure. Refer to Figure 123 for sites in the Casamero community. For a narrative discussion, see Marshall et al. (1979).

Haystack

Data pertaining to this outlier community are presented in tabular form in chapter 6. Figure 1 shows the location of this community and Figures 124, 125, and 126 the Haystack Chacoan structure; for a narrative discussion, see Marshall et al. (1979).

El Rito

This outlier community is located on the hill slopes and flats around El Rito Creek, southwest of San Mateo and northwest of the summit of Mt. Taylor (Figure 1). Elevation is 2,232 m (7,320 feet) above sea level.

Examination of aerial photo imagery in the vicinity of the El Rito community has revealed a well-defined prehistoric road extending through the San Mateo Valley from the Kin Nizhoni community on the west to the San Mateo Chacoan structure on the east. At this latter site, the Southwest Road joins the valley road after entering the valley from the north. El Rito, in turn, is linked into this system by a road that diverges from the main San Mateo Valley road. From there, it leads to the El Rito Chacoan structure where it apparently terminates (Obenauf 1980).

Portions of the main valley road have been ground-checked by Richard Loose (1978:personal communication), but the El Rito branch has not been examined on the ground.

Site Remains

Chacoan Structure

The El Rito Chacoan structure is a rectangular mound, two-and possibly three-stories high in portions. It has an estimated 55 rooms

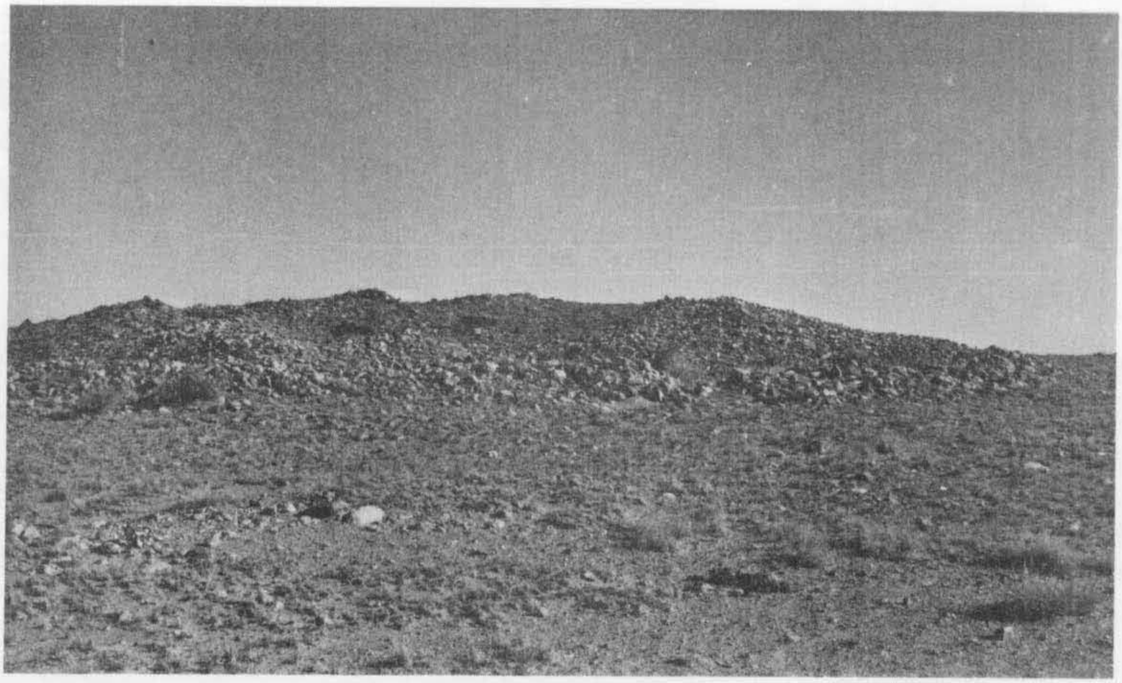


Figure 119. Skunk Springs Chacoan structure. View of east plaza and house mound. Three to four meter mound height suggests probable second story.

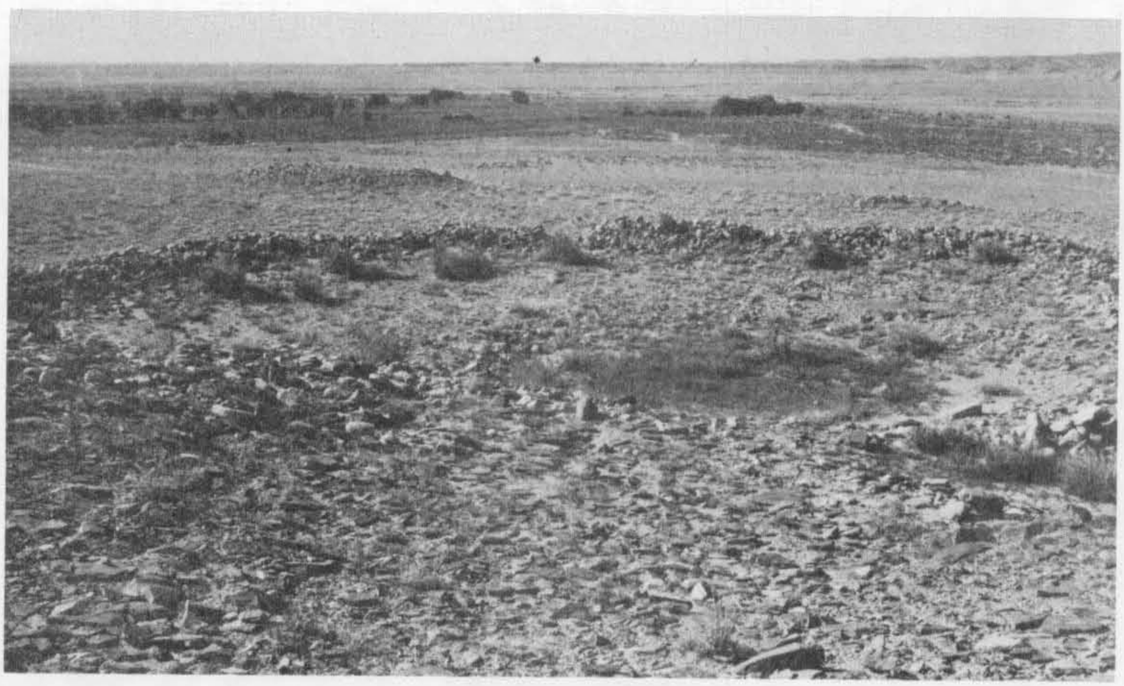


Figure 120. Skunk Springs Chacoan structure. View south into east plaza containing depression of large kiva. Note shrine mound on mesa edge at left center.

Figure 121. Casamero Chacoan structure. Looking northwest.

Figure 122. Casamero Chacoan structure. Detail of Chaco-style masonry in excavated rooms.

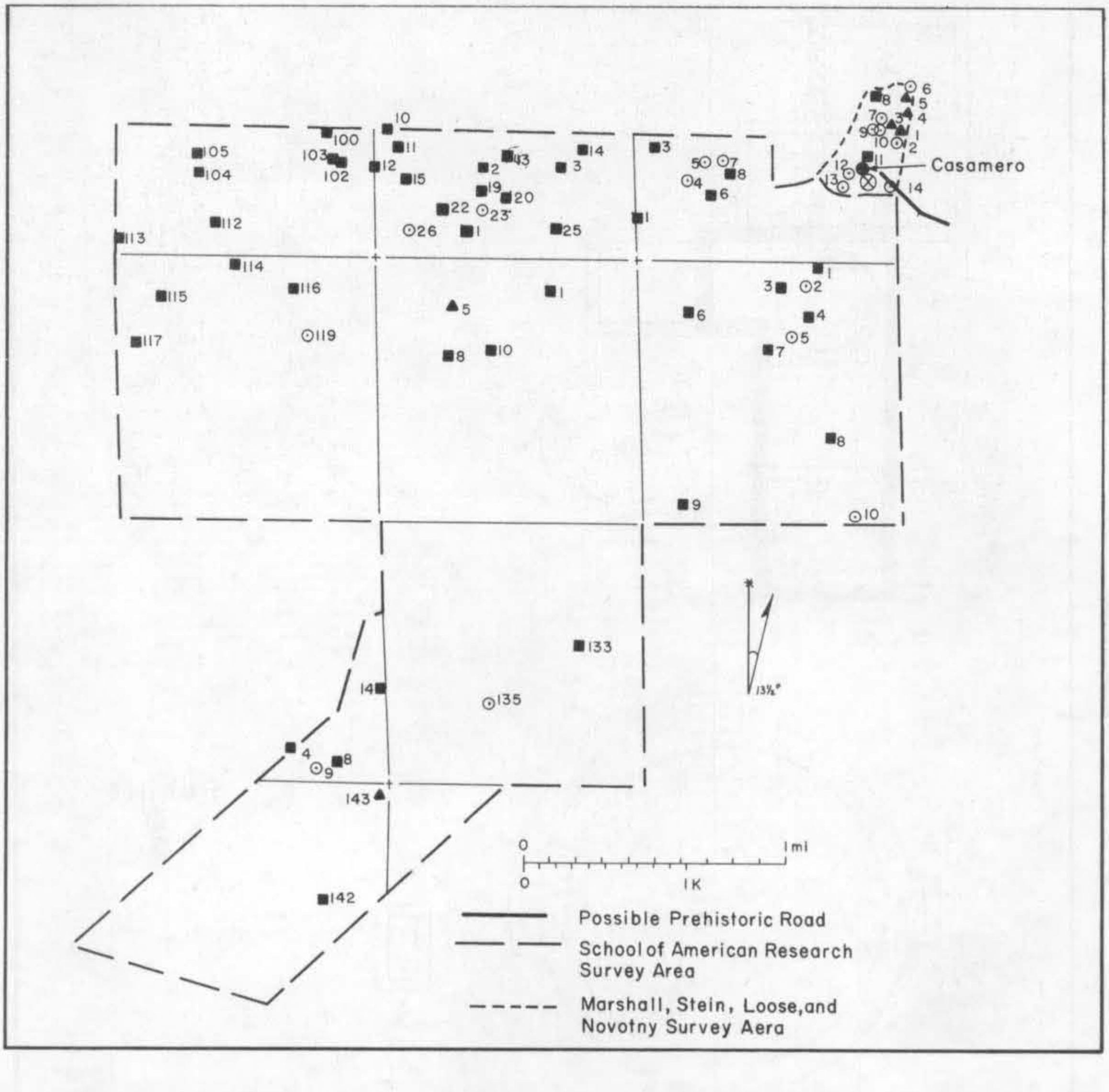


Figure 123. Casamero community (after Whitmore 1979 and Marshall et al. 1979).

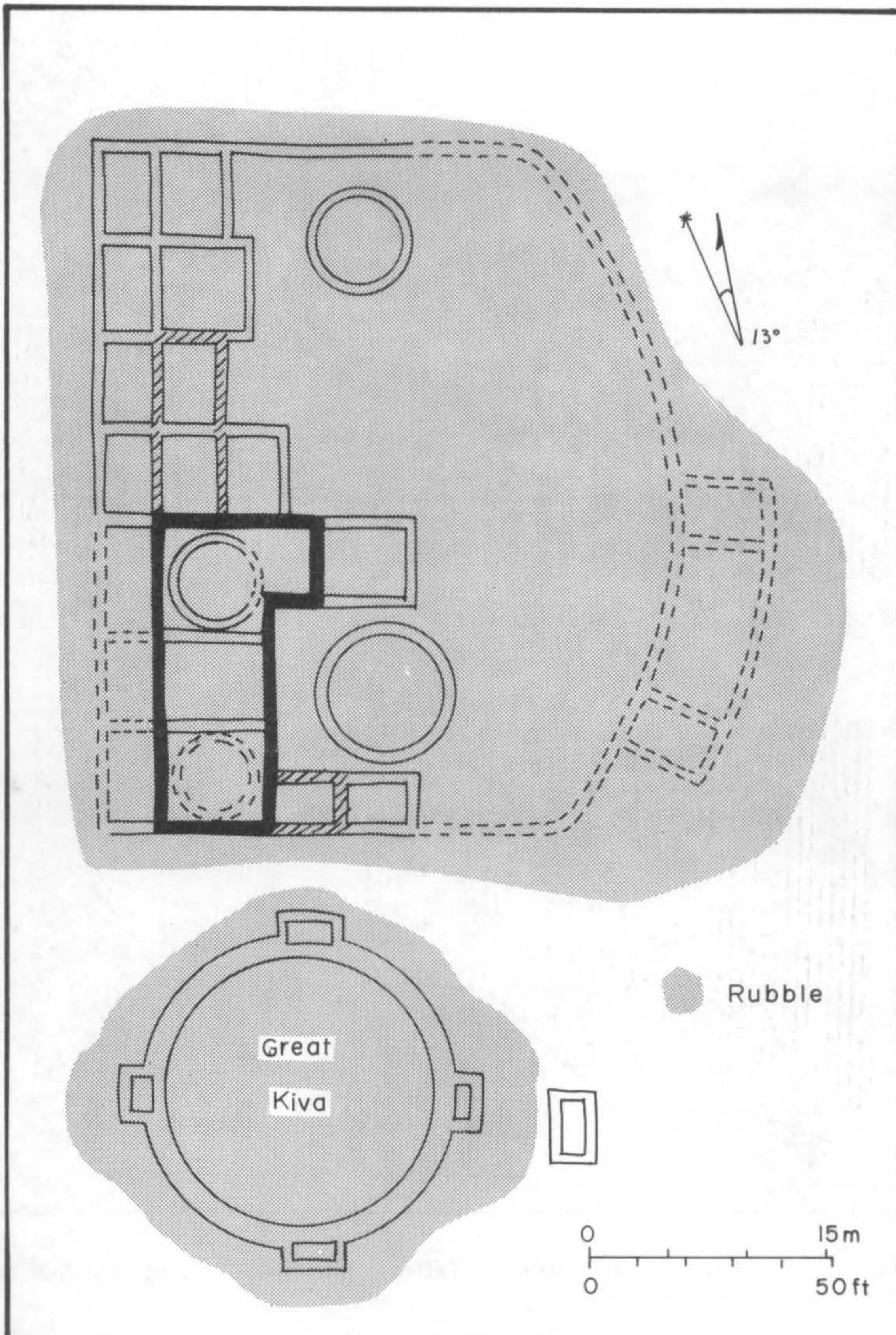


Figure 124. Haystack (after Marshall et al. 1979 and NPS archaeological survey map 1974).

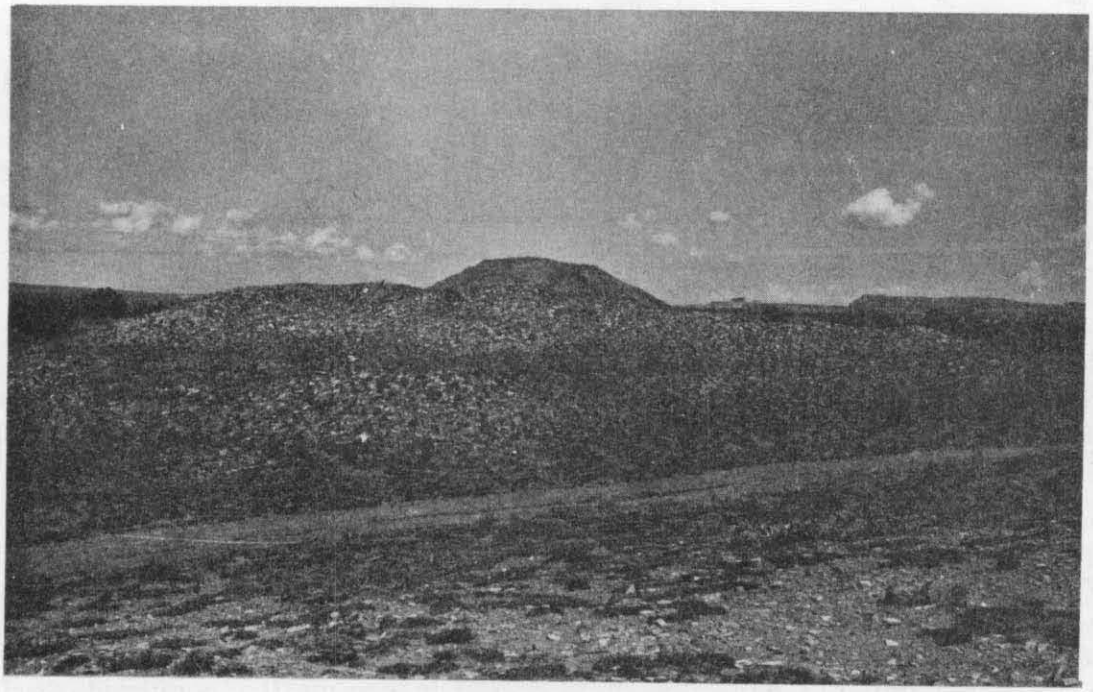


Figure 125. Haystack Chacoan structure. Plaza wall rubble and house mound as seen from refuse area. Haystack Mesa in background.

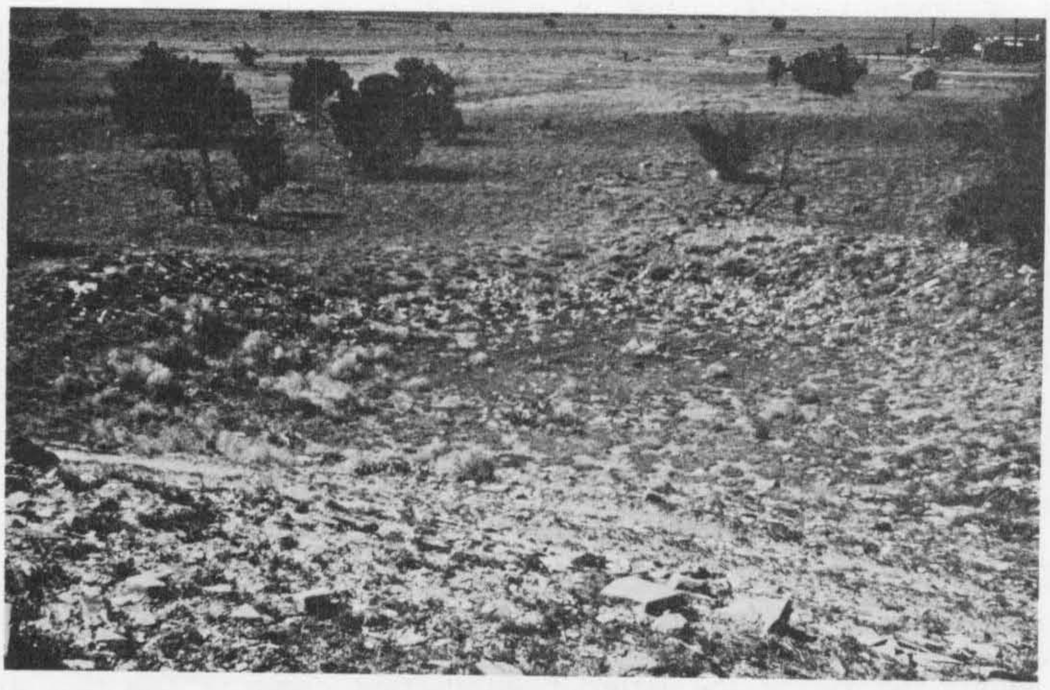


Figure 126. Haystack Chacoan structure. Great kiva depression at southwest corner of structure.

four kivas, and an associated great kiva (Figure 127) (Allan and Gauthier 1976). Two of the kivas and the great kiva are located in an open plaza area to the south of the ruin, while two others are present within the roomblock. The house mound rises to 3 m, and, including the upper-story areas, a total floor area of 795 m^2 is estimated. Rubble that covers the mound prevents an assessment of the scale of planning or the number of construction intervals involved.

The primary Chacoan architectural feature of this site is the scabbled compound masonry, very similar to Hawley's Type I as found at Una Vida and other early Chacoan structures occupied during Early Pueblo II (Bannister 1965; Hawley 1934, 1938; Lekson et al. 1982). Other architectural features are hidden by overlying debris.

Other Sites

As determined by Allan and Gauthier's (1976) survey, the El Rito Creek area was the focus of a community from Pueblo I to Early Pueblo III times (Figure 128). The height of the occupation occurred during Early Pueblo II - Late Pueblo II. Sites represented range from small houses and fieldhouses to water-control devices and other limited use sites.

Ceramics

Ceramics found in association with the El Rito Chacoan structure indicate occupation from Early Pueblo II to Late Pueblo III. Allan and Gauthier (1976) suggest calender dates of approximately 925 to 1270 with a hiatus between 1075 and 1250. A grab sample of identifiable sherds from the Chacoan structure shows Cibolan series types predominate (84%), with San Juan series types accounting for 3%. Types represented include Gallup, Puerco, Escavada, Red Mesa and McElmo black-on-whites for the Pueblo II and Early Pueblo III periods, along with Wingate Black-on-red. A short, and probably minor, Late Pueblo III occupation is indicated by the presence of St. Johns Polychrome, St. Johns Black-on-red, and Mesa Verde Black-on-white.

Lithics

An in-situ, grab analysis of the El Rito Chacoan structure lithics by Allan and Gauthier shows cherts and chalcedonies to be the most common materials (83%). Yellow-brown chert (#1072), a possible intrusive, accounts for 70% of the material within this group. The Oso Ridge source of this material is approximately 50 km to the southwest.

The only other chert intrusive is Washington Pass (#1080), accounting for two flakes (4%). Filling out the remainder of the sample are silicified wood (4%) and Grants Ridge obsidian (#3510).

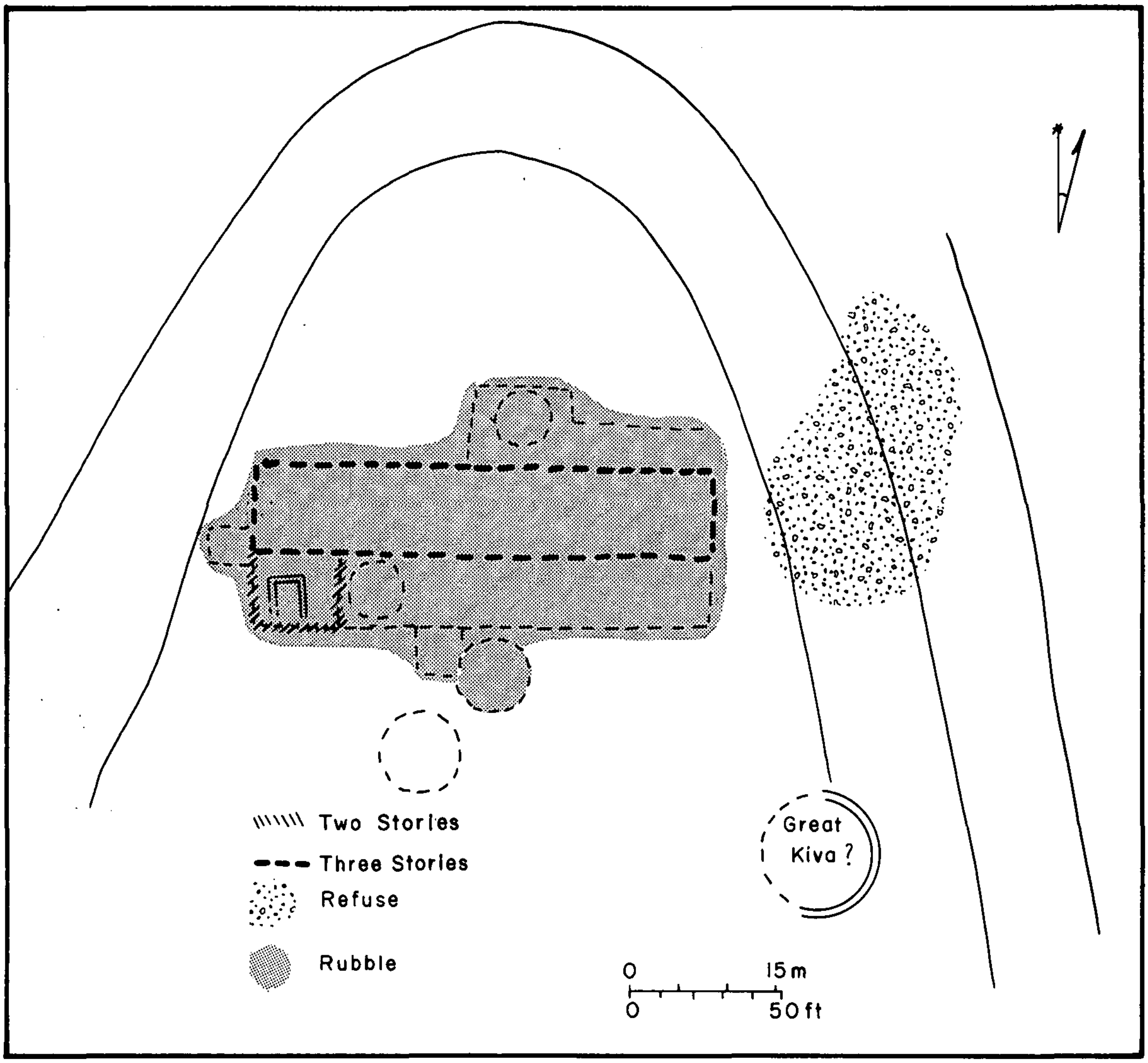


Figure 127. El Rito (courtesy of Rory Gauthier).

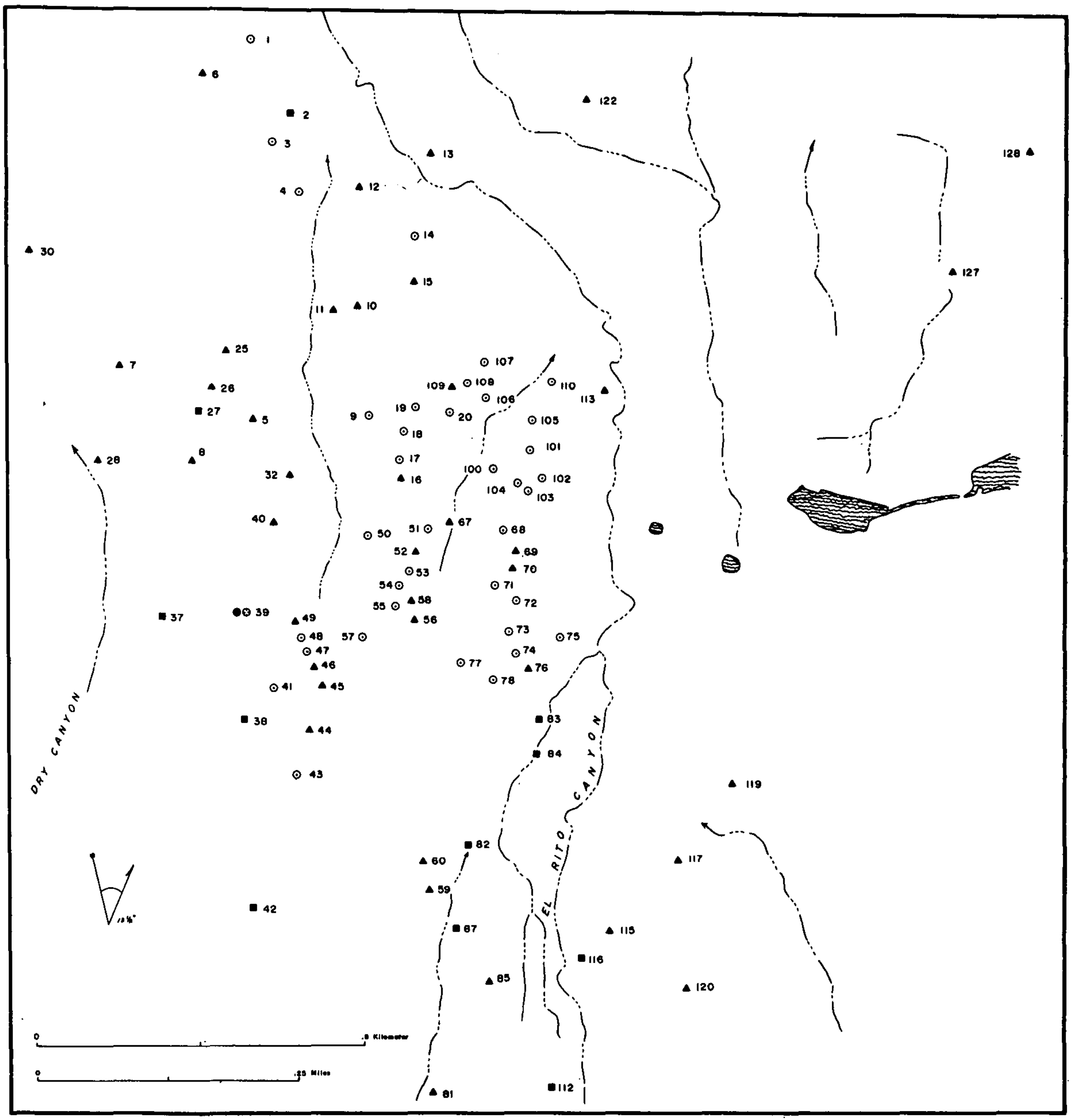


Figure 128. El Rito community. Site 39 is the Chacoan structure (courtesy of Rory Gauthier).

The obsidian accounts for 13%, a relatively weak showing considering the short 15-km distance from El Rito to the Grants Ridge sources.

Guadalupe

This Chacoan structure is located on an isolated mesa overlooking the junction of Salado and Tapia Canyons with the Rio Puerco East. The site is south of the abandoned village of Guadalupe and southwest of Cabezon Peak (Figure 1). Elevation is 1,842 m (6,040 feet) above sea level.

Aerial photo imagery of the Guadalupe area has been examined, but to date no possible prehistoric road segments have been identified. Archaeological surveys have similarly failed to reveal any possible road segments in the Guadalupe area (Pippin 1979:personal communication).

Site Remains

Chacoan Structure

The Guadalupe Ruin is a one-story, E-shaped structure with an estimated 25 Chacoan rooms and three kivas (Figure 129). A long north wing and two short east and west wings attached to the former appear to enclose a small central plaza area. This area is partially walled on the south by a thick retaining wall (Pippin 1979:173-184). The height of the mound is 4-5 m, and a total floor area of 1400 m^2 is estimated for the site. As indicated by wall construction sequences, construction units composing this site cannot be termed large-scale; in fact, most additions seem to have consisted of less than a half-dozen rooms (Pippin 1979:173-184).

Built over the course of several construction phases, the earliest Chacoan structure may have consisted of only nine contiguous rooms constructed of simple masonry very similar in appearance to Hawley's Type I masonry (Pippin 1979:173-176). Eight tree-ring dates ranging from a 918r date through a 971+rB date, with intermediate 965r and 969+r dates, affirm the early appearance of the masonry, although extensive reoccupation and remodeling have removed the timbers from their original contexts. At least three subsequent additions of Chacoan architectural style are thought to have occurred between 1050 and 1125, although the recovery of only one tree-ring date of 1112v, does little to confirm this time span, which Pippin (1979:173-184) feels is suggested primarily by core and veneer walls similar to Hawley's (1934, 1938) narrow and inferior wide-banded styles.

Architectural features of both the early and late Chacoan portions of the structure include simple as well as core and veneer-style Chacoan masonry and rooms with a mean size of 10.5 m^2 (Figure 130). Although three kivas are present, remodeling of the two excavated kivas by late Pueblo III occupants (Figure 131) in addition to erosion and modern vandalism, have left no clear Chacoan-style kiva features.

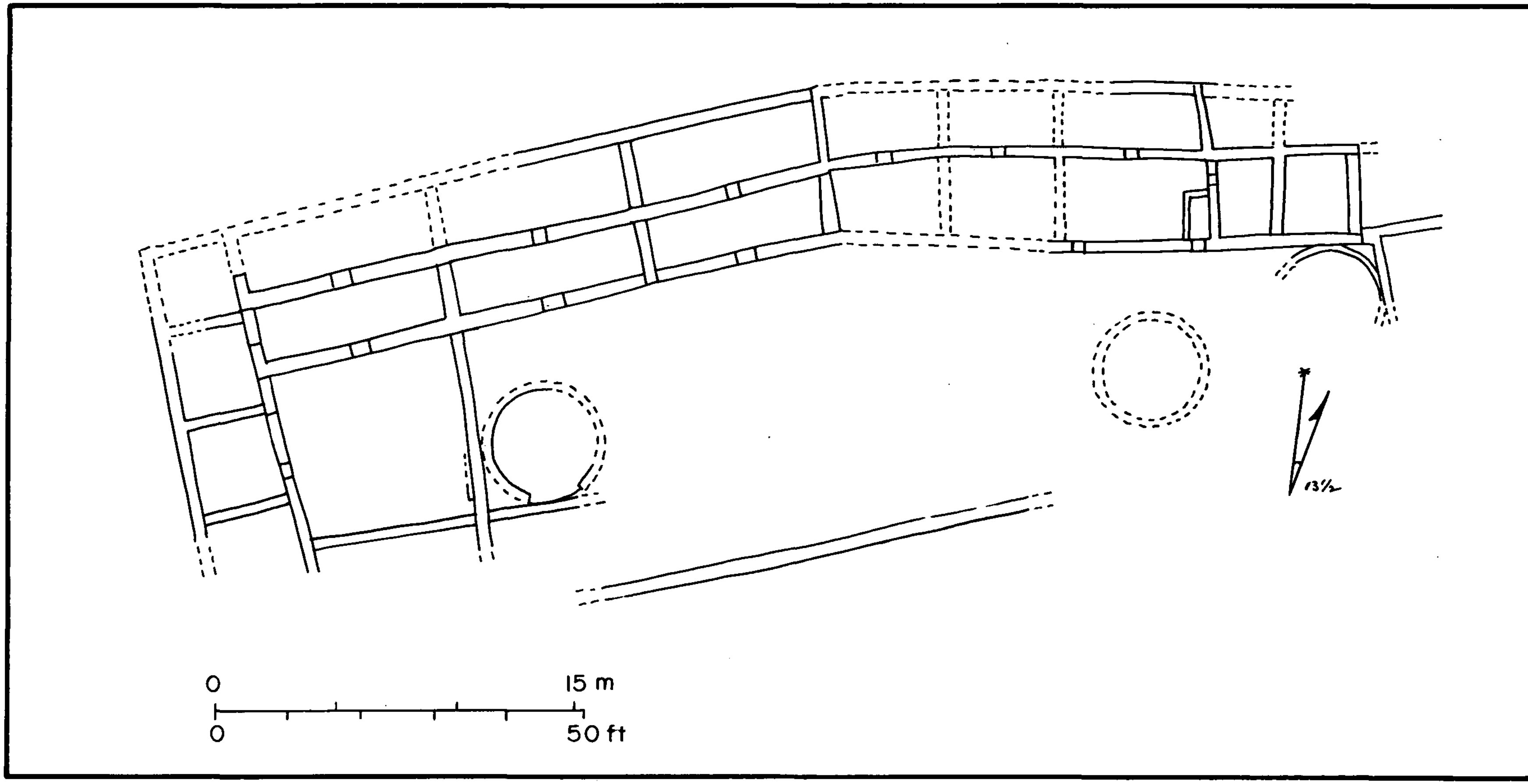


Figure 129. Guadalupe (after Pippin 1979).

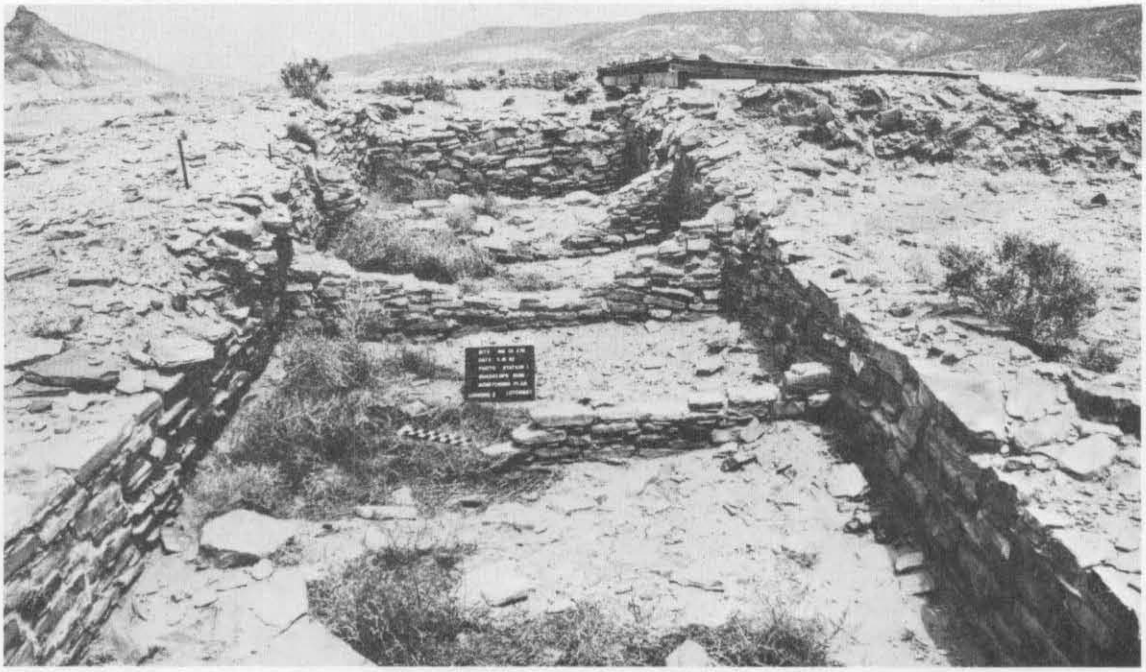


Figure 130. Guadalupe Chacoan structure. Large, late Chacoan room, subdivided by late occupation cross walls. Photo by Louis Flam, courtesy of BLM. Looking east.

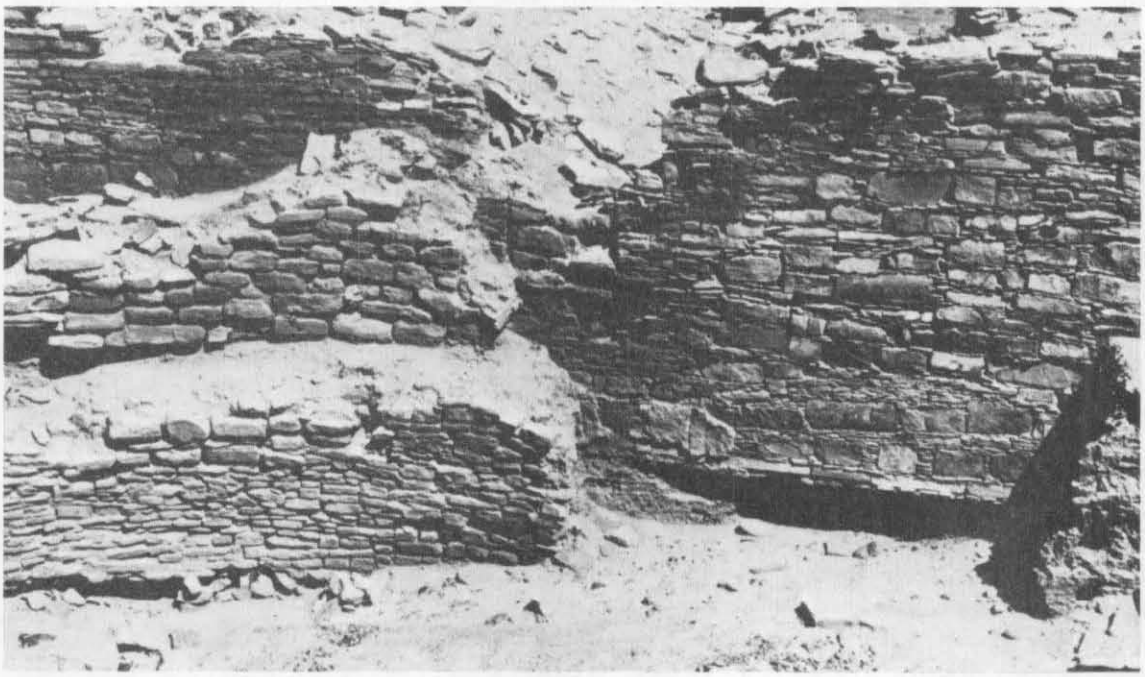


Figure 131. Guadalupe Chacoan structure. View of Chaco-style masonry in southwest arc of kiva. Photo by Anthony Lutonksy, courtesy of BLM.

Complementing the tree-ring dates, ceramics recovered from the site indicate occupation from Early Pueblo II to Late Pueblo II.

Other Sites

Citing Washburn's (1972, 1974) spatial analysis of Pueblo I-III sites in the middle Rio Puerco Valley, Pippin (1979:320-321) notes the occurrence of numerous tenth through thirteenth century small habitations, or small house sites, in the vicinity of Guadalupe. Although site-specific chronological data are not available, the distribution of sites in the immediate vicinity of Guadalupe does suggest a sizeable associated community (Figure 132).

Ceramics

Pueblo II and Early Pueblo III Cibolan ceramics appear to account for as much as 44% of the sherds recovered during excavation at Guadalupe (Pippin 1979:Tables 5-21). However, with the exception of four undisturbed Chacoan strata, the early Cibolan ceramics are mixed with Late Pueblo III San Juan and Rio Grande series types (most of which were probably locally manufactured). This mixture probably was the result of removal of Chacoan deposits by the Late Pueblo III occupants (Pippin 1979:160). Within the four unmixed strata, Cibolan sherds account for 96% of the total.

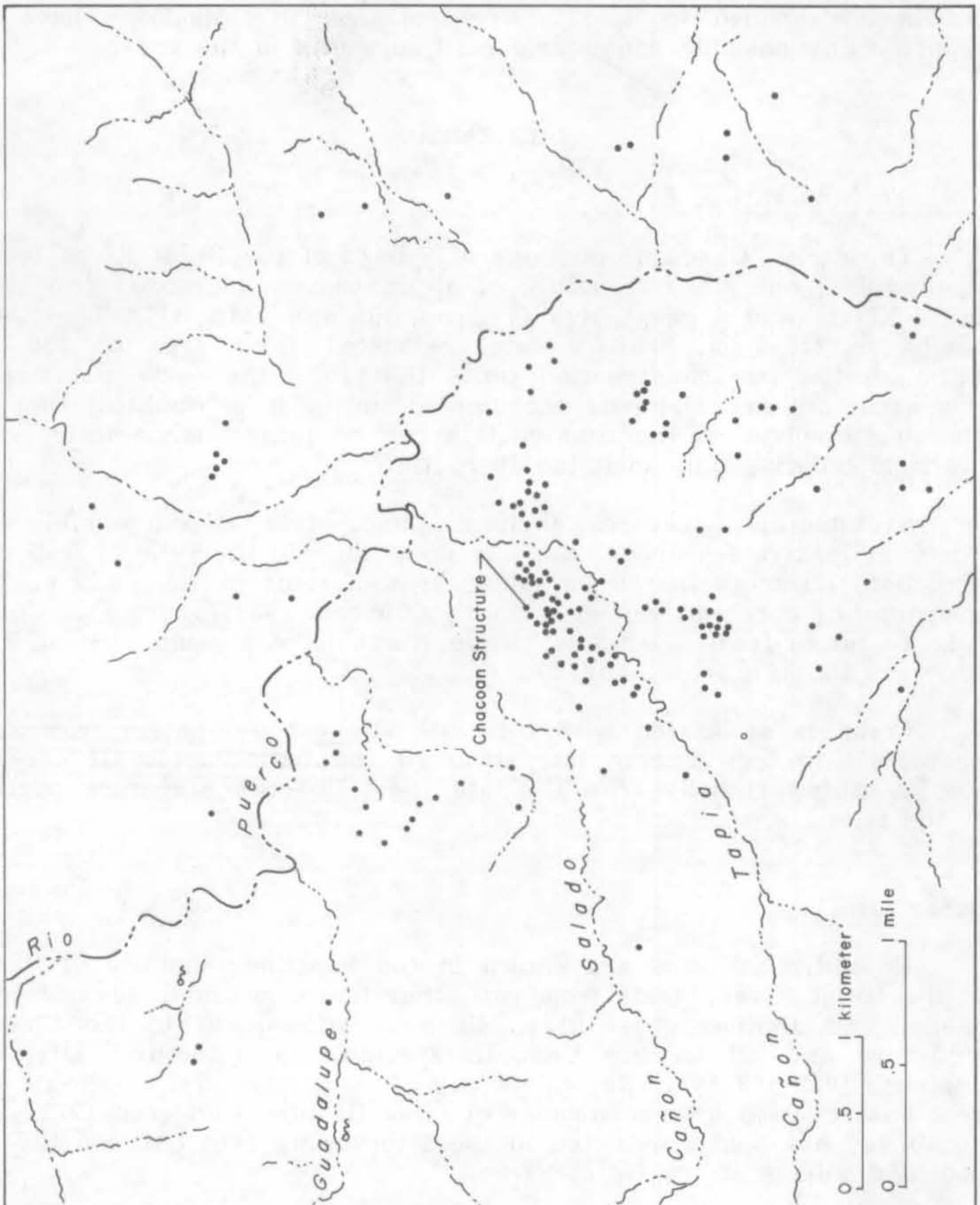
Cibolan ceramic types of Pueblo II and Early Pueblo III date that are present at Guadalupe include Red Mesa, Gallup, Puerco, and Chaco Black-on-white. Also present is Kwahe'e Black-on-white, a Rio Grande series type with McElmo design styles. Other Cibolan types present, but considered intrusive to the middle Rio Puerco Valley, are Wingate and Puerco black-on-reds, and Socorro and Tularosa black-on-whites (Pippin 1979:156-161).

Lithics

As with the ceramic material, lithics were presumably recovered from only four strata of unmixed, Chacoan context. Debitage from these layers is dominated by miscellaneous chalcedony and chert (75%) materials. Silicified wood (20%) accounts for much of the rest of the assemblage, with basalt (1%), Polvadera Peak obsidian (1%), and quartzite (3%) completing the sample (Pippin 1979:96-99). Pippin (1979:100) notes that only one obsidian projectile point was found in the Chacoan strata. Although a few other lithic tools were found in Chacoan contexts, the material types of these implements are not reported.

Village of the Great Kivas

This Chacoan structure is situated in Nutria Canyon, southwest of the Zuni farming village of Lower Nutria and northeast of Black Rock, New Mexico (Figure 1). Elevation is 2,074 m (6,800 feet) above sea level.


Rio
Puerco
Chacoan Structure
Salado
Tapia
Cañon
Cañon
Guadalupe
Cañon
kilometer
mile

Aerial photo imagery of the Village of the Great Kivas area has not been examined to date. Archaeological investigations have not reported any possible prehistoric road segments in the area.

Site Remains

Chacoan Structure

The early "Chacoan" portions of Village of the Great Kivas form a rectangular, one-story structure of approximately 18 rooms, two intramural kivas, and a great kiva (Figures 133 and 134A,B). The mound height is 2.5-3 m, with a total estimated floor area of 590 m^2. Although the two construction units that form the early portions of this structure are planned, coordinated units, it is doubtful that the planning involved in the construction can be termed large-scale, since the final building only included 18 rooms.

Architectural features include Chaco-style masonry and some Chaco-style kiva features. Roberts does not cite the type of wall construction, although the 60-cm thicknesses of many of the walls suggest compound or core and veneer masonry (Roberts 1932:Figure 1). Ceiling heights range from 2.1-2.7 m, while rooms have a mean size of 6 m^2 (Roberts 1932:Figures 1 and 2).

Ceramics associated with this site suggest occupation from Early Pueblo III to Late Pueblo III, although the Late Pueblo III ceramics are probably primarily from the late, post-Chacoan structure portions of the site.

Other Sites

No additional sites are known in the immediate vicinity of Village of the Great Kivas, aside from two other house mounds, several trash heaps, and another great kiva, all built subsequent to the Chacoan structure and all lacking Chacoan structure architectural attributes (Roberts 1932:158-59). Recent survey of the proposed Yellowhouse Dam area has revealed a large number of sites (Hunter-Anderson 1978), but no survey has been conducted in the intervening area between the dam pool and Village of the Great Kivas.

Ceramics

Determination of the series affiliations and types of ceramics recovered by Roberts from the early portions of the Chacoan structure is all but impossible, for Roberts' discussion of the ceramics predates current typologies and does not include specific artifact proveniences. Nevertheless, vessels pictured by Roberts (1932) include examples of Sosi, Wingate, Puerco, Flagstaff, and Red Mesa design styles, in addition to what Roberts describes as a carbon paint decorated "proto-Mesa

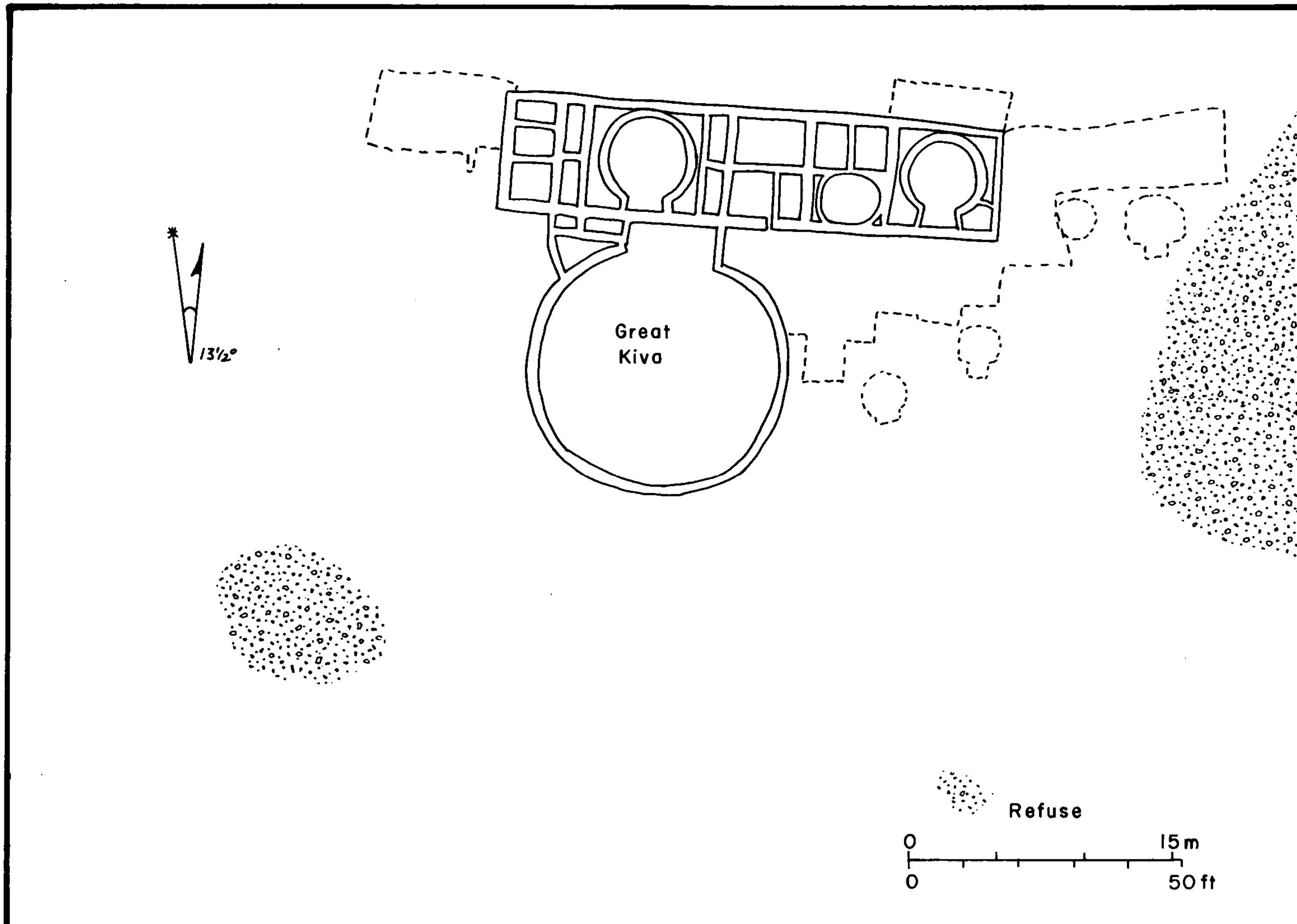


Figure 133. Village of the Great Kivas (after Roberts 1932).

Figure 134A. Village of the Great Kivas. Chacoan structure and great kiva as viewed from talus to the north.

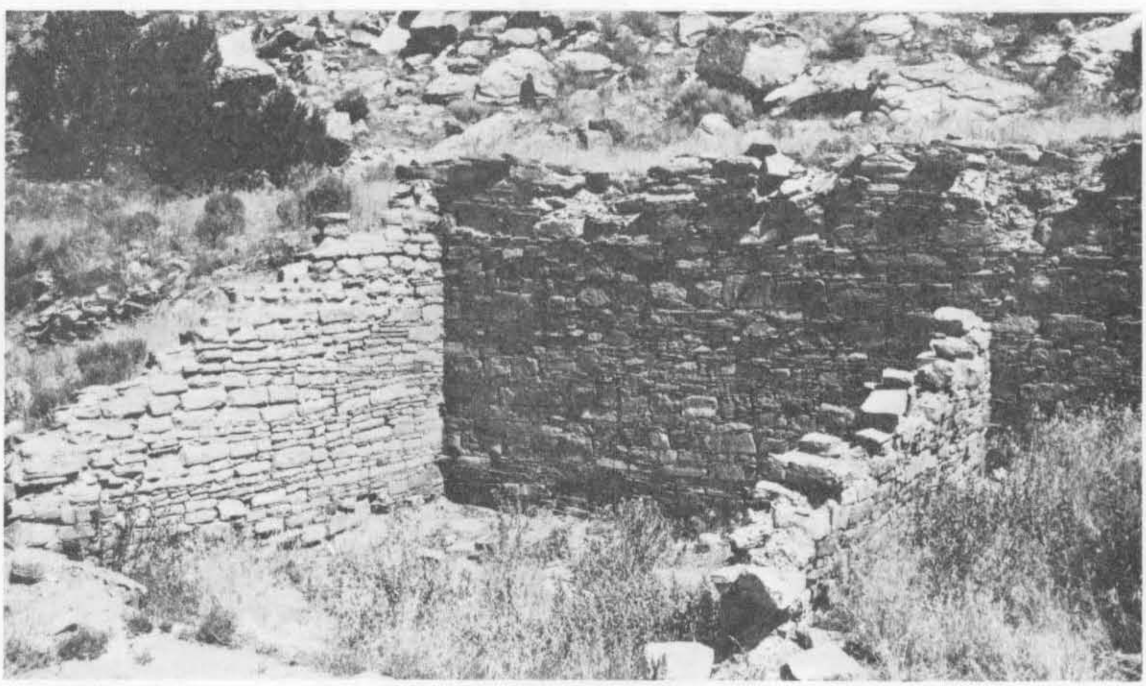


Figure 134B. Village of the Great Kivas. Detail of Chaco-style masonry in excavated room.

Verde black-on-white ware." Black-on-red vessels pictured appear to be Wingate and Puerco Black-on-red, while the polychromes illustrated are probably St. Johns, Wingate, and Houck polychromes.

Lithics

Quantified data on lithic material types at Village of the Great Kivas are not available. Roberts does note the recovery of chalcedony, chert, jasper, and obsidian (Roberts 1932:145).

Allantown

This Chacoan structure is situated on the mesa top overlooking the western edge of Whitewater Draw, south of Allantown and southwest of Lupton, Arizona (Figure 1). Elevation is 1,891 m (6,200 feet) above sea level.

Aerial photo imagery of the Allantown area has not been examined, and archaeological studies have not recorded any possible road segments.

Site Remains

Chacoan Structure

This Chacoan structure consists of two major rectangular roomblocks separated by a passageway that opens into an unenclosed plaza (Figure 135). Roberts thought that the northernmost block, a two-story structure (2-3-m mound height) with perhaps 30 rooms and a large plaza kiva, was constructed first. At a later time, a pentagonal structure was added to the south end of the unit, adding five one-story rooms and another kiva. A short distance northeast of the structure is a large great kiva depression, later tied to the house by a connecting wall. Just east of the great kiva is a large refuse mound (Roberts 1939:245-246).

South of the first block is a second major unit, a rectangular complex of perhaps 65 rooms, fronted on the east by three intramural kivas (Figure 136). The westernmost portions of the house are thought by Roberts to have stood at least three stories (4-5-m mound height) high, and he postulates a fourth story. Southeast of the house is a second large refuse area associated with the structure (Roberts 1939: 245-246).

The size and number of construction units involved in the northern and southern blocks is not known, rendering it impossible to assess the scale of construction planning at this time. Combined, the two roomblocks have a total estimated floor area of 3,460 m^2.

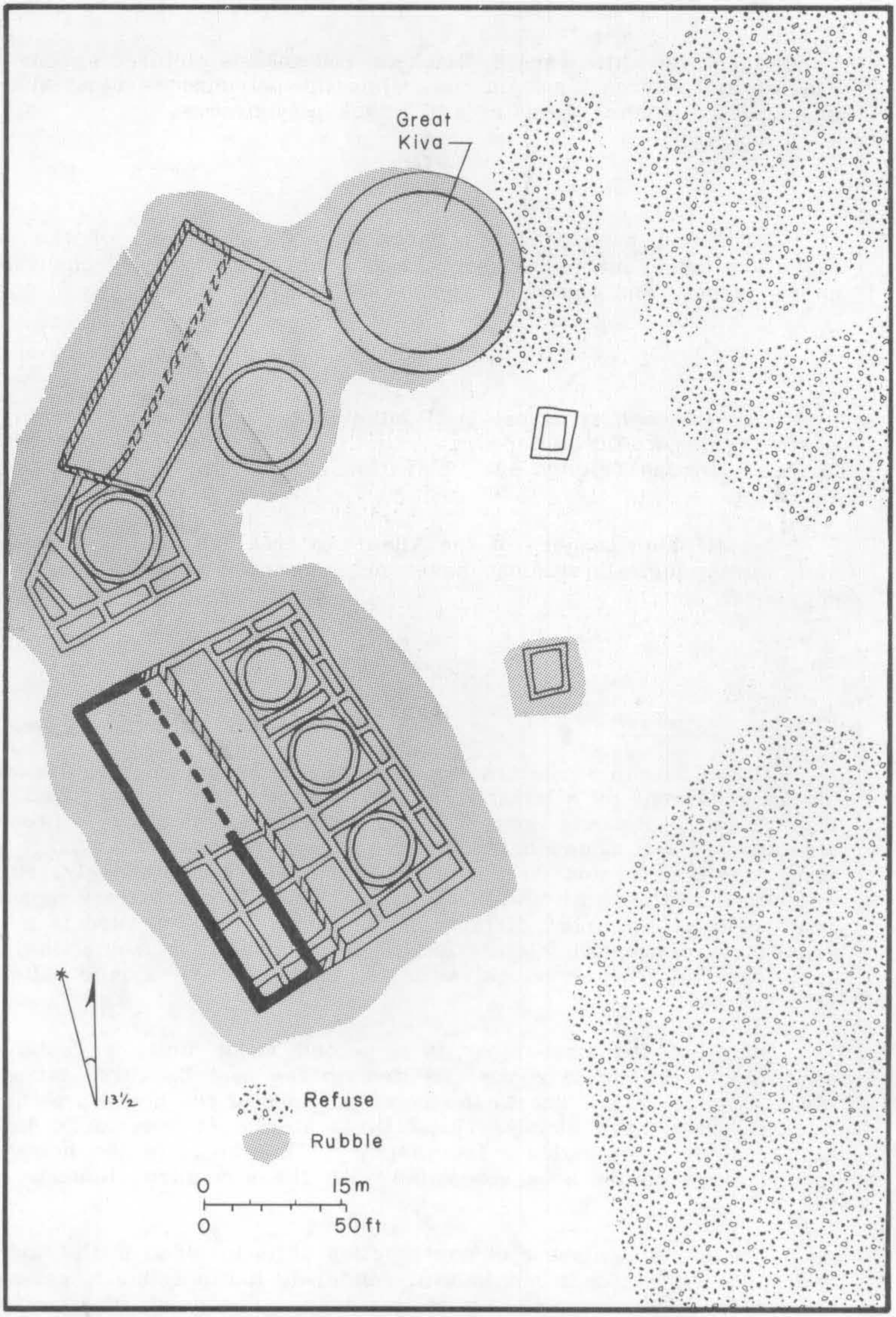


Figure 135. Allantown (after Roberts 1939).

Figure 136. Allantown Chacoan structure. South house mound as viewed from the plaza. Mound height is 4-5 m suggesting two to three stories.

Except for core and veneer Chaco-style masonry, architectural features of the structures are unknown.

Other Sites

Roberts' excavations at Allantown concentrated on two complexes of Pueblo I remains to the immediate north and south of the Chacoan structure roomblocks. Also excavated were three small houses, two of which were located at the foot of the mesa to the north of the Chacoan structure. The third, Unit 3, is located 1.5 km to the east, also at the edge of the valley floor (Roberts 1939). Unit 3, with several tree-ring cutting dates in the early eleventh century, is the only site reported by Roberts (1939:258) that may have been partially contemporary with the Chacoan structure. Roberts makes several references to numerous other ruins in the general area, but these are not specifically discussed or documented.

Although there are clearly some sites in the vicinity of the Allantown Chacoan structure, not enough data are available to determine the presence or absence of a community.

Ceramics

Although Roberts includes no quantified discussion of the ceramics recovered from trenching in the southeast trash mound, it is clear that the ceramics are primarily Cibolan and date to the eleventh century.

An initial occupation date for the site of around 1000 is suggested by the similarities between the Chacoan structure ceramics and the ceramics from Unit 3, a small house with architecture dating between 1005 and 1014 (Roberts 1939:252-253).

The designs of decorated vessels illustrated by Roberts (1940) include Gallup-Reserve-Tularosa, Red Mesa, and Puerco-Escavada styles, in addition to Puerco and Wingate black-on-reds. The complete absence of polychromes and other twelfth century types indicates abandonment of the site by the early 1100s (Roberts 1939:252-253).

Lithics

Roberts (1940:123-125) does not quantify the lithic materials recovered from the southeast refuse mound or state lithic material types specific to it. Chalcedony, obsidian, chert, quartzite, petrified wood, and jasper are listed as the most common materials recovered from the excavations as a whole.

Houck

This Chacoan structure is located on a mesa ridge overlooking the northern edge of the Rio Puerco West, southwest of Houck and northeast of Sanders, Arizona (Figure 1). Elevation is 1,836 m (6,020 feet) above sea level.

No aerial photo imagery of the Houck area has been examined to date, nor have archaeological studies identified any prehistoric road segments.

Site Remains

Chacoan Structure

The Houck site is a rectangular, one-story structure of nine rooms and two kivas (Figures 137, 138, and 139). A total floor area of 200 m^2 is estimated. Masonry is core and veneer and of Chacoan style, with rooms 10 m^2. Exposed walls stand to 1.8 m in height. Wall construction sequence data are not available; but even if the site were built during one interval, its construction was not a large-scale endeavor. Features of the structure's two kivas cannot be clearly identified due to extensive pothunting. No distinct trash mound is associated with the site, although a light scatter of refuse surrounds the immediate area (Gumerman and Olson 1968:124-125).

Other Sites

A number of what appear to be small house mounds are present in the vicinity of the Chacoan structure. Some have been excavated, probably in conjunction with the highway salvage operations reported by Gumerman and Olson (1968).

Ceramics

Gumerman and Olson (1968:124-125) place occupation of the Houck Chacoan structure within the middle thirteenth century, apparently on the basis of ceramics recovered from the trash-filled rooms. The Chacoan architectural attributes of the site, however, contradict Gumerman and Olson's dating. Instead, they suggest a much earlier initial occupation date, perhaps in the eleventh or early twelfth century. Considering both the vandalized condition of the site and "indications that the ruin had been used as a dump after its abandonment," it seems quite possible that the site could have been constructed during Early Pueblo III with subsequent use continuing to the middle thirteenth century.

Quantified ceramic type identifications for the Houck Chacoan structure have not been reported, although Cibola series ceramics were dominant (Gumerman and Olson 1968).

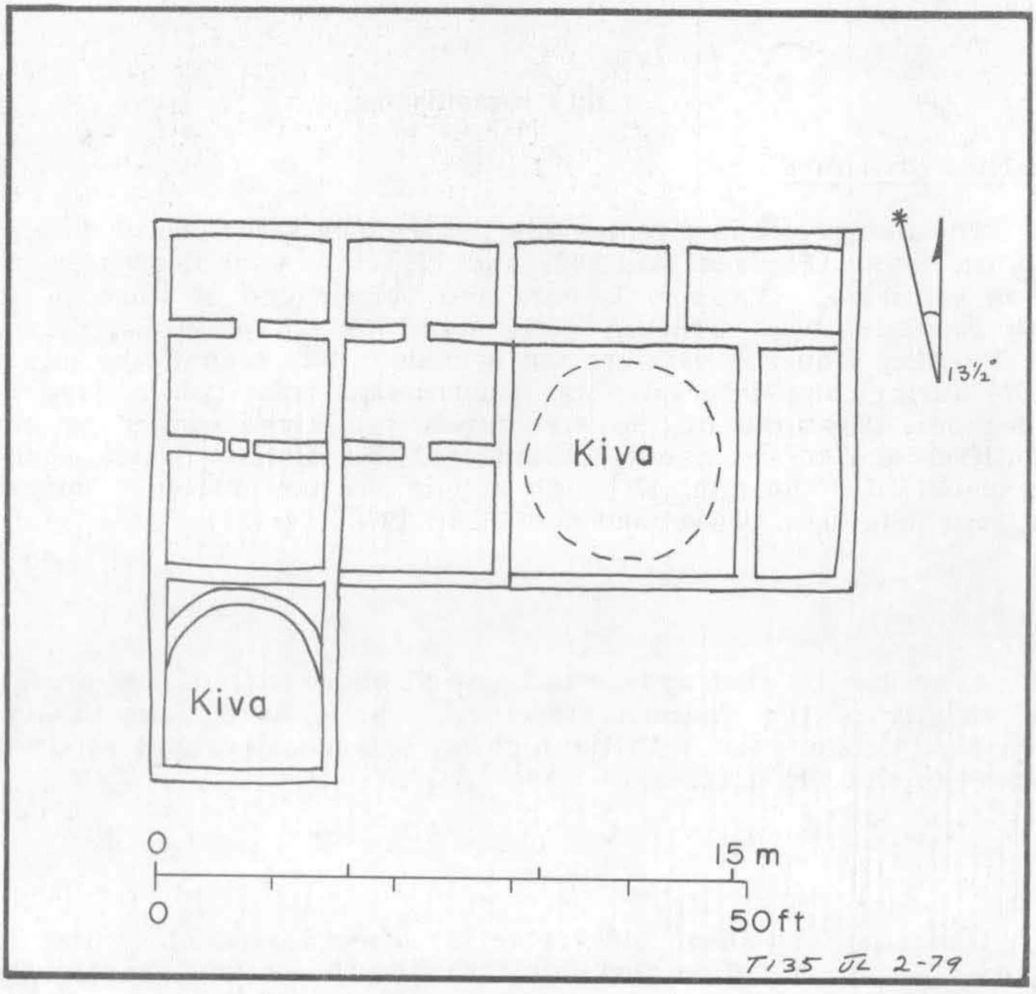


Figure 137. Houck.

Figure 138. Houck Chacoan structure. View of excavated rooms.

Figure 139. Houck Chacoan structure. Detail of Chaco-style masonry.

Lithics

A very small grab collection of lithics from the Houck Chacoan structure shows cherts and chalcedonies (45%) and silicified wood (45%) in equal quantities, with one specimen of quartzite (9%) completing the collection. All materials sampled are locally available in the Houck area.

6

A CHACOAN REGIONAL SYSTEM

Introductory Comments

In chapters 2, 3, and 4, three outlier communities have been documented in detail. Chapter 5 has presented the same range of data in more condensed form on 33 additional outlying sites and communities. Ideally these two levels of data complement each other; detailed documentation allows examination of specific outlying communities in some depth, while the more general data provide a wide base from which to extend these observations to outlying sites and communities throughout the San Juan Basin. Presumably generalizations drawn from the data base presented also have predictive value for outlier communities not yet documented.

In this chapter the data collected on physical environment and cultural remains are presented in sections synthesizing chronology, settlement pattern, environment, site type morphology, and ceramic and lithic remains.

Outlier Chronology

Basketmaker III-Pueblo I (500-900)

The occupation of areas which became the sites of outlying Chacoan structures and associated communities often began several hundred years earlier. Here the term locality is used to refer to the 8 km^2 area (1.6 km or 1 mile radius) surrounding the Chacoan structure within which most communities have been defined.

At least ten (29%) of the localities experienced limited settlement by Basketmaker III, while 14 (40%) had either limited settlement or communities by Pueblo I (Table 19, Figure 140). As defined here, limited settlement occurs when less than eight habitation sites are definable within the 8 km^2 area and/or when six or more sites do not occur within any 1 km^2 of this area. A community is defined as eight or more sites within 8 km^2 with at least six sites in 1 km^2 of the area.

A breakdown by site type for Basketmaker III and Pueblo I suggests that small houses (pithouses) are the most consistent initial site type present (Table 20). No Basketmaker III great kivas have been identified in the outlier localities, but they are known to exist during the period (Roberts 1929; Windes 1975). By Pueblo I great kivas are represented in two localities and perhaps are more frequent than present data indicate. Also by this period, small communities are present in the Pueblo Pintado, Kin Bineola, Skunk Springs and El Rito areas, while the community at Kin Ya'a is quite substantial.

Table 19 Settlement types by time period at outlier localities (cumulative)[a]

	BM-III	P-I	EP-II	LP-II	EP-III	LP-III
Limited settlement[b]	10	9	7	5	–	2
Community[c]	–	5	6	3	–	1
Chacoan structure[d]	–	–	3	6	15	13
Outlier community[e]	–	–	4	10	20	4
Total	10 29%	14 40%	20 57%	24 69%	35 100%	20 57%

a – the proposed Chacoan structure at Yucca House is not included in this and subsequent tables, reducing the sample number of Chacoan structures to 35.

b – <eight habitation sites in 8 km^2; or <6 sites in 1 km^2.

c – $\geq$ eight habitation sites in 8 km^2; with minimum of 6 sites in 1 km^2.

d – Chacoan structure; or Chacoan structure with <eight associated habitation sites in 8 km^2 and less than 6 sites in 1 km^2.

e – Chacoan structure with $\geq$ eight associated habitation sites in 8 km^2 and $\geq$ 6 associated habitation sites in 1 km^2.

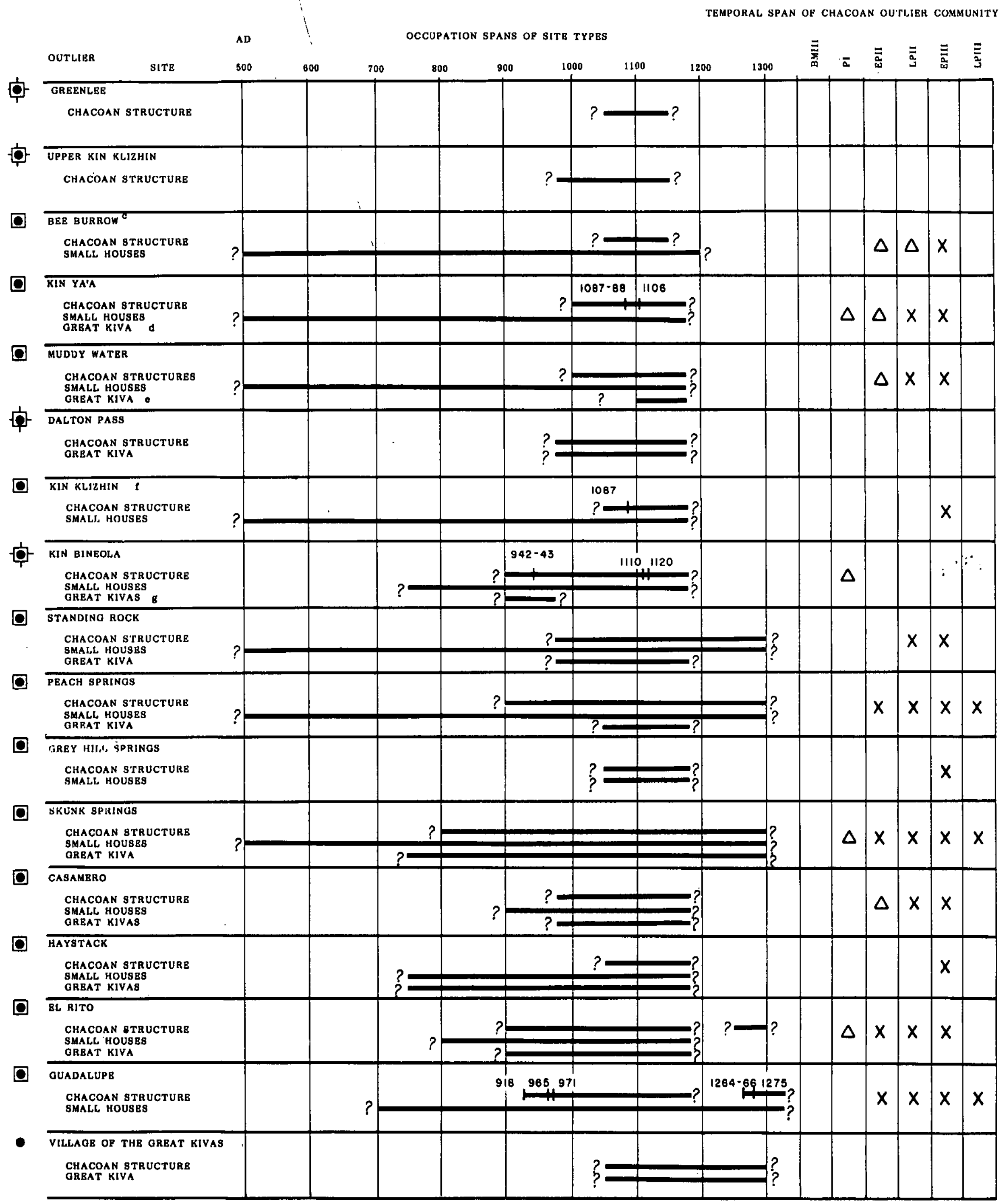


Figure 140. Occupation intervals at outliers.

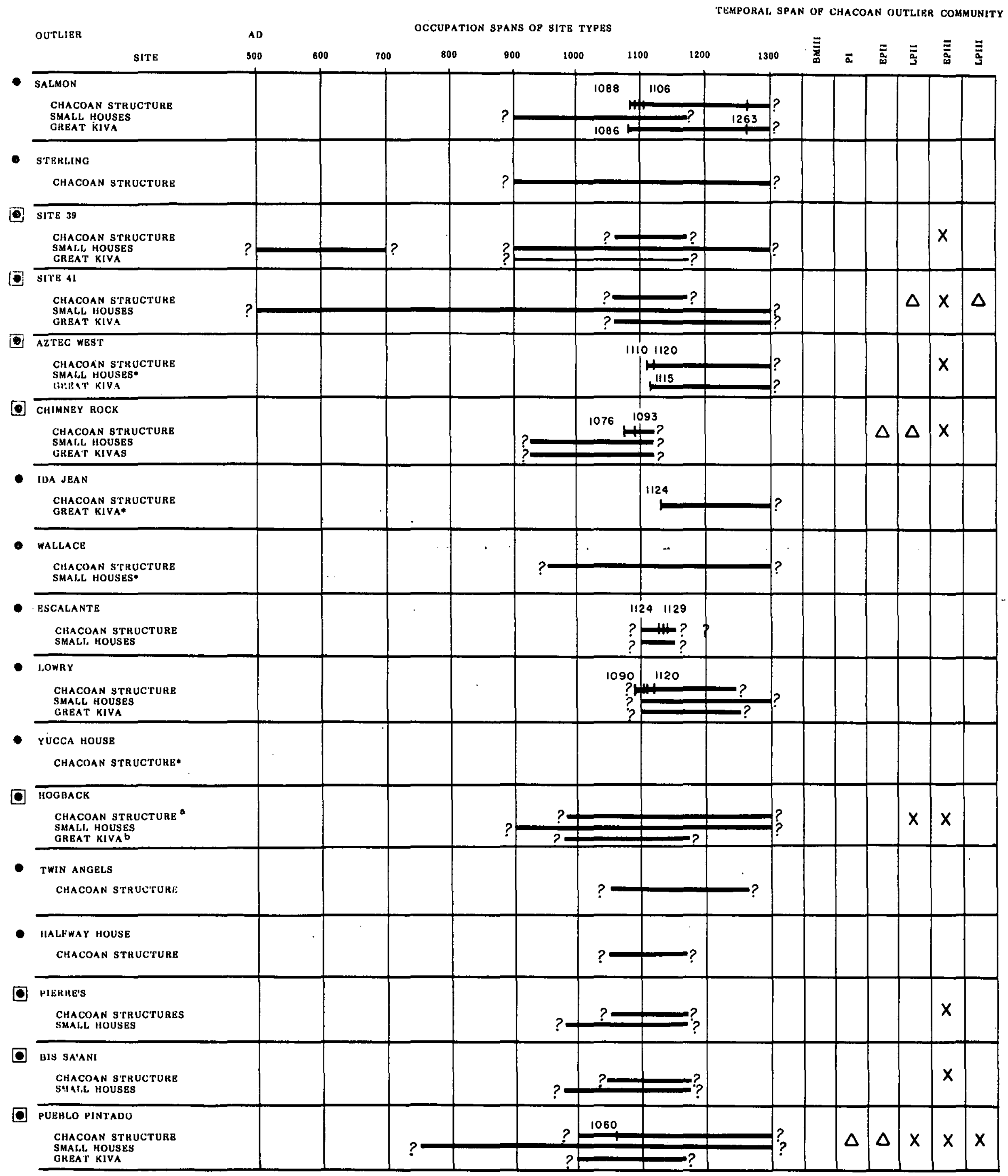
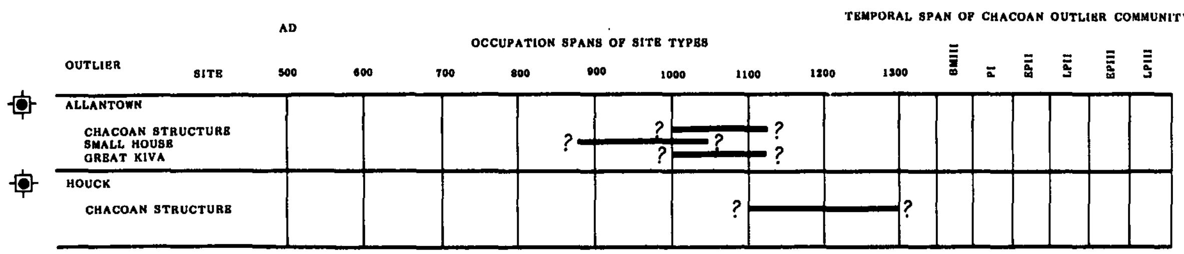


Figure 140 continued.



? Occupation span estimated on basis of site ceramics. The EP III cutoff date of 1175 has been followed from Hayes (1981). Where ceramics of a time period are present in frequency adequate to indicate occupation, occupation throughout the duration of the period is assumed, unless excavation data, ceramic analyses, or dates limit or allow more specific placement.

1. Vertical bars indicate clusters of individual tree-ring dates suggesting major or probable construction. Earliest and latest construction dates are shown regardless of construction magnitude.

• Occupation spans of sites not known.

a - Examination of ceramics at Hogback indicates the presence of both EPIII and LPIII types. The late ceramics are apparently not reflected in Wiseman's or Marshall et al's (1979) samples for which Marshall has assigned a termination date of 1050.

b - Although white wares tabulated by Marshall et al. (1979) suggest LPII occupation, the high percentage of indented corrugated recorded by Marshall suggests continued occupation into EPIII.

c - Although the Bee Burrow Chacoan structure does appear to have an associated community, all BMIII-PI sites, and the majority of the EPII-EPIII community sites, occur between 1.6-2.4 km (1-1.5 miles) from the Bee Burrow structure.

d - Occupational periods of this great kiva (29Mc117) are uncertain. Hayes believes it was intruded into a PI-PII house mound. Exposed masonry in the kiva appears to be relatively late (1000s).

e - Occupation span impossible to determine because of lack of associated ceramic material (Marshall et al 1979). Possible ca. 1050.

f - BMIII-PII sites in the Kin Klizhin area are 1.6-2.4 km from the Chacoan structure and are equidistant from the Padilla Wash community. Their association with either community is as such arguable.

g - Refuse near both great kivas (Marshall et al. 1979) suggests EPII use, although it is not certain that the refuse accurately delimits the use span of either structure.

X Chacoan structure and associated community present during indicated period.

Δ Community (without Chacoan structure) present during indicated period.

● Outlying Chacoan structure

Outlying Chacoan structure and associated community.

Outlying Chacoan structure and probable associated community.

Figure 140 continued.

Table 20 Site types at outlier localities by temporal period (cumulative)

	BM-III 500–750		P-I 750–900		EP-II 900–975		LP-II 975–1050		EP-III 1050–1175		LP-III 1175–1300	
	#	%	#	%	#	%	#	%	#	%	#	%
Chacoan structures	–	–	–[a]	–	7	20	16	46	35	100	17	49
Small houses	10	29	14	40	19	54	21	60	24	69	10	29
Great kivas	–	–	2	6	6	17	11	31	18	51	6	17

a – A P-I structure is present at the site of the Skunk Springs Chacoan structure, but it is not known if this structure is an early Chacoan structure.

Early Pueblo II (900-975)

The first Chacoan structures appear in Early Pueblo II at seven outlier localities (Table 20, Figures 140 and 141); five of these already supported limited settlement or a community (Table 21). The construction of a Chacoan structure defines each locality as an outlier. Associated Early Pueblo II communities are documented at Peach Springs, Skunk Springs, El Rito and Guadalupe (Table 19, Figure 140). Surface small houses and great kivas are the other site types comprising the communities during this time period, as well as all subsequent periods (Table 20). Although limited use sites are present at many localities, their presence or absence has not been considered in defining communities.

Of the Early Pueblo II outlying Chacoan structures, Kin Bineola and Guadalupe are the most firmly dated, with tree-ring dates indicating construction in the early half of the tenth century (Figure 140), accompanied by diagnostic masonry and ceramics. The presence of stonework very similar to Hawley's Type I masonry, and Early Pueblo II ceramic types (primarily Red Mesa, Newcomb, Tunicha or Cortez Black-on-whites accompanied by narrow neckbanded graywaves at El Rito, Peach Springs, Sterling, and Wallace), also suggest construction of these Chacoan structures during the early to middle portions of the tenth century. Tree-ring dates from early room contexts have not been obtained from these latter sites. One final Chacoan structure that may have had its origin during this time period, as indicated by the presence of some Early Pueblo II ceramics, is Skunk Springs. Until confirming tree-ring or masonry evidence is obtained, however, occupation of Skunk Springs during this interval is conjectural.

Several Chacoan structures in Chaco Canyon also experienced initial construction during Early Pueblo II (Figures 141 and 142). Three with early construction dates and Type I masonry associations are Pueblo Bonito, Penasco Blanco, and Una Vida. Chetro Ketl and Hungo Pavi have also produced a small number of beams with early cutting dates; but these are not in their original context at either site, nor is Hawley's Type I masonry exposed (Bannister 1965:138-152, 165-167; Robinson et al. 1974; Lekson and McKenna 1979; Lekson et al. 1982). From present evidence, it is impossible to determine if construction of the Chaco Canyon structures was earlier than the outlying Chacoan structures, or vice-versa.

Late Pueblo II (975-1050)

Initial construction of another nine Chacoan structures is thought to have begun during the Late Pueblo II interval (Table 20, Figures 140 and 143). Of these at least seven had previous evidence of either a community or more limited settlement (Table 21). The addition of a Chacoan structure to six of these existing communities brings the number of outlying communities occupied during this period to a total of 10 (Table 19, Figure 140). Not enough sites have been identified at the remaining localities with Chacoan structures to document them as communities.

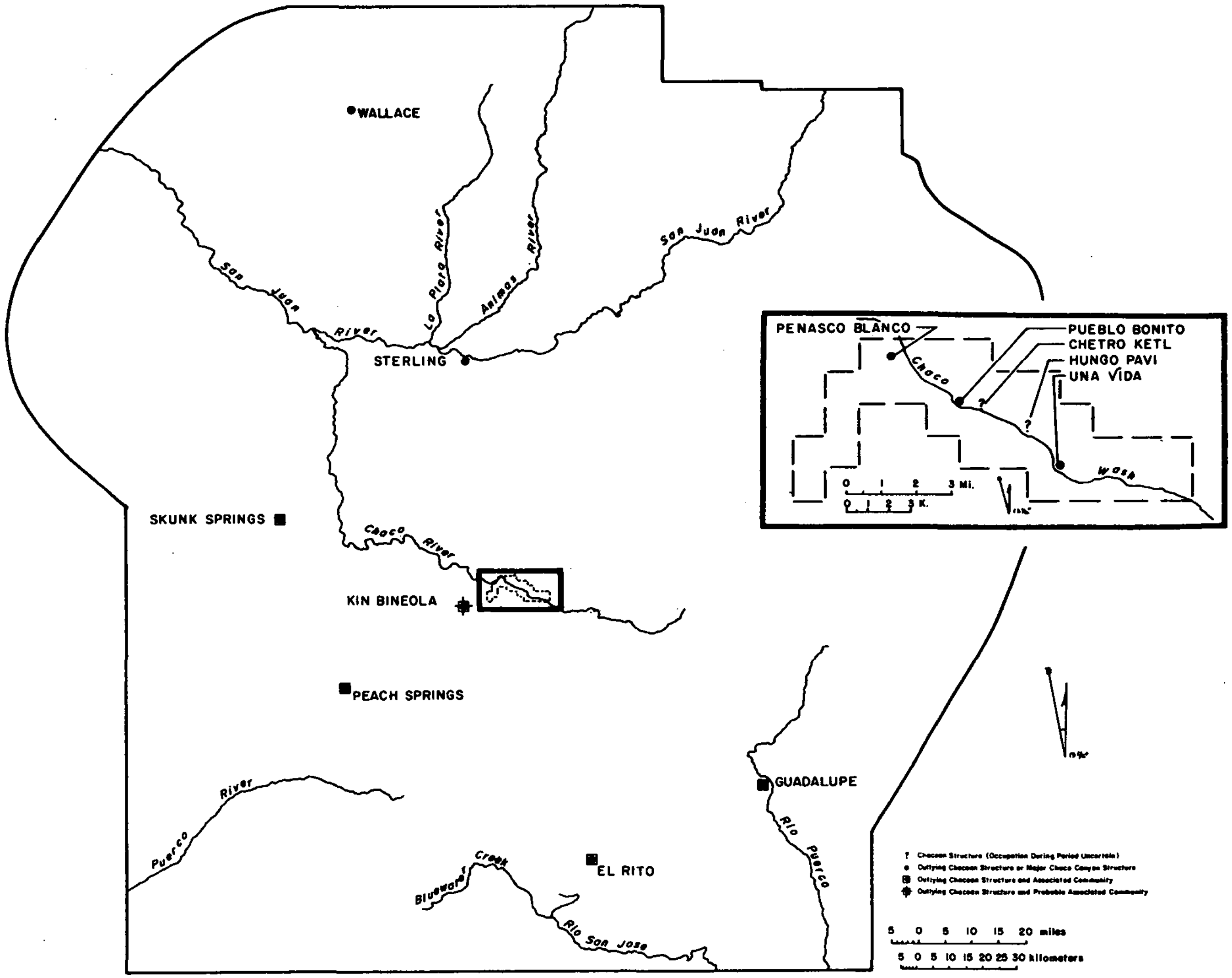
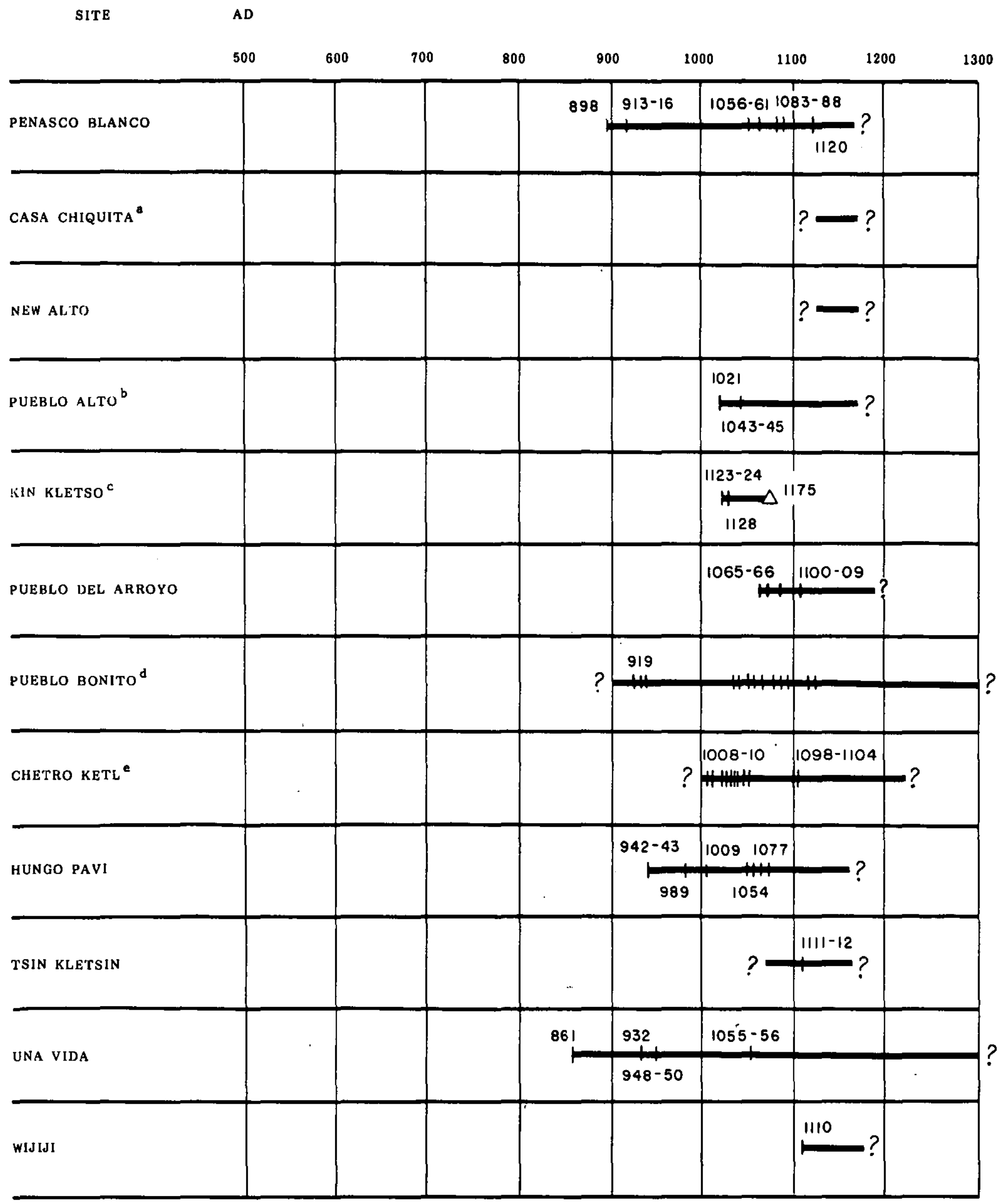


Figure 141. Occupation intervals at major Chaco Canyon Chacoan structures.

Table 21 Settlement types preceeding Chacoan structures at outlier localities

	Number of Chacoan structures by period				
	EP-II (n=7)	LP-II (n=8)	EP-III (n=19)	Total (n=35)	Percent
No settlement	2	2	10	14	40
Limited settlement	2	3	6	11	31
Community	3	4	3	10	29

a – Preceeding settlement types are those of the previous time period, i.e, two Early Pueblo II Chacoan structures were built in localities which were not occupied in Pueblo I.



?▬? Occupation span estimated on basis of site ceramics. The EPIII cutoff date of 1175 has been followed from Hayes (1981).

| Vertical bars indicate clusters or individual tree-ring cutting dates suggesting major or probable construction. Earliest and latest construction dates are shown regardless of construction magnitude.

△ Archaeomagnetic date.

a - The 1060 dates from Casa Chiquita (Robinson et al. 1974) are believed to be timbers recycled from another site or pre-existing structure. Lekson et al. (1982) suggest initial construction at this site did not occur until 1125-1130.

b - 1130 and 1132 cutting dates from Pueblo Alto, in addition to other dates from Plaza Feature 1, do not reflect construction (Windes 1980c).

c - Dates prior to 1123-24 at Kin Kletso (Robinson et al. 1974) are believed to represent timbers recycled from another or pre-existing structure (Lekson et al. 1982).

d - Tree-ring cutting dates prior to 919 are believed to be from earlier razed structures. The string of dates from 1040 to 1116 is believed to represent a relatively continuous series of building projects (Lekson et al. 1982).

e - A date of 963vv from the room below Room 92, and other late 900's cutting dates, suggest some construction at Chetro Ketl in the late tenth century (Dean n.d.). There is an almost continuous sequence of cutting dates from 1008 through 1077, probably representing both minor repairs and major construction. Except for major construction indicated by cutting dates of 1098-1104, the relative lack of late cutting dates probably reflects sampling, timber reuse, and the scarcity of timber from upper story rooms (Dean n.d.)

Figure 142. Early Pueblo II communities with Chacoan structures.

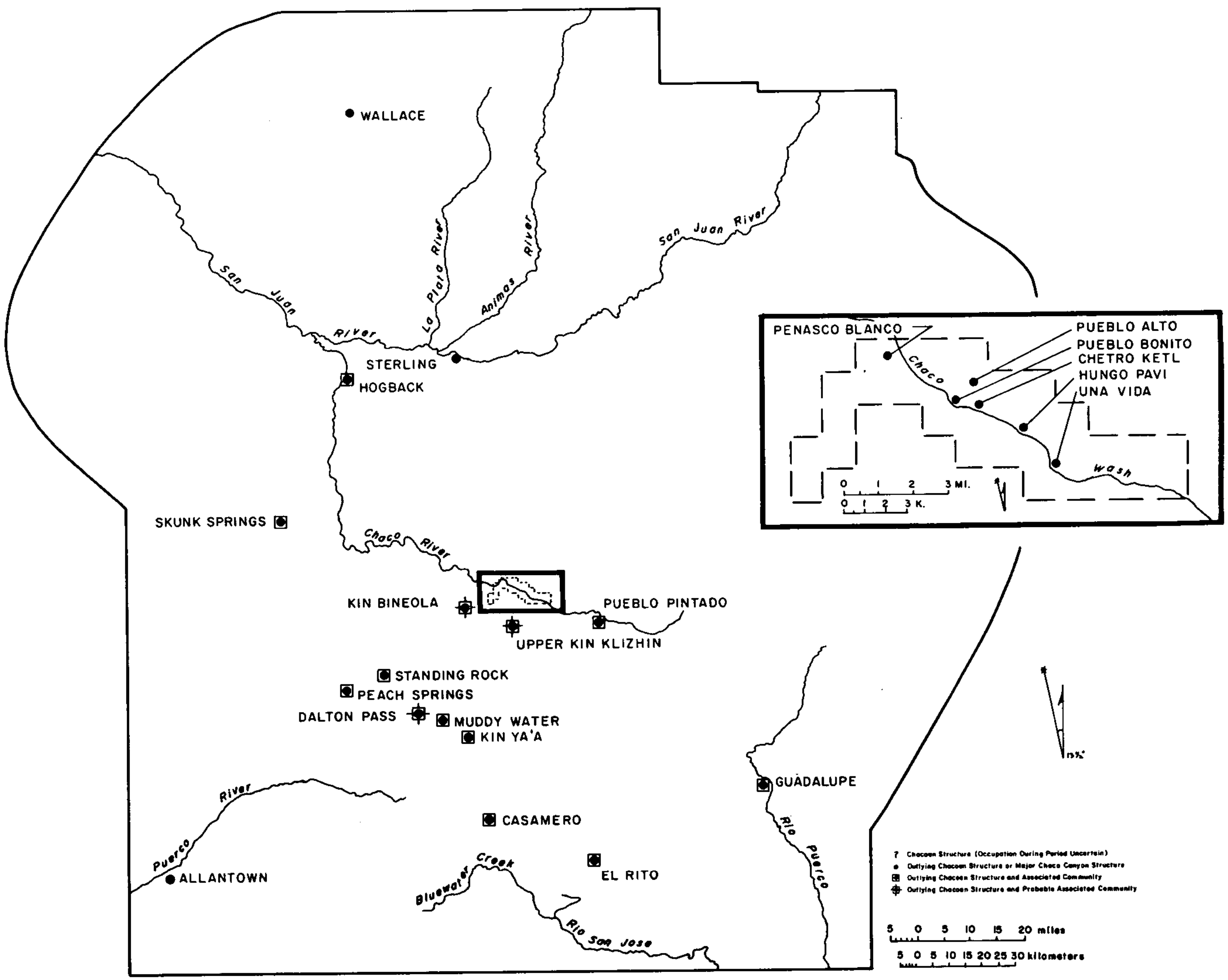


Figure 143. Late Pueblo II communities with Chacoan structures.

In many instances a lack of dendrochronological evidence and absence of diagnostic masonry styles necessitates dating Chacoan structures in this period on the basis of small surface ceramic samples. Predominant amounts of Red Mesa, Newcomb or Mancos Black-on-whites, in conjunction with narrow neck-banded and neck-indented corrugated culinary types, are diagnostic of initial occupation during this time interval. Gallup and Puerco, Chuska, Toadlena or Mancos Black-on-whites appear in moderate quantities by the end of the period.

While 23 cutting dates clustering at 1058 and 1060 (Bannister et al. 1970) suggest initial construction at Pueblo Pintado in Early Pueblo III, site ceramics suggest occupation at least as early as 1000 (Windes 1980b). A similar situation exists at Kin Ya'a where the earliest tree-ring cutting dates are 1087-1088; yet ceramics in the associated refuse mounds indicate occupation, and presumably some form of Chacoan structure, by 1000 (Windes 1980b).

While some construction continued at a number of Chaco Canyon structures (Figure 141 and 143) during the Late Pueblo II interval, construction appears to have begun there at only one site, Pueblo Alto. Substantial quantities of Red Mesa Black-on-white pottery, in addition to archaeomagnetic, C-14 and tree-ring dates, suggest initial construction at Pueblo Alto by the early 1000s (Lekson et al. 1982; Windes 1980b).

Early Pueblo III (1050-1175)

It is during this period that the majority of the Chacoan structures make their appearance. Of the 19 that appear to have been constructed during Early Pueblo III (Table 20, Figures 1 and 140), at least nine are in localities that previously supported a community or more limited settlement (Table 21), bringing to 20 the total number of outlying communities (Table 19, Figure 140). At the remaining localities that have a Chacoan structure, not enough sites are known to propose community status (Table 19), although it may be tentatively suggested for six (Figures 1 and 140).

With the exception of the 1058-1060 cutting dates at Pueblo Pintado and one 1076 cutting date at Chimney Rock, the bulk of the Early Pueblo III Chacoan structure construction activity does not appear to have been undertaken until the last half of the 1080s (Salmon, Lowry, Kin Ya'a, Kin Klizhin), and then continuing into the 1090s (Lowry, Salmon, and Chimney Rock), 1100s (Salmon, Lowry, Kin Ya'a) and 1110s (Aztec, Lowry, Kin Bineola). This interval of intense activity appears to have been concluded by the first half of the 1120s (Aztec, Escalante, Ida Jean, Lowry, Kin Bineola), although some construction appears to have continued into the 1130s and perhaps early 1140s at Escalante.

The chronology of the remaining Early Pueblo III Chacoan structures is not precisely defined. Temporal placement at these sites is indicated by ceramic assemblages dominated by Gallup and Puerco Black-on-white, with McElmo and Chaco Black-on-white appearing late in the period. North of the San Juan River, McElmo and its predecessor, Mancos Black-on-white, are the dominant Early Pueblo III types. A Cibolan variety of McElmo, termed Chaco-McElmo, is common in the ceramic assemblages of Chacoan structures in the Chaco Canyon area by the 1120s, but is rare in the southern sites, particularly those south of Lobo Mesa. Chaco Black-on-white is never common regardless of area. Puerco and Wingate Black-on-red are quite diagnostic of the time, occurring at virtually all sites in small quantities. In the Chuska Valley, Toadlena, Chuska, and Nava are the common black-on white types. Culinary vessels found within the entire San Juan Basin and to the immediate south are dominated by a variety of indented corrugated types.

Construction at existing Chaco Canyon Chacoan structures continued unabated during Early Pueblo III until the early 1120s. Between the late 1080s and 1124, construction was ongoing at outliers and Chaco Canyon structures contemporaneously during some years; while during others none is indicated.

In the Canyon, initial construction and occupation took place during this period at Pueblo del Arroyo, Tsin Kletzin, Wijiji, New Alto, Casa Chiquita, and Kin Kletso (Figure 1 and 141). Although the latter two structures have produced a number of eleventh century cutting dates, Lekson et al. (1982) have argued that initial construction did not occur at these sites until the early 1120s. This is suggested because the earlier dates at Kin Kletso, at least, are from upper story beams that overlie first story timbers with cutting dates in the 1120s. The latest cutting date from a Chacoan structure in the Canyon (Pueblo Alto) is 1132.

Early Pueblo III is the earliest period to which the construction and use of prehistoric roads can be dated. Examination of ceramics associated with roads is the simplest means of dating them, but as of this writing, the Great North Road is the only one to have been systematically examined with this intent (Morenon 1977). Morenon found that sherds associated with this road were almost exclusively of Early Pueblo III date, although a handful are representative of Late Pueblo III and suggest subsequent use. In view of the Early to Late Pueblo III dating of Chacoan structures and communities associated with the Great North Road, it is clear that the sites and the road are contemporary. Five other major roads (Figure 1) remain undated. However, since all major construction at Chacoan structures with associated roads appears to have ceased by the end of Early Pueblo III, it is probable that most roads had also been constructed by then. The apparent absence of Late Pueblo III ceramics at some Chacoan structures and communities linked by the roads implies further that road construction did not continue into that period.

Late Pueblo III (1175-1300)

The number of outlier localities with evidence of occupation during Late Pueblo III drops to 20 (Table 19, Figures 140 and 144), with 17 Chacoan structures showing occupation (Table 20, Figure 140). Only four of these qualify as outlier communities (Tables 19, Figure 140). The complete lack of new Chacoan structures and the lack of new construction at existing Chacoan structures during this period signal the decline of the outlying communities and their subsequent abandonment.

Some outliers may have been abandoned by 1175 or slightly earlier (i.e. Chimney Rock), but at many the presence of some carbon painted pottery dominated by McElmo or Nava Black-on-white with a few Mesa Verde Black-on-white sherds indicates that either the Chacoan structure or some sites in the locality may have been occupied somewhat longer by a reduced population.

Of the Chacoan structures in Chaco Canyon, Pueblo del Arroyo, Pueblo Bonito, Chetro Ketl, and Una Vida have small quantities of McElmo and Mesa Verde Black-on-white and other early thirteenth century carbon types suggesting occupation until the late twelfth or early in the thirteenth century. Many of the remaining canyon Chacoan structures also may have been occupied at this time; but, as with the outlier localities, surface ceramic collections are small and provide uncertain evidence.

While evidence for occupation of outlier communities from 1150-1250 is slight, occupation in the mid-1200s (as indicated by tree-ring dates and large quantities of Late Pueblo III ceramics) is clear, particularly north of the San Juan River. Whether this mid-to-late thirteenth century occupation represents renewed activity by a reduced resident population or reoccupation by a new population is not known. However, the associated architectural and ceramic complex is not Chacoan.

A number of tree-ring construction dates from Salmon, Aztec, and Guadalupe are associated with substantial remodeling efforts in the 1250s and 1260s. Mesa Verde or Crumbled House Black-on-whites, or other locally made variations of it, St. Johns Polychrome, and a few other types diagnostic of the 1225 to 1300 span are present. This occupation was short lived, however, as complete and final abandonment occurred virtually everywhere by about 1300, or 1350 at the latest.

Community Settlement Pattern

Surprisingly, previous recognition of Chacoan outlier communities in the San Juan Basin has been limited. This may derive, in part, from the fact that in the past archaeologists have assumed Anasazi site interaction to be generally sporadic and uncoordinated (c.f. Vivian 1970a). It also may be the result of the focus of archaeological investigation on Chaco Canyon itself; the canyon was so densely popu-

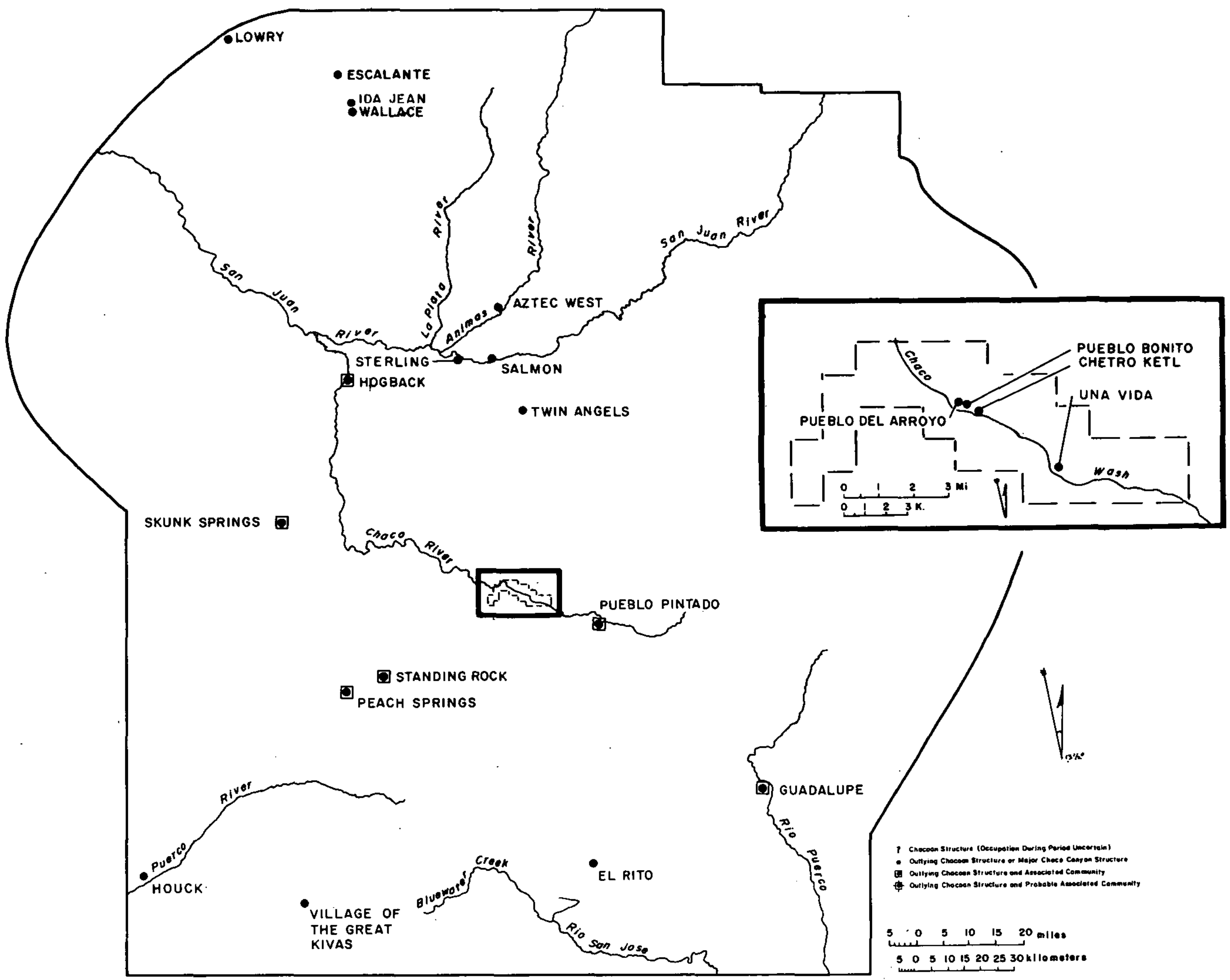


Figure 144. Late Pueblo III communities with Chacoan structures.

lated by Pueblo II and Early Pueblo III that community clusters are difficult to identify there (Hayes 1981).

It is not surprising that Fred Wendorf (in Wendorf and Lehmer 1956), one of the few archaeologists to propose multi-site communities analogous to those presented in this study, developed his community concept from archaeological research conducted outside of Chaco Canyon. Wendorf applied the term "community" to clusters of contemporaneous and spatially proximate habitation sites (or small houses) with an associated great kiva. He argued that such communities were first observable during Basketmaker III and continued through Early Pueblo III. The only substantial difference between Wendorf's community and ours is that Chacoan structures, not recognized as such by Wendorf, are conidered a vital element of Pueblo II and Early Pueblo III outliers.

In chapter 1 communities were defined as aggregations of contemporaneous sites in a small circumscribed area, with a site density exceeding that of surrounding areas. The types of sites included were Chacoan structures, small houses, great kivas, and limited use sites. In the preceeding discussion of chronology this definition was carried a step further by setting a minimum site frequency at eight habitation sites in an 8 km^2 area, with minimum site density of six habitation sites within 1 km^2 of that area. On this basis outlier communities (communities with an occupied Chacoan structure) and communities (communities without an occupied Chacoan structure) were identified during various time periods at many of the localities.

The purpose of the following discussion is to arrive at a more comprehensive understanding of outlier community settlement pattern. Beginning with the Basketmaker III and Pueblo I intervals, site frequency, density, and distribution at communities are summarized utilizing available survey and reconnaissance data. The community, in turn, is identified as the basic unit and component in the organization of a site system of regional extent. Ultimately, the community data are utilized to propose hierarchial relationships within the community and region.

Basketmaker III (500-700)

No communities are definable at outlying localities during Basketmaker III, although this may reflect the limited amount of survey performed at many outliers. Shifts in settlement location, as documented at Peach Springs, may also be an important factor. Communities do occur elsewhere during the period, however. In Chaco Canyon, Basketmaker III communities, as defined by Hayes (1981), include the Penasco Blanco locality with 23 sites in 8 km^2 and 13 sites in 1 km^2.

Pueblo I (700-900)

Five Pueblo I communities are documented at outlier localities (Table 19, Figure 140). Of the four with quantified data (Table 22),

Table 22 Site densities at outlying communities

Temporal Period	Outlier	Size of Survey Area (km^2)	No. of Sites[1]	Max. No. of Sites in km^2	Density of Sites per km^2
P-I	P. Pintado	.70	6	6	(9)
(750-900)	Kin Ya'a	1.30	31	30	24
	Kin Bineola	1.00	7	6	7
	El Rito	6.40	12	10	2
EP-II	Chimney Rock	15.75	64	13	4
(900-975)	P. Pintado	.70	13	12	(14)
	Kin Ya'a	1.30	34	33	27
	Muddy Water	1.90	9	9	5
	Peach Springs	2.00	6	6	3
	Casamero	.20	6	6	(30)
	El Rito	6.40	19	19	3
LP-II	Site 41	.10	8	8	(80)
(975-1050)	Chimney Rock	15.75	64	14	4
	P. Pintado	.70	15	15	(21)
	Kin Ya'a	1.30	28	27	22
	Muddy Water	1.90	33	33	17
	Peach Springs	2.00	26	25	13
	Casamero	.20	7	7	(35)
	El Rito	6.40	37	30	6
EP-III	Site 41	.10	8	8	(80)
(1050-1175)	Chimney Rock	15.75	65	14	4
	Pierre's	3.00	11	11	4
	Bis sa'ani	8.10	8	6	1
	P. Pintado	.70	15	15	(21)
	Kin Ya'a	1.30	20	18	15
	Muddy Water	1.90	36	32	19
	Peach Springs	2.00	22	19	11
	Casamero	.20	6	6	(30)
	El Rito	6.40	6	6	1
LP-III	Site 41	.10	13	13	(130)
(1175-1300)	P. Pintado	.70	13	13	(17)
	Peach Springs	2.00	11	11	5.5

a - occupation during Late P-III tentative for most sites in this community.
1 - includes only Chacoan structures, great kivas, and small house sites.
( ) Hypothetical site density for 1 km^2 based on site density within areas less than 1 km^2 in size. Hypothetical values have not been used for analytical purposes.

the Kin Ya'a community, with 30 sites in 1 km^2 and 31 known sites in a 1.3 km^2 area, clearly has the highest site frequency and greatest density.

Early Pueblo II (900-975)

Ten communities are known during Early Pueblo II (Table 19, Figure 140) with quantified data available on seven of these presented in Table 22. Kin Ya'a, with 34 sites in 1.3 km^2 and with 33 sites in 1 km^2, still has the highest site density, although Chimney Rock has a total of 64 sites within a nearly 16 km^2 area. Of the four outlier communities (communities with a Chacoan structure), El Rito, with 19 sites in 1 km^2, is the first documentable case of a Chacoan structure with an associated high density site cluster.

Late Pueblo II (975-1050)

Of the 13 communities identifiable during Late Pueblo II (Table 19, Figure 140), eight with quantified data are presented in Table 22. Five of these have a Chacoan structure with 15 or more sites within 1 km^2. El Rito, Peach Springs, Muddy Water and Kin Ya'a have the highest frequencies as well as densities.

Early Pueblo III (1050-1175)

The number of identifiable outlier communities grows to 20 during Early Pueblo II (Table 19, Figure 140), and quantified data on ten are presented in Table 22. Of these, only one, Muddy Water, shows moderate increases in site frequency and density, while frequencies and density at Kin Ya'a, Peach Springs, and El Rito decrease. Communities such as Pierre's and Bis sa'ani, with few sites and low densities, make their appearance during the period.

Late Pueblo III (1175-1300)

Reflecting the abandonment of many portions of the basin by Late Pueblo III, only five communities are identifiable during this period. Quantified data are available for three (Table 22), and as shown, the site frequencies and densities have dropped further at both Pueblo Pintado and Peach Springs. Although an increase in site frequency and density is indicated at Site 41, this may be more apparent than real since the actual number of sites occupied during Early Pueblo III and previous periods is probably obscured by the substantial Late Pueblo III occupation.

Community Boundaries

Communities are currently identifiable at outlier localities from Pueblo I to Late Pueblo III, reaching their peak in frequency (n = 20, 57%) during Early Pueblo III (Table 19). Future survey should confirm additional communities at many of the remaining Chacoan structure localities. The limited data suggest that highest site frequencies and densities may have occurred during Late Pueblo II with a slight drop in site frequency and density during Early Pueblo III. The era of communities is clearly over by Late Pueblo III.

The criteria used in the preceeding pages to define communities are necessarily arbitrary and will remain so until more extensive archaeological investigations are performed. The minimal criteria were adopted using the Bis sa'ani aggregation as a guideline. As we have documented in Table 22, the frequency and density of sites at other outlier communities such as Kin Ya'a and Chimney Rock is much higher.

The recent survey of a 15.8 km^2 area contiguous to the southwest portion of Casamero (Figure 123), as reported by Whitmore (1979), does allow the detailed documentation of site density variability over a substantial area at an outlier community. Applying a series of concentric circles spaced at 1.6 km (1 mile) intervals to a distance of 6.4 km (4 miles) from the Casamero Chacoan structure, Whitmore calculated the number of sites that could be expected within each 1.6 km (1 mile) radius, presuming a random distribution and adjusting for the increasing size of each progressively distant circle. It was found that the actual number of sites within the 1.6- and 3.2-km (1- and 2-mile) radii exceeded the number expected by 87% and 14% respectively. At the 4.8-and 5.4-km (3-and 4-mile) distances, however, fewer sites were found than expected (24% and 58% respectively).

This substantial drop off appears to indicate quite clearly that a high density area does exist at Casamero, but that it is not necessarily confined to a 1 km^2 area. By defining the community as an area of high site density relative to the surrounding periphery, it is easy to delimit the community at Casamero. Unfortunately, only four of the communities documented in Table 22 (El Rito, Chimney Rock, Bis sa'ani and Pierre's) have large enough survey areas to provide a means of testing the Casamero results. A comparison of the maximum 1 km^2 site density versus the overall site density at these four localities suggests significant drops in site density outside of the 1 km^2 area (Table 22). The relationship of peripheral, lower density areas to the focal higher site density area remains undocumented, and the question of whether these peripheral areas should be considered part of the actual community is unresolved. (The high site density community area should not be confused with the much larger peripheral settlement and economic resource range defined later in this chapter.)

Parenthetically, although the Bee Burrow community (Figure 102) is not included in Table 22 because the community is separated from the Chacoan structure by a 2 km distance (which exceeds the 1.6 km definitional limit), the Bee Burrow community does appear to be associated with the Bee Burrow Chacoan structure, and does have a high site density area (O'Laughlin 1980).

Site Type Distributions in the Community

All five communities just mentioned, with the exception of Bis sa'ani, have a Chacoan structure located within the high site density area. At Bis sa'ani the Chacoan structure is offset by ca. 600 m, apparently in order to situate it on a prominent ridge. The only other known example of a community with its Chacoan structure outside the high density aggregation is Bee Burrow, where we suspect the prehistoric road may have determined its location.

In the smaller survey areas where high density areas cannot be accurately delimited, Chacoan structures at several communities (including Kin Ya'a, Muddy Water, and Peach Springs) occur within 1 km^2 areas with site densities that are comparable to those of the five discussed above. Although it is not known if these are the areas with highest densities, their density levels certainly suggest this. The fact that high densities are already present at some localities prior to the construction of a Chacoan structure (Table 22) strongly suggests that these structures are not a primary causal force behind initial aggregation but, rather, may result from it. They may, however, have engendered more aggregation, as suggested by the increase in site density at a number of communities subsequent to the construction of the Chacoan structures. Thus it is predicted that few, if any, Chacoan structures were constructed at localities not already supporting either limited settlement or a community. Although Table 21 indicates that no such prior settlement is known at 15 localities, this is probably due to the lack of survey at these areas.

The central location of Chacoan structures within some high site density areas suggests purposeful placement, but whether this holds true throughout is not yet clear. At Chimney Rock, the Chacoan structure appears to be on the periphery of the high density area (Figure 74). At other communities, however, the Chacoan structure appears to be more centrally located (for example see Figures 21, 37, 105, 132). The location of some structures on prominent topographic features, as at Bis sa'ani, and Chimney Rock, would appear to have been at the expense of centrality.

Great kivas also occur in the high density areas of communities. Since 15 (71%) of the 21 great kivas recorded at outliers are either incorporated into the Chacoan structure or are located within 100 m of it, the two site types appear closely associated. However, the six great kivas which are more than 100 m from Chacoan structures appear to be more closely associated with small houses, as at Chimney Rock (Figure 74) or Standing Rock (Figure 117). In some instances it is clear that these kivas predate the erection of the Chacoan structure in the community.

Small house sites comprise the majority of sites in the high density areas and are usually nearest neighbors to each other. Although aggregated clusters of these sites seem apparent at many communities, a detailed investigation of small house spatial relationships has not been possible to verify this.

The size of small houses and limited use sites has been examined from a spatial viewpoint by Whitmore (1979), again utilizing the Casamero data. Cross-tabulating site size by distance from the Casamero Chacoan structure, Whitmore was able to determine that site size decreased as distance from the Chacoan structure and high density area increased. Artifact scatters, sites with less than two masonry rooms (many presumed to be fieldhouse structures), and other probable special use sites were predominant (n = 17, 74%) at distances of 4.8-5.4 km from the Chacoan structure, while the majority (n = 9, 60%) of sites within a 3.2-km radius were those with more than two masonry rooms on up to those with multiple roomblocks. Only one site with more than two rooms occurred outside the 4.8-km radius (Whitmore 1979:Table 10).

Whitmore's results are interesting, not only because the size gradient has hierarchical implications, but because changes in site type clearly co-occur with reductions in site size. Limited use sites (fieldhouses, scatters) replace small houses in frequency as distance from the community increases. Although an examination of site size/type variability at outliers was not possible in this study because of the limited size of survey areas, hints of similar patterns were noted at Peach Springs and Pierre's, where limited use sites in peripheral areas may represent loci supportive to the community.

Hierarchy in the Community

In investigations of settlement pattern, site frequency, size, spacing, and morphology commonly provide the basis for inferring types of settlement systems. Site hierarchies have been documented as components of some settlement systems (cf. Bullard 1960; Flannery 1976; Haggett 1965; Peebles and Kus 1977; Renfrew 1973; Sanders and Price 1968). As used here, the term site hierarchy refers to a pyramidal organization of sites with unequal importance and function. Sites that occupy positions at the apex of the hierarchy are few in number but may be the loci of important administrative, economic, or ceremonial functions. Large size, monumental architecture, specialized ceremonial features, a central location, and relatively equidistant spacing to sites of comparable or higher hierarchical levels are attributes that may distinguish these sites. In contrast, lower level sites that may account for the majority of sites in settlements are often small, lack monumental architecture and specialized ceremonial facilities, and have nearer neighbors of comparable levels. Hierarchical settlement does not necessarily reflect equivalent social hierarchy or ranking. For example, limited use sites of the Anasazi may be low level satellites of small houses, a rudimentary hierarchical relationship but one that is clearly without corresponding social ranking.

Within Chacoan communities, two major hierarchical levels are defineable: Chacoan structures (high) and small houses (low). Further distinction within levels may be discernible, particularly during Early Pueblo III when the community settlement system is at its height of complexity; these distinction are subtle and perhaps only incipient in development. In any case, hierarchical discrimination of this nature requires more detailed analysis than is presently possible.

The two-level dichotomy is quite evident by Early Pueblo II. Chacoan structures are physically distinct from small houses in size and morphological features, and are frequently associated with specialized features such as great kivas. By Early Pueblo III roads can be documented in association with the Chacoan structures.

While roads bypass many small house sites, they link only Chacoan structures. Similarly, while great kivas do occur in proximity to small houses, they do not occur in the plazas of small house sites nor are they physically attached. Chacoan structures are also limited in occurrence; usually one, or at most three, Chacoan structures are identifiable in a single community, while the small houses are quite numerous.

The spatial relationships of Chacoan structures with great kivas and roads suggest they performed community level ceremonial, administrative, and economic functions -- the latter especially since roads are logical routes for moving both information and commodities. Excavations of Chacoan structures should confirm these suppositions; but much of the currently available data are equivocal, beyond establishing that portions of the structures were occupied as residences (Carlson 1966; Eddy 1977; Morris 1928, 1939).

Based on evidence suggesting that Chacoan structures were in part residences, one may suggest that they were occupied by a small, differentiated, elite group. Yet, confirming evidence from outliers in the form of status burials, differential distributions of artifacts, or qualitative differences in artifacts is scant. The only probable high status burial from an outlying locality is that from the Dominguez Site (Reed 1979) located several hundred meters from the Escalante Chacoan structure. Interestingly, this burial was recovered from a small house site.

We suggest that ranking may eventually be documented at outliers, particularly at the larger Chacoan structures. Whether the smaller Chacoan structures present at the majority of the outlying communities were similarly occupied by small elite groups remains problematic.

Regional Settlement Pattern and Site Organization

Up to this point discussion has focused on site relationships within the community; now a broader regional perspective is attempted through examination of the spatial relationships between communities. Although it is not possible to document the association of each Chacoan structure with a surrounding community (see Table 21), it is assumed that most Chacoan structures are focal points. As such, the distances between Chacoan structures may represent the distances between the high density areas of individual communities. Since only those communities with a Chacoan structure were evaluated, it is necessary to exclude

Basketmaker III and Pueblo I communities from consideration in the following chronological summary.

Early Pueblo II (900-975)

Examination of the distribution of known Early Pueblo II outliers reveals that they are a mean distance of 54 km apart (Table 23). With the exception of the Wallace Ruin and Kin Bineola, they are located at the Chaco Basin peripheries. Thus the wide distances separating early communities with Chacoan structures may be considered representative of early outlier settlement (Figure 141). The location of Kin Bineola near the center of the Basin is somewhat anomalous with respect to the location of other early outliers.

In obvious contrast to this dispersed pattern, in Chaco Canyon the structures are relatively closely spaced (2 km mean), a pattern that is increasingly distinctive through the succeeding intervals (Table 23, Figure 143).

Late Pueblo II (975-1050)

The distribution of Late Pueblo II Chacoan structures (Figure 143) shows continued establishment of Chacoan structures at basin periphery areas, although a few additional communities were established elsewhere. Communities are closer together, with a mean distance of 31 km (Table 24). Five sites along the southwestern perimeter of the basin (Peach Springs, Standing Rock, Dalton Pass, Muddy Water, and Kin Ya'a) are a mean distance of 10 km apart. Although no undocumented communities are believed to exist between these, further survey should reveal additional aggregations along the north edge of Lobo Mesa east of Kin Ya'a, in the Tohatchi Flats west of Peach Springs, and along the southeastern flank of the Chuskas.

Comparable densities may have been attained in the northern Chuska Valley (Biella 1974; Harris et al. 1967; Peckham and Wilson 1965), and may also be expected for the Red Mesa Valley portions of the Rio Puerco West. Although the density of outlying Chacoan structures increases during this period, the outliers are still considerably more dispersed than the dense (2 km mean) group of Chacoan structures in Chaco Canyon (Table 24 and Figure 144).

Early Pueblo III (1050-1175)

While a few Chacoan structures were probably established on the peripheries in Early Pueblo III (Haystack is the only new Chacoan structure in our sample), the greatest increases are seen north of the San Juan River and in the interior portions of the Chaco Basin (Figure 1). The mean distance between communities with Chacoan structures continues to decrease to a mean of 17 km (Table 25), even though some of the most distant outliers are 30 to 70 km from their nearest neighbors. A lesser mean distance of 12 km is indicated for road connected

Table 23 Early Pueblo II
Distance to nearest known neighbor

Chacoan structure		Distance (km)	Nearest neighbor
		Chacoan structures	
Wallace		85.0	Sterling
Sterling		72.5	Penasco Blanco
Skunk Springs		54.0	Peach Springs
Peach Springs		40.0	Kin Ya'a
Kin Bineola		14.5	Penasco Blanco
El Rito		56.0	Kin Ya'a
Guadalupe		57.0	El Rito
	Mean	54.0	
	Std. Dev.	23.0	
		Chaco Canyon Chacoan Structures	
Penasco Blanco		4.0	Pueblo Bonito
Pueblo Bonito		1.0	Chetro Ketl*
Chetro Ketl*		1.0	Pueblo Bonito
Hungo Pavi*		2.0	Chetro Ketl*
Una Vida		2.0	Hungo Pavi*
	Mean	2.0	
	Std. Dev.	1.0	

* - occupation during Early Pueblo II is conjectural.

Table 24 Late Pueblo II
Distance to nearest known neighbor

Chacoan structure		Distance (km)	Nearest neighbor
		Chacoan structures	
Wallace		79.0	Hogback
Sterling		35.0	Hogback
Hogback		35.0	Sterling
Skunk Springs		51.0	Hogback
Peach Springs		13.0	Standing Rock
Standing Rock		13.0	Peach Springs
Dalton Pass		10.0	Muddy Water
Muddy Water		7.0	Kin Ya'a
Kin Ya'a		7.0	Muddy Water
Casamero		28.0	Kin Ya'a
El Rito		34.0	Casamero
Guadalupe		57.0	El Rito
Allantown		81.0	Peach Springs
Upper Kin Klizhin		12.0	Una Vida
Kin Bineola		14.5	Penasco Blanco
Pueblo Pintado		22.0	Una Vida
	Mean	31.0	
	Std. Dev.	24.0	
		Chaco Canyon Chacoan structures	
Penasco Blanco		4.0	Pueblo Alto
Pueblo Alto		1.0	Pueblo Bonito
Pueblo Bonito		1.0	Chetro Ketl
Chetro Ketl		1.0	Pueblo Bonito
Hungo Pavi		2.0	Chetro Ketl/Una Vida
Una Vida		2.0	Hungo Pavi
	Mean	2.0	
	Std. Dev.	1.0	

Table 25 Early Pueblo III
Distance to nearest known neighbor

Chacoan structure	Distance (km)	Nearest neighbor
	Chacoan structures	
Lowry	35.0	Escalante
Escalante	11.0	Ida Jean
Ida Jean	1.0	Wallace
Wallace	1.0	Ida Jean
Chimney Rock	72.5	Aztec West
Site 41	13.5	Site 39
Site 39	13.5	Site 41
Sterling	10.5	Salmon
Salmon	10.5	Sterling
Aztec West	15.5	Salmon
Twin Angels	15.5	Salmon
Halfway House	16.0	Pierre's
Pierre's	16.0	Halfway House
Hogback	35.0	Sterling
Skunk Springs	34.0	Grey Hill Springs
Grey Hill Springs	21.0	Standing Rock
Peach Springs	13.0	Standing Rock
Standing Rock	13.0	Peach Springs
Dalton Pass	10.0	Muddy Water
Muddy Water	7.0	Kin Ya'a
Kin Ya'a	7.0	Muddy Water
Bee Burrow	13.0	Upper Kin Klizhin
Upper Kin Klizhin	5.0	Greenlee
Greenlee	5.0	Upper Kin Klizhin
Kin Bineola	6.0	Kin Klizhin
Kin Klizhin	6.0	Kin Bineola
Pueblo Pintado	16.0	Bis sa'ani
Bis sa'ani	10.0	Wijiji
Casamero	16.5	Haystack
Haystack	16.5	Casamero
El Rito	18.0	Haystack
Guadalupe	55.0	El Rito
Village of the Great Kivas	41.0	Allantown
Allantown	8.0	Houck
Houck	8.0	Allantown
Mean	17.0	
Std. Dev.	15.1	

Table 25 Continued

Chacoan structure		Distance (km)	Nearest neighbor
		Chaco Canyon Chacoan structures	
Penasco Blanco		3.0	Casa Chiquita
Casa Chiquita		1.0	Kin Kletso
Kin Kletso		1.0	Pueblo del Arroyo
Pueblo del Arroyo		0.0	Pueblo Bonito
New Alto		0.0	Pueblo Alto
Pueblo Alto		0.0	New Alto
Pueblo Bonito		0.0	Pueblo del Arroyo
Chetro Ketl		1.0	Pueblo Bonito
Tsin Kletsin		3.0	Chetro Ketl/P. Bonito
Hungo Pavi		2.0	Una Vida/Chetro Ketl
Una Vida		2.0	Hungo Pavi
Wijiji		4.0	Una Vida
	Mean	1.0	
	Std. Dev.	1.0	
		Central Chaco Canyon Chacoan structures	
Pueblo Bonito		0.3	Pueblo del Arroyo
Cherto Ketl		0.5	Pueblo Bonito
Pueblo Alto		0.2	New Alto
New Alto		0.2	Pueblo Alto
Kin Kletso		0.6	Pueblo del Arroyo
Pueblo del Arroyo		0.3	Pueblo Bonito
	Mean	0.3	
	Std. Dev.	0.2	

outliers (Table 26). Such "isolated" sites as Lowry, Chimney Rock, Guadalupe, Village of the Great Kivas, Allantown, and Houck probably have greater nearest neighbor distances only because little survey has been conducted in the areas between them.

While the density of outliers increases, so does the density (1 km mean) of Chaco Canyon structures (Figure 1, Table 25). This extreme density may in part reflect the lack of associated communities with some of the Chaco Canyon structures.

The lack of new Chacoan structures along the perimeters of the Chaco Basin during Early Pueblo III suggests that maximum densities were reached in Late Pueblo III with spacing as close as 10 km in some areas such as the southwestern perimeter. Using this and the 17 km mean for all Chacoan structures, the spacing of Chacoan outliers can be estimated. Areas with radii from 5 km (78.5 km^2) to 8.5 km (227 km^2) can be proposed as the range of each outlier. It is suggested that the outer portions of this range probably served as peripheral settlement and economic resource areas. Sites in these areas, particularly the limited use sites, were probably affiliated with or dependent on, the central community.

While spacing of Chacoan structures does provide a means of estimating community and economic resource area size, the reliability of these figures remains untested. Factors such as unoccupied spaces, incomplete survey data, and environmental differences make these very tentative estimations.

Late Pueblo III (1175-1300)

The number (n=17) of Chacoan structures decreases substantially by Late Pueblo III, with the mean distance between them increasing to 26 km (Table 27). As Figure 144 illustrates, many of the communities that survive into this period are north of the San Juan River (n=7, 41%), on the edges of the Chaco Basin (n=6, 33%), or to the south or east of the basin (n=3, 18%). Virtually the only central basin outlier with signs of occupation at this time is Pueblo Pintado.

In Chaco Canyon only four Chacoan structures bear some evidence of late occupation, with a 1.5 km mean distance between them (Table 27).

Roads

The presence of roads by Early Pueblo III suggests an intercommunity organization and settlement system of regional extent. As shown in Figure 1, at least four major roads extend from Chaco Canyon to the perimeters of the Chaco Basin by Early Pueblo III. The roads may well continue beyond the edges of the basin, but remote sensing studies to date have been limited to delineation of roads within the Chaco Basin (Obenauf 1980).

A number of additional roads, currently known only from limited segments, may ultimately be defined. One of these, extending north-northwest from Penasco Blanco, could tie in much of the Chuska Valley

Table 26 Early Pueblo III road distances between nearest Chacoan structures[1]

Road	Chacoan structure	Distance (km)	Chacoan structure
North Road	Salmon (?)	16.0	Twin Angels (?)
	Twin Angels (?)	21.0	Halfway House
	Halfway House	16.0	Pierre's
	Pierre's	19.0	Pueblo Alto
Total		72.0	
Mean		18.0	
Std. Dev.		2.5	
West Road, North Branch	Pueblo Bonito (?)	11.0	Kin Klizhin
	Kin Klizhin	6.5	Kin Bineola (?)
	Kin Bineola (?)	12.0	Indian Creek (?)
	Indian Creek (?)	46.5*	Tohatchi Flats**
Total		76.0	
South Branch	Pueblo Bonito (?)	47.0*	Standing Rock
	Standing Rock	12.5	Peach Springs
	Peach Springs	11.5	Grey Ridge
Total		71.0	
Possible branch interconnections	North Branch	13.0*	Standing Rock
	North Branch	3.0*	Grey Ridge
	North Branch	7.0*	Peach Springs
Total		23.0	
Mean distance between outliers (both branches)		11.0	
Std. Dev.		2.0	
Northwest Road	Penasco Blanco	8.5	Casa del Rio
	Casa del Rio	8.0	Lake Valley
Total		16.5	
Mean		8.0	
Std. Dev.		0.0	
Southwest Road	Pueblo Bonito (?)	12.0	Upper Kin Klizhin
	Upper Kin Klizhin	13.0	Bee Burrow
	Bee Burrow	20.0	Kin Ya'a
Branch	Kin Ya'a	7.0	Muddy Water
Total		52.0	
Mean		13.0	
Std. Dev.		5.0	

Table 26 Continued

Road	Chacoan structure	Distance (km)	Chacoan structure
Southeast Road	Una Vida (?)	9.0	Greenlee
	Greenlee	78.0*	San Mateo
	San Mateo	6.0	El Rito
	El Rito	12.5	Kin Nizhoni
Branch	Seven Lakes Junction**	24.0*	Kin Ya'a
Total		129.5	
Mean		9.0	
Std. Dev.		3.0	
East Road	Una Vida (?)	5.5	Wijiji (?)
	Wijiji (?)	18.0	Pueblo Pintado
Total		23.5	
Mean		12.0	
Std. Dev.		9.0	
Grand Total		463.5	
Mean		12.0	
Std. Dev.		5.0	

1 - Short road segments are also tentatively identified in association with the following outliers: Andrews, Bis sa'ani, Casamero, Hogback, Newcomb, and Skunk Springs. However, in each case the major road associations are not known.
* - Distance not included in mean or standard deviation calculations.
**- Locality or place name with no known outlier.
(?) Probable road associated Chacoan structure, but road presently not identifiable within 1 km radius of site.

Table 27 Late Pueblo III
Distance to nearest known neighbor

Chacoan structure	Distance (km)	Nearest neighbor
	Chacoan structures	
Lowry	35.0	Escalante
Escalante	11.0	Ida Jean
Ida Jean	1.0	Wallace
Wallace	1.0	Ida Jean
Sterling	10.5	Salmon
Salmon	10.5	Sterling
Aztec West	15.5	Salmon
Twin Angels	15.5	Salmon
Hogback	35.0	Sterling
Skunk Springs	51.0	Hogback
Peach Springs	13.0	Standing Rock
Standing Rock	13.0	Peach Springs
Pueblo Pintado	18.5	Wijiji
Guadalupe	55.0	El Rito
El Rito	54.0	Guadalupe
Village of the Great Kivas	48.0	Houck
Houck	48.0	Village of the Great Kivas
Mean	26.0	
Std. Dev.	19.0	
	Chaco Canyon Chacoan structures	
Pueblo del Arroyo	0.0	Pueblo Bonito
Pueblo Bonito	0.0	Pueblo del Arroyo
Chetro Ketl	1.0	Pueblo Bonito
Una Vida	5.0	Chetro Ketl
Mean	1.5	
Std. Dev.	2.0	

and the northwestern portions of the Chaco Basin. Similarly, a road to Pueblo Pintado, running along the Chaco Canyon floor may extend further southeastward.

Figure 1 shows that all four major roads link numerous outlying communities with Chaco Canyon. In so doing, each of the roads transects the Chaco Basin by a relatively direct, or linear, route. However some compromises in linearity occur, as shown in Table 28 which compares the most direct route (in terms of distance) versus the actual route chosen. It is apparent that relatively little route alteration took place on some roads, while others are considerably less direct, perhaps because of major topographic obstacles and/or detours to link additional outliers. The fact that each road ultimately reaches a <u>different</u> segment of the basin edge suggests that the purpose of each road was to link a variety of basin and extra-basin environments and the communities located therein.

Figure 1 also shows that Chaco Canyon is the convergence point of all presently documented extra-cañyon roads. Penasco Blanco and Pueblo Alto are clearly two entry points for roads to the canyon. Other major canyon Chacoan structures (including Pueblo Bonito, Pueblo del Arroyo, Chetro Ketl, and Una Vida) are logical possibilities because of their proximity to natural canyon entry points through which major roads enter the canyon. Intra-canyon roads are documented at a few locations and are postulated to connect a number of canyon Chacoan structures (Lyons and Hitchcock 1977).

Outside of the canyon the divergence of the major roads suggests that each served a separate system, although a branch of the South Road does interconnect with the Southwest Road (Figure 1). It is unlikely that the major road systems were interconnected since there is little evidence for road linkage between outlying sites associated with different road systems. Until exhaustive remote-sensing studies are performed however, this possibility cannot be completely discounted.

In the central portions of the basin, the Southwest and North roads have no branches. Here the communities with Chacoan structures are located "in series" along the road routes. On the South and West roads however, several branches diverge before the basin perimeters are reached, creating a more dendritic system. At the basin perimeters all roads may take on this dendritic pattern since the spatial distribution of communities with Chacoan structures at the perimeter is generally perpendicular to the angle at which roads approach. One such branch leads from the main Kin Ya'a road to the Muddy Water community. A similar pattern occurs where the South road branches to connect the El Rito, San Mateo, and Kin Nizhoni outlier communities (Figure 1).

The Central Canyon's Place in Regional Settlement

The convergence of major roads at Chaco Canyon suggests a hierarchical system of regional dimensions. The position of Chaco Canyon with respect to the outlying communities appears to replicate at a higher level the centralized settlement pattern of individual communities.

Table 28 Road distances vs. airline distances

Road	From	To	Airline Distance (km)	Road Distance (km)	Difference (km)
North Road	Pueblo Alto	Salmon*	70.0	71.5	1.5
West Road	Pueblo Bonito*	Peach Springs	58.0	64.8	6.8
Southwest Road	Pueblo Bonito*	Kin Ya'a	44.7	45.8	1.1
Southeast Road	Una Vida*	El Rito	82.0	93.6	11.6

* – Probable road associated Chacoan structure, but road presently not identifiable within 1 km radius of site.

Besides their centralized position, the high density of the Early Pueblo III Chaco Canyon Chacoan structures, compared to that of the outlying Chacoan structures, suggests that they had to rely extensively on resources located outside the canyon, especially in view of the relatively poor Chaco Canyon resource base.

It is proposed that certain of the Chaco Canyon structures, particularly those associated with entering roads or natural access points to the canyon, can be viewed as intermediate level centers dominant over individual outlying road systems and their associated communities. Primary among these are Penasco Blanco, Pueblo Alto, Pueblo del Arroyo and Una Vida. Chetro Ketl and Pueblo Bonito may comprise an even more important high level in this hierarchy.

It should be pointed out that some Canyon structures, including Casa Chiquita, New Alto, Kin Kletso, Tsin Kletzin, and Wijiji (as indicated by late construction dates and smaller size) may have occupied no higher level than the outliers. They may, in fact, be attendant structures or facilities of the larger Chacoan structures such as Pueblo Alto and Pueblo Bonito. Lekson and Judge (1978) have emphasized the consistent association of the "McElmo" structures with the larger canyon Chacoan structures and have suggested that they may have been specialized ancillary sites.

Central to settlement within Chaco Canyon is the dense cluster of Pueblo Bonito, Chetro Ketl, Pueblo del Arroyo, Pueblo Alto, New Alto, and Kin Kletso, as well as a large number of contemporaneous small house sites situated in the surrounding South Gap and the Casa Rinconada localities. Pueblo Bonito and Chetro Ketl are clearly prominent in size, and presumably in importance.

The criterion of size alone (size data are presented later in this chapter) suggests similar importance for Penasco Blanco and Aztec. Penasco Blanco is not located at the heart of the Chaco Canyon settlement area but is 4.0 km downstream from Pueblo Bonito, while Aztec is located 75 km to the north (Figure 1). Their hierarchical placement is thus difficult to discern -- although both are clearly as important as the intermediate level sites or possibly more so. Pueblo Bonito and Chetro Ketl, however, as the largest structures located at the heart of the regional central place and central also with respect to both intra-canyon road and settlement, may be placed with certainty at the apex of the hierarchical system, perhaps occupying a third and separate high level. The length of time that these two sites occupied positions of pre-eminence is unknown. It is probable that Chaco Canyon was the sole central place of the outlier system until late in the Early Pueblo III interval. The late emergence of prominent northern sites such as Aztec and Salmon, could indicate the development of relatively independent centers thereafter.

As in the relationship between small houses and outlying Chacoan structures, the relationship of intermediate hierarchical level sites in the Canyon, such as Pueblo Alto and Pueblo de Arroyo to high level Pueblo Bonito and Chetro Ketl, is proposed to be one of the subordinance. In the canyon, however, all the Chacoan structures are presumed to be administrative, economic, and ceremonial centers to varying degrees, with responsibilities reflecting their position within the Chacoan system. Evidence of elite residence at these intermediate and high level structures is scant and uncertain, but it is clearly at these sites that evidence of social ranking is most probable.

Finally, several hundred small house sites of the Pueblo II to Early Pueblo III period occur in Chaco Canyon in a dense and continuous distribution throughout the canyon bottom. These sites are spatially proximate to many of the Chacoan structures; but because of their relatively uniform distribution, community cluster areas are not readily apparent and remain to be defined. The critical point here is that many of the canyon Chacoan structures do appear to have associated communities analogous to those with outlying Chacoan structures (Hayes 1981).

Environment and Resource Variability

In considering the spatial distribution and function of outlying Chacoan structures and communities, it is important to gain at least a general understanding of environmental variability and resource distribution within the San Juan Basin. The evidence presented, suggesting that Chaco Canyon was the center of a regional, hierarchical settlement system, leads directly to questions about how the outliers may have functioned in such a system. Previous studies have entertained redistributive exchange as one possibility (e.g., Grebinger 1973; Reed 1979) inasmuch as redistribution is frequently assumed to be a basic characteristic of hierarchically organized social systems (Fried 1967; Service 1962). As outlined by Service (1962, 1975) and others (Sanders and Price 1968), redistribution develops as groups adapting to specific geographic zones with different resources become increasingly specialized and interdependent economically.

Recently questions have been raised regarding not only the role of interdependence based on local specialization, but also concerning the importance of redistribution as the principal mode of exchange in ranked societies (Earle 1977, 1978; Peebles and Kus 1977; Renfrew 1973). Instead it has been suggested that local groups are basically self-sufficient and not specialized subsistence units (Peebles and Kus 1977: 432). Earle (1977:227), on the basis of ethnographically documented Hawaiian chiefdoms, has suggested that redistribution involved only the social elite and existed largely to "finance the political and private activities of an elite population." However, Peebles and Kus (1977: 432-433) stress that "society-wide organizational activity" becomes crucial in providing buffering mechanisms for environmental perturbations and management organization for intersocietal trade and warfare.

Other archaeologists (Athens 1977; Gall and Saxe 1977; Isbell 1978) have developed this latter concept of a larger organizational structure as an ecological response to the vagaries of a fluctuating and uncertain environment. Particularly in a semiarid environment such as the San Juan Basin, fluctuations in energy production, both through time and across the region, are large and to some extent unpredictable (Noy-Meir 1973). Thus a successful region-wide adaptation must provide both temporal averaging or leveling of seasonal and yearly fluctuations (through storage) and spatial averaging of differential production and natural resource availability, either through movement of goods or people.

Judge (1977, 1979) and Schelberg (1979) have recently argued that the outlier system represents such a region-wide ecological adaptation and that an organized system of storage and redistribution with Chaco Canyon at the center was at the crux of the Chacoan development. Toll (1978) has developed a case for an incipient marketplace economy as a critical mechanism in the adaptation. Our objective here is to examine environmental and resource variability within the San Juan Basin. This is attempted by means of an inventory of selected resources and resource zones within economic range of Pueblo II-III outliers.

Resources examined at each Chacoan structure or community with a Chacoan structure include those pertinent to agricultural production (estimated mean annual precipitation; distance to, and quality of, arable land; distance to water), site construction (distance to roofing timber), and fuel (distance to firewood). Documentation of ecological zones present within the economic range of communities with Chacoan structures provides a final, comprehensive means of comparing environmental variability and resource availability. It is not claimed that domesticated foodcrops, roofing timber, or wood fuels were exchanged. Yet by examining their spatial distributions or potential, and by examining overall basin ecological variability, a means of evaluating the need or lack thereof for regional economic integration is provided.

Paleoenvironment

Interpretation of the past environment has long been a concern of researchers in the San Juan Basin. Within Chaco Canyon, Bryan (1925, 1954) provided the first extended discussion of the geomorphology and past environmental conditions of the canyon, though Jackson (1878) and Dodge (in Pepper 1920:22-25) had previously considered the problem of arroyo development. Other important discussions of conditions during the Anasazi occupation include Brand et al. (1937); Douglass (1935); Fisher (1934); Hawley (1934); Judd (1954); Senter (1937); and Vivian and Mathews (1965). More detailed studies during the past decade include reports on palynological and geomorphological evidence by Hall (1975, 1977) and Love (1977b, 1979). In progress are analyses of packrat midden remains by Betancourt and Van Devender (1980) and dendroclimatic reconstructions by Robinson and Rose (1979).

Elsewhere in the San Juan Basin, palynological reconstructions have been offered for the Navajo Reservoir area (Schoenwetter and Eddy 1964) and the Chuska Valley (Schoenwetter 1967, 1970; Schoenwetter and Dittert 1968). Wright et al. (1973) have studied the palynological record of early Holocene vegetation in the Chuska Mountains. Geomorphological evidence of past environment has been reviewed by Eddy (Schoenwetter and Eddy 1964) and Nials (1972) along the San Juan River and by Love (1977a) along the lower Chaco river. Harris (1963, 1967, 1970) has discussed faunal indications of climatic change and Allan (1977) has presented a literature review of climatic data. Also of note is a recent attempt by Euler et al. (1979) to provide a regional correlation of climatic and geologic events for the entire Colorado Plateau.

Beginning with the research by Bryan (1925), Douglass (1935), and Judd (1954) of the National Geographic Society expedition in the 1920s, a general model or scenario of environmental conditions and changes during the Anasazi occupation of Chaco Canyon was proposed and subsequently widely accepted. This viewpoint, supported and supplemented by most of the pre-1970 researchers noted above, holds that conditions during the earlier part of the Anasazi period were generally more favorable than today. Specifically, (1) the Chaco Canyon area was to some extent forested, not only with more pinyon and juniper but with appreciable amounts of ponderosa pine; (2) precipitation values were higher than now; and (3) no arroyo was present, the water table was higher, and surface water was more abundant. At a later interval in the prehistoric occupation, it was suggested that conditions deteriorated markedly, presumably playing a causal role in abandonment. Critical loss of agricultural production, and irrigation and drinking water are thought to have resulted from the formation of a deep arroyo along the main wash with a concommitant lowering of the water table and erosion of irrigable land. The arroyo was the result of drought combined with decreased vegetation cover, increased runoff, and greater erodability. In one of the more recent versions of this model, Vivian (1970a) has followed Schoenwetter and Eddy (1964) in suggesting that a shift from winter to summer precipitation dominance was fundamental in the development of arroyos.

Although this general reconstruction has become widely accepted, more detailed research during the past decade has suggested that many aspects are not accurate. Current information indicates that conditions then were not significantly more mesic than now and that evidence of a catastrophic episode of arroyo formation late in the prehistoric occupation is questionable. The following is a brief account of some of the more recent data which cast doubt upon previously accepted reconstructions.

First, evidence of significantly more extensive ponderosa pine woodlands is minimal at best. Hall's (1977) study of pollen from dated alluvial sediments concludes that ponderosa woodlands have been absent from the Chaco area for nearly 6,000 years, long before the Anasazi occupation began. Wright et al. (1973) also argue, on the basis of higher altitude pollen records, that most of the San Juan Basin lacked ponderosa cover even during late Pleistocene times.

Evidence from prehistoric plant remains is similarly negative. Betancourt and Van Devender (1980) have examined pack rat midden debris throughout the canyon and found essentially no indication of ponderosa during Anasazi times. However, the record does document more extensive pinyon and juniper woodlands that may have been decimated by Anasazi exploration (see also Cully 1977; Struever 1977).

One of the main reasons for suggesting the prehistoric presence of more ponderosa at Chaco has simply been the relative abundance of this species among construction materials (e.g., Vivian and Mathews 1965). Brand succinctly voiced this assumption when he suggested that "it is much more logical to bring the forests of pine and pinyon thirty miles closer from the Continental Divide and the Dutton Plateau than to believe that the prehistoric inhabitants of the Chaco lugged by hand great logs over long distances" (Brand et al. 1937:46). Logical as this supposition may be, the information available now favors the second possibility, that is, that many of the construction timbers in the Chaco Canyon Chacoan structures do appear to have been imported over appreciable distances.

To accept the traditional view of more widespread ponderosa woodlands occurring in the immediate vicinity of Chaco, and diminishing through the course of Anasazi occupation, one would expect the relative frequency of ponderosa beams used in construction there to decrease through time. Such is not the case. Instead, ponderosa makes up only 1% of the dated wood samples from Basketmaker III and Pueblo I sites in the canyon while pinyon and juniper make up over 80% of that total. Douglas fir and white fir, with slightly more mesic requirements than ponderosa, are completely absent. Later, in Pueblo II-III, when population and organizational complexity are at their peak, ponderosa constitutes over half of the more than 800 specimens, while white fir and Douglas fir make up 11%, and pinyon and juniper less than 20% (Bannister 1965; Breternitz 1977; Windes 1977b). Though there are several factors which may have biased the selection of larger, more mesic species during later times (such as the need for longer timber lengths for larger rooms), this shift in species frequency strongly supports the proposition that timbers were procured from greater distances during the height of the Anasazi occupation of the canyon.

Faunal remains from archaeological sites also suggest that conditions were not drastically different from today. Hibben (in Brand et al. 1937) suggested that the presence of the woodland species of Cottontail (*Sylvilagus nuttalli*) at site Bc-50 supported the notion of a prehistoric ponderosa woodland. However, our re-examination of the supposed *S. nuttali* specimens from Bc-50 and Leyit Kin indicates that they are the more common Desert Cottontail (*S. audobonii*). A few *S. nuttalli* individuals may be present in other archaeological deposits but they are rare, as are other possible indicators of woodland habitats (such as Abert's Squirrel, *Sciurus aberti*). In general, the assemblages of animals found in Anasazi sites are quite similar to those presently found in the canyon (Akins 1982; Gillespie 1981).

The contention of many past Chaco researchers that precipitation during at least the first part of the Anasazi occupation was greater than today (e.g., Bryan 1954; Hawley 1934; Judd 1964) is not supported by recent dendroclimatological analyses (Dean and Robinson 1977; Robinson and Rose 1979; Schulman 1956). Instead there appear to be frequent fluctuations throughout the prehistoric occupation with the average values and range of variability about the same as today, or perhaps slightly more arid during some periods. These data show alternating periods of subnormal and above-normal tree growth, but no periods of drastically reduced precipitation.

Robinson and Rose's (1979) dendroclimatic reconstruction is the most detailed, with predictions of seasonal (spring, winter and previous summer) as well as annual precipitation values for each year from 900 - 1960. Their predicted values indicate that different seasons show varying degrees of correlation with each other and with the annual estimated amount. Spring and winter most closely correlate with annual amounts. Summer rainfall is more poorly or negatively correlated with the annual pattern during some time spans, despite the fact that summer precipitation is higher than either spring or winter precipitation. Sellers (1960) notes this same pattern in historic records for the Southwest. Accordingly, periods of below average summer rainfall may show normal or above average annual values, while times of subnormal annual precipitation may have above average summer rainfall. Indeed, this is the case with most of the short drought periods proposed first by Hawley (1934) and Douglass (1935). This has important implications when we are considering prehistoric agriculture for which summer rainfall was most crucial. Thus the periods of drought indicated by analysis of annual tree-ring values (Dean and Robinson 1977), while representing real variability in tree growth, may be in part independent of summer agricultural potential. A better indication of important climatic fluctuation may be gained by examining Robinson and Rose's summer and spring reconstructions (Figures 145 and 146). For example, the most extensive period of below average summer precipitation is in the mid-twelfth century (roughly 1130-1180) that includes one 23-year run during which every year has summer precipitation below the mean. During the same 23 year period, only 10 of the estimated annual amounts are blow the mean.

Precipitation Trends: 900-1300

Following is a brief account of the more conspicuous fluctuations in Robinson and Rose's (1979) reconstructed precipitation values for annual, summer, and spring precipitation for the period 900-1300. Annum are hydrologic years (October to September) while summer is July-August-September, and spring March to June. Graphs of combined values are presented in Figures 145 and 146.

900s. Annual precipitation values during this century are somewhat higher than average but show marked variations. The period from 930 to 970 is above average except for a short subnormal period in the early 950s. Above-normal precipitation also occurs in the 910s and in two short but very high peaks in the late 980s and late 990s. These two are the most marked positive deviations at any time during the 400-year record. The most extensive dry period for this century is in the late 970s and early 980s.

Summer values correlate poorly with the annual reconstruction. After ca. 930 the association is negative with peaks of annual precipitation most often during periods of subnormal summer rainfall. The

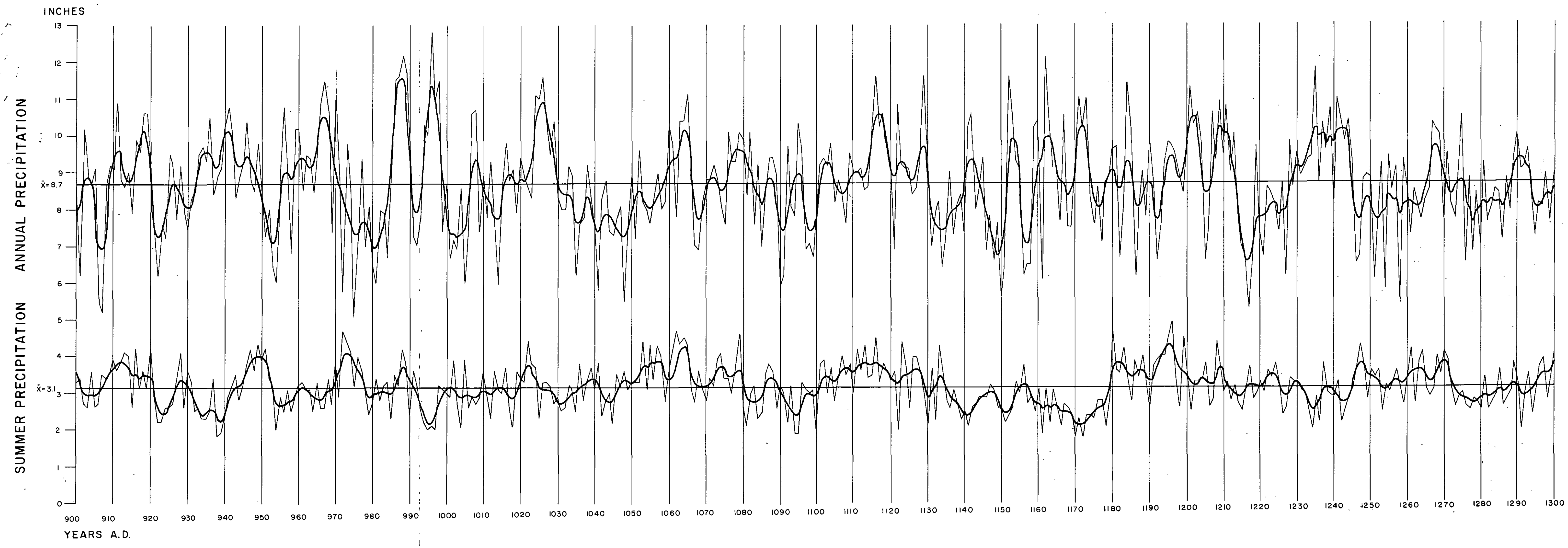


Figure 145. Precipitation chart. Reconstructed precipitation values based on Robinson and Rose's (preliminary report 1979) dendroclimatic data for the Northwest Plateau, New Mexico, A.D. 900-1300. Smoothed curves are 5-year weighted running means. Mean values ($\overline{x}$) are for the 400 year period.

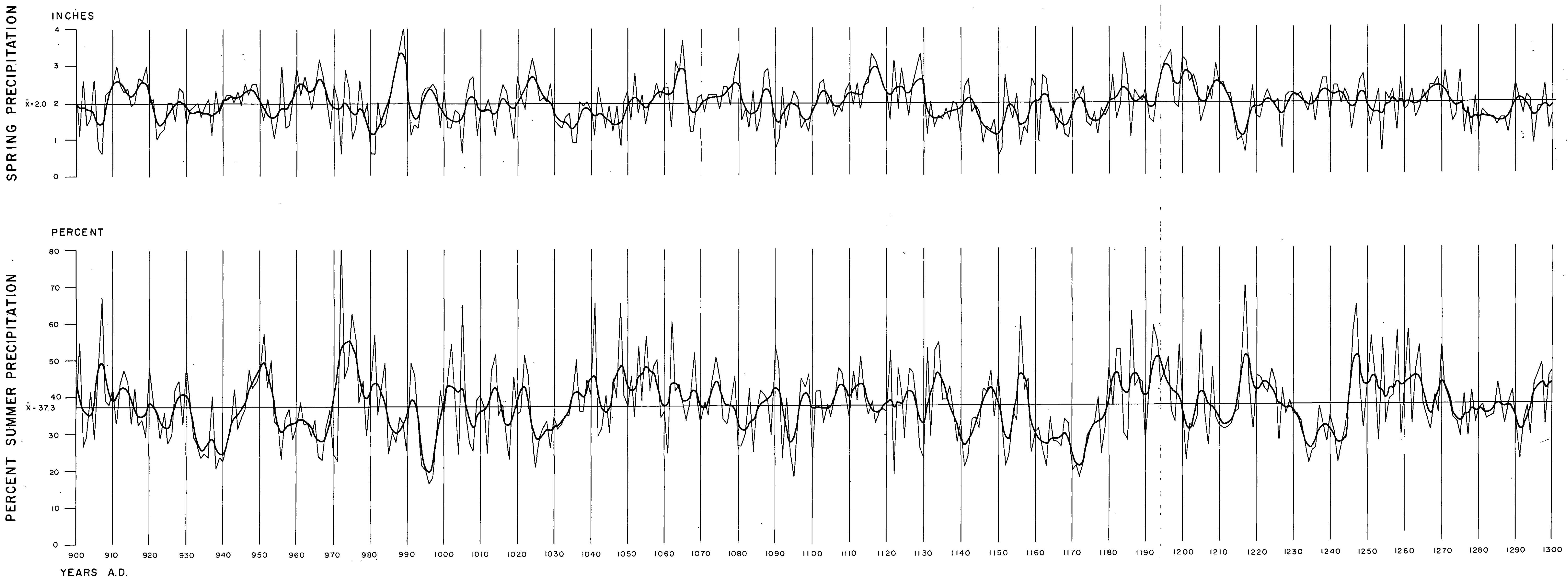


Figure 146. Precipitation chart. Reconstructed precipitation values based on Robinson and Rose's (preliminary report 1979) dendroclimatic data for the Northwest Plateau, New Mexico, A.D. 900-1300. Smoothed curves are 5-year weighted running means. Mean values ($\overline{x}$) are for the 400 year period.

most noticeable runs of above-normal summer precipitation occur in the 910s, from 945-953, and in the 970s. Subnormal conditions are most prominent in the 920s-940s (18 of 22 years below the 400 year mean), the mid-950s to 970, and the mid-990s. The major positive peaks of annual precipitation in the 980s and 990s are not present in the summer precipitation record.

Spring precipitation more closely correlates with the annual totals and shows the same pattern of peaks and troughs. As with the annual record, the 980s peak is the largest in the 400 year period although the 990s wet period is not as prominent.

1000s. Annual totals for the eleventh century are slightly below average. Peaks occur in the 1020s and 1060s, but the period from 1030 to 1060 shows a lengthy span of subnormal precipitation. Summer precipitation is slightly below normal until 1045 but then shows a 34-year span of higher than average rainfall (26 of 34 years above the mean). The biggest drought period in summer rainfall is during the 1090s.

Spring values are again closely correlated with the annual amounts with the same extended subnormal period during mid-century and with peaks in the 1020s and 1060s. All three sets of data show declining values during the 1080s and 1090s, with a minor positive peak in the late 1080s.

1100s. During this century annual precipitation fluctuates markedly with generally above average values before 1130; below average totals in the 1130s, the late 1140s, and the late 1150s; and normal or slightly above normal values for the remainder of the century. In contrast to the frequent fluctuations of the annual record, summer totals show three extended periods of high or low rainfall. As with the annual rainfall, the first three decades are above normal with 23 of the first 29 years above the record mean. However, from the mid-1130s to 1180 is the most extensive drought period recorded by the summer record. From 1135 to 1179, 42 of 45 years are below average including 23 consecutive years from 1157 to 1179. Above-normal summer precipitation is also characteristic of the last two decades and the early 1200s as well. Spring precipitation again is more strongly correlated with the annual pattern but does show the 1130-1180 drought period more clearly than does the annual record.

1200s. Annual values show more definite trends in the 1200s than in preceeding centuries. Precipitation is reconstructed as above normal before 1214, subnormal to 1230 (especially in the late 1210s), then above normal for another 15-year span to 1245. The last half of the century is predominantly subnormal with brief positive peaks in the late 1260s and early 1290s. The short drought period beginning in the mid-1210s shows the strongest negative departure of running mean totals anywhere in the 400 year record.

Summer values do not show the marked trends of the annual record. Values are near normal for the first 45 years, are slightly above normal through the early 1270s, and somewhat subnormal from 1272 to 1295 (roughly the Great Drought formerly thought so important in Mesa Verde prehistory). Departures from the mean are smaller during this century than in preceding ones.

The spring reconstruction also shows above-normal conditions at the beginning of the century and, as with the annual totals, shows conspicuous low values in the 1210s. Values are near normal through the mid-century before recording subnormal conditions in the last three decades.

Community Economic Range

The term economic range is applied here in the sense of a catchment area -- the area within which natural resources are regularly procured by the Chacoan structure or community. Some measure of the economic range of a community is clearly fundamental to our understanding of the outlier system. By definition, resources outside of this range would be utilized minimally, unless obtained indirectly from other groups through exchange.

Catchment studies of early Neolithic agricultural sites at Mt. Carmel, Palestine, by Vita-Finzi and Higgs (1970), and of Formative villages in Oaxaca, Mexico, by Flannery (1976) suggest limits of 5 km for the distance traveled to agricultural fields. Both are influenced by Chisholm's (1979) study of modern European peasant agriculture. He concluded that at a distance of 1 km "the decline in net return is large enough to be significant as a factor adversely affecting the prosperity of the farming population," and "at about 3-4 km, the costs of operation rise sufficiently to be oppressive and seriously detrimental" (Chisholm 1979:61).

These studies also recognize the effect of such factors as topography, climate, and population density which may increase or decrease distances traveled. Such factors greatly increase the distances traveled in the Southwest, with 10-13 km (6-8 miles) distances between village and fields not unusual for the Hopi and Pima (Castetter and Bell 1942:126; Hack 1942:28). In such cases, fieldhouses are usually constructed and are occupied continuously or sporadically throughout the growing season, substantially lessening the amount of travel energy expenditure. Given the environmental similarities of the San Juan Basin and the Hopi country, it is probable that the Anasazi traveled such distances to their fields.

The distances traveled for wild plant, animal, and mineral resources are generally thought to be much greater. Flannery (1976), using the Formative village data base in Oaxaca, suggested a 10-15 km radius for hunting and gathering. Lee (1968) derived a radius of approximately 10 km as the range of !Kung Bushmen groups on one day forays. During the dry season longer treks of 16 to 20 km were made, often with establishment of a temporary camp in the distant area. In the case of the San Juan Basin Anasazi, however, the distances traveled to wild resources may not have been much greater than distances to agricultural fields, although hunting and gathering trips may have extended beyond 10 km, particularly if the itinerary allowed a stopover at a fieldhouse or camp intermediate between the objective and the permanent residence.

While there is no desire to imply close cultural similarities between the Anasazi and the diverse cultural systems from which the economic range radii have been drawn, these examples do serve to provide initial guidelines that may be compared with the 5-8.5 km ranges based on Chacoan structure distribution. Given that some community overlap in usage of peripheral areas may have occurred and that Chacoan structure distribution alone is not an adequate basis to define economic range, it is suggested that there is a 10 km range for agriculture and a similar 10 km range for hunting and gathering. It is anticipated that future investigations will be able to refine these range estimates considerably.

It is our intent to examine selected resources of the community as a whole since it is clearly not possible to examine the economic zones of each individual site. Thus only the economic ranges of outlying Chacoan structures have been documented with the assumption that the economic range of the Chacoan structure is essentially coterminus with that of the high density area and with large portions of the ranges of sites within 1-2 km of the Chacoan structure. The following section discusses the availability of a variety of resources, including precipitation, water, arable land, wood, and ecological zones, within the economic ranges of the Chacoan communities.

Precipitation

Most of the Chaco Basin, the northern tributaries of the San Juan River, the Great Sage Plain, and the Rio Puerco East, Rio San Jose, and Rio Puerco West drainages are classified as semiarid, with mean annual precipitation less than 305 mm (12 in). As noted by Noy-Meir (1973, 1974), this relative scarcity of water is the dominant controlling factor in the ecosystem. All organisms, including man, must cope not only with its scarcity, but also its largely unpredictable variability in both time and space. In such a situation, biological production in both animals and plants, including cultigens, is closely correlated with moisture. Accordingly, the quantity of potential food resources for human populations is directly related to the availability of water.

One of the more predictable aspects of precipitation in this area is the close correlation between elevation and mean annual precipitation (see Hodges 1974). Other factors, such as rain shadows, are so minor that elevation can be considered an accurate indicator of mean annual amounts (though great year-to-year variability must be kept in mind). Applying a modified version of Hodges' correlation (see chapter 1) to the elevations at Chaco structures yields the estimates presented in Table 29.

These estimates should be seen as only general approximations. Rainfall at sites in the Great Sage Plain in southwestern Colorado is estimated to range from 330 to 391 mm (13.0 to 15.4 in) while actual precipitation reaches a low of about 178 mm (7.0 in) per annum in the vicinity of Shiprock, New Mexico. Throughout the interior of the Chaco Basin, values are moderately higher, as exemplified by Chaco Canyon with an actual precipitation mean of approximately 218 mm (8.6 in) (U.S. Climatological Data for New Mexico). Around the southern edge of the Chaco basin and southward to the Red Mesa Valley (upper Rio San Jose and Rio Puerco West), the estimated, as well as actual, means are comparable or slightly higher (211-290 mm, 8.3-11.4 in). Mountain values (500 mm) are equalled or approached only by lower mountain slope communities such as Chimney Rock (498 mm, 19.6 in) and El Rito (310 mm, 12.2 in).

These average values, of course, do not reflect variability of annual rainfall amounts. For example, at Chaco Canyon annual totals since 1950 have ranged from 85 mm (3.35 in) to 350 mm (13.75 in) with only 12 of the 29 years above the mean for that period (209 mm, 8.2 in). On shorter time scales the variability is even greater. Sellers (1960) notes that coefficients of variation for winter precipitation at weather stations in Arizona and New Mexico range from 34 to 65, while summer coefficients range between 29 and 59. For any given month the variability is greater. Again in Chaco Canyon, June rainfall since 1950 ranges from 0 to 38 mm (1.5 in) with a mean of 10 mm (.4 in) and a standard deviation of 11. In other words the coefficient of variation is greater than 100. Comparable variability is characteristic throughout the San Juan Basin.

As noted above, moisture amounts are critical for agriculture as well as other forms of primary production. The precipitation values are low enough that dryland production of maize is virtually impossible at all but a few parts of the basin. Hack (1942) and Carter (1945) suggest that something on the order of 305 mm (12.0 in) of annual precipitation is the lower limit of dryland farming in the northern Southwest (though the critical factor is summer moisture rather than annual amount). As a result nearly all of the farming done within the San Juan Basin at outlier localities would have required supplementary moisture of some variety, either by locating fields where runoff naturally concentrates water from a larger drainage area or by physically diverting water to fields. The one exception may have been sand dune agriculture where subsurface water retention allows "dry farming" where precipitation would otherwise be inadequate (Hack 1942). However, precipitation is somewhat lower in most of the Chaco Basin than at the Hopi dune fields described by Hack, perhaps low enough to minimize reliance on dune agriculture. Further, the presence of substantive dune areas in the vicinity of only a few outliers (e.g. Bis sa'ani, Grey Hill Springs, Peach Springs) suggests that their contributive role was minor.

Table 29 Agriculture related variables at Chacoan structures by time period

Chacoan structure	Soil association	Irrigability rating C1	C2	C3	C4	C6	Distance to Arable land (m)	Elev. (m)	Est. Mean[1] Annual Precip. (mm)	Dist. to Water (km)	Source
Early Pueblo II											
Kin Bineola	Rockland-Billings (Billings)	-	-	17%	13%	70%	.2	1844	211	.4	Kin Bineola W. (E)
Wallace	Not classified	-	-	-	-	-	On site	1896	330	.1	Simon Draw (E)
Sterling	Werlow-Fruitland Turley	30%	36%	14%	10%	10%	On site	1615	201	.2 .1	San Juan R. (P) Stewart Canyon (E)
Skunk Springs	Werlow-Fruitland Turley	30%	36%	14%	10%	10%	.3	1780	165	.8	Skunk Springs (E)
Peach Springs	Hagerman-Travesilla	-	4%	5%	43%	48%	.2	1865	211	.1 .4	Peach Springs (P) Wild Berry W. (E)
El Rito	Lohmiller-San Mateo	15%	29%	25%	18%	13%	.5	2231	310**	.5	El Rito Creek (P)
Guadalupe	Christianburg Clays	No rating					.2	1841	259**	.3 .4	Canon Tapia (E) Canon Salado (E)
Mean							.2	1867	241	.3	
Std. Dev.							.2	185	61	.2	
Early Pueblo II Chaco Canyon Chacoan structures											
Penasco Blanco	Rockland-Billings	-	-	17%	13%	70%	.3	1908	224	.3 .8	Chaco Wash (E) Unnamed trib. (E)
Pueblo Bonito	Rockland-Billings	-	-	17%	13%	70%	On site	1865	216	.2 .1	Chaco Wash (E) Unnamed trib. (E)
Chetro Ketl*	Rockland-Billings	-	-	17%	13%	70%	On site	1871	216	.3 .3	Chaco Wash (E) Unnamed trib. (E)
Hungo Pavi*	Rockland-Billings	-	-	17%	13%	70%	On site	1884	218	.3 .7	Chaco Wash (E) Unnamed trib. (E)
Una Vida	Rockland-Billings	-	-	17%	13%	70%	On site	1890	221	.1 .5	Chaco Wash (E) Unnamed trib. (E)
Mean							.1	1912	219	.4	
Std. Dev.							.1	18	3	.2	
Late Pueblo II											
Hogback	Rockland-Badland	-	2%	-	-	98%	.2	1554	185	.2 .6	Chaco Wash (E) Chinde Wash (E)
Upper Kin Klizhin	Persayo-Camborthid (Billings)	-	4%	4%	11%	81%	.5	1932	229	.5	Kin Klizhin W. (E)
Standing Rock	Lohmiller-San Mateo	15%	29%	25%	18%	13%	.7	1914	223*	.7	Standing Rock Wash (E)
Dalton Pass	Hagerman-Travesilla (Lohmiller?)	-	4%	5%	43%	48%	.3	2073	251	.3	Dalton Pass (E)
Kin Ya'a	Hagerman-Travesilla (Lohmiller)	-	4%	5%	43%	48%	.5	2066	251	.5	Unnamed trib. (E)
Muddy Water	Lohmiller-San Mateo	15%	29%	25%	18%	13%	.3	2057	249	.3	Unnamed trib. of Indian Creek (E)
Casamero	Moriarty-Prewitt	-	15%	37%	36%	12%	.3	2112	264	.3	Casamero Draw
Allantown	No classification	-	-	-	-	-	.3	1890	295**	.1 .6 .4	Unnamed wash (E) Whitewater Dr. (E) Unnamed spring (P)
Pueblo Pintado	Persayo-Lohmiller (Lohmiller)	-	26%	6%	8%	60%	1.0	1987	239	.3 1.0	Chaco Wash (E) Unnamed trib. (E)
Mean							.45	1945	243	.45	
Std. Dev.							.25	169	30	.2	
Late Pueblo II Chaco Canyon Chacoan structures											
Pueblo Alto	Rockland-Billings	-	-	17%	13%	70%	1.0	1963	234	1.0 1.0	Cly Can. seep (E) Chaco Wash (E)
Early Pueblo III											
Lowry	No classification	-	-	-	-	-	On site	2048	361**	.8 .6	N. and S. forks of Cow Canyon (E)
Escalante	No classification	-	-	-	-	-	.2	2195	391**	.2	Dolores River (P)
Ida Jean	No classification	-	-	-	-	-	.5	1917	335	.2 .4	Unnamed Wash (E) Simon Draw (E)
Chimney Rock	No classification	-	-	-	-	-	2.0	2316	498	1.3 2.0 3.0	Devil Creek (P) Stollsteimer C (P) Piedra River (P)
Site 41	Werlow-Fruitland-Turley	30%	36%	14%	10%	10%	.2	1826	239	.1 .4	La Plata (P) Dawson Arroyo (E)
Site 39	Werlow-Fruitland-Turley	30%	36%	14%	10%	10%	.1	1707	213	.4 .2	La Plata (P) Barker Arroyo (E)
Salmon	Werlow-Fruitland-Turley	30%	36%	14%	10%	10%	On site	1652	236	.4 .2 .8	San Juan River (P) Unnamed trib. W(E) Kutz Canyon (E)
Aztec West	Werlow-Fruitland-Turley	30%	36%	14%	10%	10%	On site	1720	244	.4 1.0 .8	Animas River (P) Farmer Arroyo (E) Estes Arroyo (E)
Twin Angels	Rockland-Badland	-	2%	-	-	98%	.1	1817	218	.1	Kutz Canyon (E)
Halfway House	Doak-Shiprock	-	60%	20%	5%	15%	.7	2012	218	.7 2.4	Unnam. trib. W (E) Gallegos Wash (E)
Pierre's	Turley-Badland	-	45%	-	3%	52%	.4	1981	213	.4	Trib. wash of Coal Creek (E)
Grey Hill Springs	Billings-Jocity	21%	27%	34%	8%	10%	.2	1753	160	.4	Coyote Wash (E)
Bee Burrow	Lohmiller-San Mateo	15%	29%	25%	18%	13%	.4	1951	206	.7	Seven Lakes Wash (E)
Greenlee	Persayo-Billings (Billings)	-	11%	22%	3%	64%	.5	1945	231	.5	Trib. of Fajada Wash (E)
Kin Klizhin	Persayo-Rockland (Billings, Woodrow or Christianburg)	-	4%	4%	12%	80%	.3	1853	213	.3	Kin Klizhin Wash (E)
Bis sa'ani	Turley-Badland	-	45%	-	3%	52%	.1	1960	234	.1	Escavada W. (E)
Haystack	Penistaja-Valent-Palma (Penistaja)	9%	45%	20%	11%	15%	.3	2127	290	.5	Unnamed wash (E)
Village of the Great Kivas	Lohmiller-San Mateo	15%	29%	25%	18%	13%	.1	2073	312	.2 .1	Nutria Canyon (E) Red Paint Cyn. (E)
Houck	No classification	-	-	-	-	-	.4	1835	284**	.4 .7	Black Creek (E) Rio Puerco W. (E)
Mean							.3	1929	268	.6	
Std. Dev.							.45	174	81	.7	
Early Pueblo III Chaco Canyon Chacoan structures											
Casa Chiquita	Rockland-Billings	-	-	17%	13%	70%	On site	1865	216	.1 .2	Clys Canyon (E) Chaco Wash (E)
Kin Kletso	Rockland-Billings	-	-	17%	13%	70%	On site	1865	216	.1	Chaco Wash (E)
New Alto	Rockland-Billings	-	-	17%	13%	70%	1.0	1963	234	.7 1.1	Clys Cyn. seep (E) Chaco Wash, (E)
Pueblo del Arroyo	Rockland-Billings	-	-	17%	13%	70%	On site	1859	213	.1 .3	Chaco Wash (E) Unnamed trib. of Chaco Wash (E)
Tsin Kletsin	Rockland-Billings	-	-	17%	13%	70%	1.5	2030	249	2.2 1.5	Chaco Wash (E) Werito's Rin. (E)
Wijiji	Rockland-Billings	-	-	17%	13%	70%	On site	1896	221	.2 1.0	Chaco Wash (E) Unnamed trib. of Chaco Wash (E)
Mean							.4	1913	225	.7	
Std. Dev.							.7	69	14	.7	

* - Occupation during Early Pueblo II is conjectural

** - Estimate is questionable or less accurate due to substantial distance to nearest weather station, substantial elevation difference between site and weather station, or shortness (>15 years) of weather station record.

1 - Mean annual precipitation data used to calculate estimated site values are from selected weather stations as reported in Gablin and Esperance (1977), Sellars (1973) and U.S. Department of Commerce Climatological Data for Colorado, 1978. Weather station records utilized range in length from 7 to 56 years.

Symbols
E = Ephemeral
P = Perennial

Water Resources

The San Juan River and its northern tributaries, the Piedra, Animas, La Plata and Mancos Rivers, are the major perennial water sources in the San Juan Basin. The only other large perennial water source is the Dolores River, at the northern limit of the basin. All of these are capable of providing large amounts of water for agricultural purposes and, in some instances, were exploited prehistorically, such as the elaborate system seen at Aztec. The small perennial streams present at Chimney Rock and El Rito were undoubtedly used for irrigation.

Within the Chaco Basin the only permanent water is found in the upper portions of a few small streams that drain the eastern slope of the Chuskas. Here flow is maintained by springs and seeps issuing from the lower contact of the Chuska sandstone, an important aquifer (Cooley et al. 1969). However, all of these small drainages become ephemeral before leaving the wooded slopes of the Chuskas, a dozen kilometers short of the alluvial flatlands around which the major Chuska Valley Anasazi communities are clustered.

Flowing springs are similarly rare in the Chaco Basin. Gregory (1916) noted several along the eastern foot of the Chuskas (Mexican Springs, Skunk Springs) and a few more near the base of Lobo Mesa. Peach Springs is one of these, but it is uncertain how productive this water source was prior to drilling done in recent times to improve its flow. Other small seeps occur in the basin, but none are large enough to have contributed water for agricultural purposes. Yucca House is the only outlier considered here that appears to have been actually built around a spring (Aztec Spring), although it is now dry. Shallow ground water in the alluvium of ephemeral stream beds may have been important at some locations, either for domestic use or, conceivably, pot irrigation. However, Cooley et al. (1969) suggest that only the largest of the ephemeral drainages, such as the Chaco River, are characterized by available shallow water.

For most agricultural production in the Chaco Basin and the eastern and southern river valleys, basic akchin and floodwater irrigation techniques must be relied on (Hack 1942; Judd 1954). This is supported by the generally short (.1-3.0 km) distances from outlying Chacoan structures to floodwater sources shown in Table 29. Although a positive association between communities and floodwater sources is assumed here, we did not test to determine if random points in the San Juan Basin show a negative correlation.

While variability in precipitation has been emphasized, drainage size and gradient, soil permeability and water quality are additional factors affecting the amount and effectiveness of floodwater. Although drainage areas above outlying communities have not been calculated, substantial differences in drainage size and in the location of communities within the drainage basin indicate major differences in the amount of runoff available to field areas. Soils in the vicinity of Lewis Shale, Kirtland-Fruitland and Menefee Formations of the eastern Chaco Basin (including Hunters, Alamo, Coal, De-na-zin, Escavada, Chaco, and Fajada Wash areas) are fine-grained and tend to have a low permeability because of large portions of shale-clay (including montmorillonite clay) sediments (Love 1977a). Even in portions of these drainages where shales and clays are less common, lower stream gradients cause depositon of very fine sediments, thereby lowering permeability. In contrast, soils around the edge of the basin are not only formed from different geological formations, but tend to have higher proportions of coarser sediments as a result of higher gradients. The sandier, coarser sediments in these localities are more premeable, allowing moisture to be more effectively absorbed for plant use.

The drainages along the northern edge of Lobo Mesa and the eastern edge of the Chuska Mountains seem to be especially favorable for akchin or simple floodwater farming because the majority of water and sediments are borne only to the edge of the mesas, where the washes then spread to wide, moist alluvial deposits. For example, Wild Berry Wash, the main affluent of the Peach Springs locality, heads at over 2134 m (7,000 ft) at the southern edge of Lobo Mesa, cuts into a narrow sandstone and shale canyon 100 m or more in depth, and then exits from the mesa, spreading over a large alluvial flat. Within 1 km of the mesa no discrete drainage is distinguishable.

Another important aspect of runoff is the chemical composition of soils. Analyses of surface and shallow ground water in the eastern Chaco Basin indicate high salinity and alkalinity for some areas (Maker et al. 1973). For example in Chaco Canyon, soils tested by Judd (1954) were found to be almost impervious due to black alkali, a mixture of sodium carbonate and bicarbonate. As Judd argues, it is difficult to produce a crop if water cannot penetrate the soils.

Soils in other portions of the basin are also somewhat saline or alkaline, but are generally better suited for agriculture (Maker et al. 1973).

Arable Land

The Soil Conservation Service land classes defined earlier rate the productivity of soils for irrigation agriculture based on soil texture, effective soil depth, water holding capacity, salinity, premeability, erosion, surface smoothness, slope, internal soil drainage, and surface drainage (Maker, Bullock and Anderson 1974). A factor not considered, however, is the availability of water for irrigation.

These ratings are based on a relatively limited amount of detailed field work and soil testing, and are intended for use in classifying land relative to its potential for modern agro-business, not prehistoric agriculture. The area included within a single soil association often consists of several hundred thousand acres, while the area farmed by a single Anasazi community within the association probably consisted of a few hundred acres at most. Thus while the percentages of land classes for the entire association could accurately reflect those within a 10 km radius of the Chacoan structure, it is extremely doubtful that they do. We assume instead that the Chacoan structure communities are situated immediately adjacent to the best lands.

Further, prehistoric subsistence farming presumably involved considerably lower crop yields than modern profit farming. As such Class 3 and 4 lands (for example, the Chaco Canyon alluvial bottomlands which were probably farmed intensively over several hundred years [Judd 1954, 1959; Vivian 1972]) would have "moderate to very severe limitations for sustained use under irrigation" according to the Soil Conservation Service.

With the exception of areas not covered by S.C.S. reports (Colorado and Arizona), the soil associations and class ratings shown in Table 29 represent those soils which appear to have the most potential for agriculture. The relatively short .0-.20 km an distances from Chacoan structures to soils of these associations are assumed to be indicative of the primary importance of agriculture to Anasazi subsistence and of the need to locate fields where they can be closely monitored. Reluctance to locate fields beyond these minimal distances might stem from the transportation energy expenditure involved, problems in protecting fields from varmits and pests, and, most importantly, inability to manipulate thundershower runoff (unless fieldhouses were used).

Examination of Table 29 from Early Pueblo II to Early Pueblo III time intervals shows that virtually all outliers within or to the south of the Chaco Basin occur in associations that have Class 1 and 2 lands, although only about half of the outliers are within associations that have substantial percentages (>4%) of Class 1 and 2 lands. To the north, all five of the Chacoan structures in or adjacent to the San Juan River and its tributary perennial river valleys have associations with high percentages (66%) of Class 1 and 2 soils. Regionwide only one outlier, Kin Bineola, is in an association which lacks Class 1 and 2 soils. In contrast, all of the Chaco Canyon Chacoan structures are within the Rockland-Billings association which also lacks Class 1 and 2 soils.

To be most useful, the land-class ratings must be limited to defining only the most general differences. From such an overall perspective, the valley bottom soils of the San Juan River Valley and its perennial tributaries, the Chuska Valley, and drainages along the northern and southern perimeters of the Lobo Mesa, appear to have higher agricultural potential as indicated by the high proportions of Class 1 and 2 soils in these associations. Lands of lesser agricultural potential (exclusively Classes 3, 4 and 6) are generally limited to the Chaco Canyon area, the central portions of the Chaco Basin, and the Moncisco Plateau (northeastern Chaco Basin).

Although the data just presented do establish a framework of variability in the San Juan Basin and allow identification of areas that may on the average have been more productive, we stress again that variability in precipitation could have overridden soil and hydrological factors. In any given year lack of precipitation may have been responsible for failure of crops in a high potential area, while crops on poorer soils in another portion of the basin may have survived.

Wood Resources

Wood resources examined here are limited to small and large conifers. Use of other arboreal species was constrained by their relatively restricted distribution and limited numbers. In comparison, conifers are relatively numerous in the San Juan Basin and surrounding areas. Further, they are admirably suited for use as fuel and construction materials.

The small conifers, pinyon (P. edulis) and juniper (J. monosperma), are presumed to have been important fuels although they may not have comprised the dominant fuelwood species. Analyses of charcoal remains from Chaco Canyon hearths at six Chaco Canyon sites (Pueblo Alto, Una Vida, 29SJ627, 29SJ628, 29SJ629 and 29SJ633) indicate that chenopodiaceous shrubs (Sarcobatus vermiculatus and Atriplex canescens) comprise the majority of fuel materials (52%), while juniper (19%), pinyon (13.5%), and sagebrush (5%) account for lesser percentages (identifications by Stanley L. Welsh of Endangered Plant Studies, Inc., 1979). Both small and large conifers were used in construction, primarily as roofing materials. Large conifers are found especially in Chacoan structures, both in Chaco Canyon and at outlying sites (Bannister 1965).

The physical distribution of conifers within the San Juan Basin is constrained primarily by precipitation, soils, and elevation. Currently these factors effectively limit large conifers to upland topography, and this is probably a relatively accurate reflection of their spatial distribution for the last 6,000 years. However, if patterns in Chaco Canyon are representative of changes throughout the San Juan Basin, pinyon and juniper have probably retreated both in spatial distribution and elevation, as a result of intensive exploitation by the Anasazi (Betancourt and Van Devender 1980). Some re-establishment undoubtedly occurred from the fourteenth century into early historic times, but the demise of the Chaco ponderosa in the first quarter of this century (Judd 1954:2-3) would suggest conifers to be retreating again.

Pinyon and juniper occur throughout the San Juan Basin at elevations of approximately 1,675 to 2,440 m, although within the Chaco Basin they are rarely found below 1,830 m. In general, pinyon and juniper ring the edges of the basin, with woodlands occurring on mesas and mountain slopes. The communities of pinyon and juniper on and near Chacra Mesa are the only major intrusions of conifers into the basin interior. Both to the north and south of the basin the distribution of small conifers is considerably more ubiquituous.

At about 2,135 m elevation, moist conditions at the heads of some north-facing canyons and rincons allow the appearance of ponderosa pine (Pinus ponderosa) and Douglas fir (Psuedostuga taxifolia) (Harris 1963, 1967). These stands are limited to canyon heads or other favorable areas of small size. Ponderosa are documented at even lower elevations (ca. 1,980 m) in the Alamo - De-na-zin Wash areas and in upper Chaco Canyon; but the trees in these small groups are stunted and of little economic value (Vivian 1970-71:unpublished notes, Chaco Archive 2110).

On Mt. Taylor, ponderosa appear at about 2,285 m (Osborn 1962), and range to about 3,050 m on dry, southern exposures. Douglas fir becomes common at about 2,620-2,680 m on more mesic north slopes. Similar general elevational occurrences are indicated for the Chuska Mountains (Wright et al. 1973), although the precise elevations at which given species are present vary substantially according to exposure, air currents and available moisure. Interestingly, white fir (Abies concolor), which occurs as roofing timber at Salmon, Pierre's and in Chaco Canyon, is not documented either on Mt. Taylor or in the Chuskas (Osborn 1962, Wright et al. 1973). It does occur in the La Plata Mountains of Colorado, however (Petersen and Mehringer 1976:280).

Small Conifers. As shown in Table 30, it is clear that most outlier communities were not located actually within woodland areas. Mean distances from outliers to small conifer areas are moderate, ranging from 5.8 km in Early Pueblo II to 2.7 km in Early Pueblo III. Assuming maximizing of resources (Gumerman 1971; Euler and Gumerman 1978), these locations may reflect conscious selection for these woodland resources, but may also indicate the primary importance of site location at slightly lower elevations, directly adjacent to lowland agricultural areas.

A breakdown of distances shows that 24 of the Chacoan structure communities are within 4 km, while 11 are 4 km or more from small conifer woodlands. At least two other outlying communities (Pierre's and Bee Burrow) and all of the Chaco Canyon structures actually belong to this latter group. After initial occupation, the sparse wood resources nearby would have been exhausted, necessitating procurement from distances greater than 4 km. Distances of 20-30 km are more realistic for Pierre's and Bee Burrow, and up to 15 km for the Chaco Canyon Chacoan structures. As the carbonized fragments from Chaco Canyon hearths indicate, use of woody shrubs for fuel was dominant. In view of the increasing scarcity of small conifers, the possibility that firewood was imported into the canyon and other central basin locations must be seriously considered.

Large Conifers. The distances to large conifers utilized (ponderosa, Douglas fir, white fir) are generally further than those to small conifers because of the limitation of the former to higher elevations. Mean distances for all sites, shown in Table 30, vary from 20.3 km in Early Pueblo II to 17.4 km in Early Pueblo III. However, if the central Chaco Basin communities are viewed separately, distances are even further, ranging from 15 km to 40 km.

Both sets of averages probably are conservative estimates since source areas such as Chacra Mesa and the Alamo - De-na-zin Wash could not have contributed more than a very minor percentage of the total timber used. Exhaustion of each of these resource areas would have

Table 30 Distances from Chacoan structures to wood resources by time period

Chacoan structure	Dist. to small conifers (km)	Location	Dist. to large conifers (km)	Location
		Early Pueblo II		
Wallace	1.0	Mesa slopes to N, E & W	15+	Lost Canyon Cr. drainage
Sterling	2.5	Mesa south of site	40+	La Plata Mts., Gobernador Cyn.
Kin Bineola	25.0	Chacra Mesa	40	Chacra Mesa ?, Lobo Mesa
Skunk Springs	6.0	Chuska Mts.	16+	Chuska Mts.
Peach Springs	2.0	Lobo Mesa	8+	Lobo Mesa
El Rito	On site	La Jara Mesa	8+	Mt. Taylor
Guadalupe	4.0	Rio Puerco Valley slopes	15+	Mesa Chivato
Mean	5.8		20.3	
Std. Dev.	8.7		13.9	
		Early Pueblo II Chaco Canyon Chacoan Structures		
Penasco Blanco	3.0**	West Mesa	40**	Chacra Mesa ?
Pueblo Bonito*	1.5**	South Mesa	35**	Chacra Mesa ?
Chetro Ketl*	1.5**	South Mesa	34**	Chacra Mesa ?
Hungo Pavi	1.5**	South Mesa	32**	Chacra Mesa ?
Una Vida	2.0**	South Mesa	30**	Chacra Mesa ?
Mean	1.9		34.2	
Std. Dev.	.6		3.8	
		Late Pueblo II		
Hogback	10.0	San Juan River	45+	Carrizo Mt.
Upper Kin Klizhin	12.0	Chacra Mesa	15–30**	Chacra Mesa
Pueblo Pintado	2.0	Chacra Mesa	8+**	Chacra Mesa
Standing Rock	7.0	Lobo Mesa	15+	Lobo Mesa
Kin Ya'a	2.0	Lobo Mesa	8	Lobo Mesa
Dalton Pass	1.0	Lobo Mesa	8+	Lobo Mesa
Muddy Water	4.0	Lobo Mesa	8+	Lobo Mesa
Casamero	.1	Lobo Mesa	10	Lobo Mesa
Allantown	On site	Surround. mesa	25–30	Manuelito Plat.
Mean	4.2		16.9	
Std. Dev.	4.4		12.7	
		Late Pueblo II Chaco Canyon Chacoan Structure		
Pueblo Alto	2.5**	South Mesa	35+**	Chacra Mesa

Chacoan structure	Dist. to small conifers (km)	Location	Dist. to large conifers (km)	Location
		Early Pueblo III		
Lowry	Off site	Surrounding	?**	Cross Canyon
Escalante	Off site	Surrounding	?**	House Creek
Ida Jean	Off site	Surrounding	15+	Lost Canyon
Chimney Rock	.3	Mesa slopes	.3	Mesa slopes
Site 41	.5–1.0	Mesas E and W	15+	Barker Dome
Site 39	1.0	Mesas E and W	15+	Barker Dome
				Gobernador Canyon
Aztec	1.5	Mesas E and W	30+	" " "
Salmon	2.0	Mesas to north	30+	" " "
Twin Angels	.1	Mesa to west	30+**	Alamo-De-na-zin Washes
Halfway House	.1	Mesa slopes to south and east	15**	" " "
Pierre's	.5**	Mesa to N	15**	" " "
Bis sa'ani	8.0	Mesas to N and E	15–25**	Chacra Mesa
Greenlee	7.0	Chacra Mesa	15–25**	Chacra Mesa
Bee Burrow	.5–2**	Mesa slopes to north and south	25–30	Lobo Mesa
Kin Klizhin	8.0	South Mesa	30+**	Chacra Mesa, Alamo-De-na-zin
Grey Hill Springs	20.0	Chuska Mts.	25–30+	Chuska Mts.
Haystack	.5	Mesa Montosa	3+	Mesa Montosa
Houck	1.0	Mesas to north	15+	Defiance Plat.
Village of the Great Kivas	.1	Mesas to northeast	3–8	Zuni Mts.
Mean	2.7		17.4	
Std. Dev.	5.0		9.7	
		Early Pueblo III Chaco Canyon Chacoan Structures		
Casa Chiquita	2.0**	West Mesa	35+**	Chacra Mesa
Kin Kletso	2.0**	West Mesa	35+**	Chacra Mesa
New Alto	3.0**	West Mesa	35+**	Chacra Mesa
Pueblo del Arroyo	2.0**	South Mesa	35+**	Chacra Mesa
Kin Kletsin	.5**	South Mesa	35+**	Chacra Mesa
Wijiji	.6**	Chacra Mesa	25+**	Chacra Mesa
Mean	1.7		33	
Std. Dev.	1.0		4.1	

* - occupation during period conjectural.
** - indicates number of modern trees at given distance is low and would be inadequate for extended exploration.
Note: Where a distance range (i.e., 25–30 km) is given, the mean and standard deviation have been calculated using the shortest distance.

been very quick, particularly those near Chaco Canyon. Evidence of high mountain origins for many of the Chaco Canyon timbers includes complacent rings, indicating continuously wet growth conditions (Judd 1954:3), and admixture of Douglas fir and white fir with the ponderosa (Bannister 1965). Mt. Taylor and the Chuskas seem to be logical sources since they are nearest (75 and 90 km respectively), but the apparent absence of white fir in the mixed conifer communities there suggests other sources as well. The distribution of white fir at northern sites (Salmon, Pierre's) raises the possibility that it was being brought south to these sites and to Chaco Canyon from the La Platas, a maximum distance of 140 km.

Ecological Zones

A final means of examining environmental variability within the San Juan Basin is provided by documenting ecological zones within the 10 km economic range of outlier communities. It is assumed that the more ecological diversity present, the greater the number of potential resources and adaptive options open to the community (Judge et al. 1981; Plog and Hill 1971; Reher and Witter 1977). In actuality this is not always true since some zones may be of little economic value.

The ecological zones, presented here are modified from Witter (1977:186). They are defined primarily on the basis of vegetative, topographic, soil, and altitudinal characteristics. The zones include the Riparian woodland/marsh; the Sand dune grass/shrub, and the Desert plains grass/shrubland zones of the lowlands; the Desert badland, Piedmont plateau grass/shrubland, and Pinyon-juniper woodland zones of the plateaus; and the Ponderosa pine and Sub-alpine forest zones of the mountains. Witter's description should be consulted for more detailed discussion of actual species included in each zone.

Ecological zones on site, and at 1, 5, and 10 km distances are recorded in Table 31 by temporal period. The mean number of ecological zones within 10 km of outliers shows virtually no change over time, but substantial variability in the number of zones exists between outliers (Table 32). The outliers with the fewest ecological zones are within the central Chaco Basin, where plains grass/shrub, plateau grass/shrub, and desert badland zones are the major ones present within economic range of the sites (Table 33). Communities at the peripheries of the Chaco Basin and in major valleys to the south and east are more diverse with plains grass/shrub, plateau grass/shrub, pinyon-juniper woodland, and ponderosa forest zones represented at the majority (Table 33). Communities with Chacoan structures along the San Juan River and its northern tributaries have the highest actual zonal diversity, with riparian woodland, plains grass/shrub, plateau grass/shrub, pinyon-juniper woodland and ponderosa forest zones represented at five or more sites. Although apparently higher, the zonal diversity recorded for the Chaco Canyon area sites (Table 33) is reduced to about two *effective* zones when one considers the very minor land area that the dune grass/shrub and desert badland zones comprise, and the probability that one zone (pinyon-juniper woodland) had been severely over-exploited by Pueblo II.

Table 31 Ecological zones within 10 km of Chacoan structures by time period

Chacoan structure	On site	1 km	5 km	10 km
		Early Pueblo II		
Wallace	Plateau grass/shrub Riparian wood	Pinon-juniper wood	-	Ponderosa forest
Sterling	Riparian wood Plains grass/shrub	-	Plateau grass/shrub Desert badland	-
Kin Bineola	Plains grass/shrub	-	-	Desert badland*
Skunk Springs	Plateau grass/shrub	Plains grass/shrub	-	Pinon-juniper wood*
Peach Springs	Plains grass/shrub	Dune grass/shrub	Plateau grass/shrub Pinon-juniper wood	-
El Rito	Plains grass/shrub Pinon-juniper wood	Ponderosa forest	Sub-alpine forest	-
Guadalupe	Plateau grass/shrub	Plains grass/shrub	Pinon-juniper wood	Ponderosa forest
		Early Pueblo II Chaco Canyon Chacoan Structures		
Penasco Blanco	Plateau grass/shrub	Dune grass/shrub Plains grass/shrub	Desert badland	-
Pueblo Bonito	Plains grass/shrub	Plateau grass/shrub	-	Desert badland Pinon-juniper wood Dune grass/shrub
Chetro Ketl**	Plains grass/shrub	Plateau grass/shrub	-	Desert badland Pinon-juniper wood Dune grass/shrub
Hungo Pavi**	Plains grass/shrub	Plateau grass/shrub	Pinon-juniper wood	Dune grass/shrub Desert badland
Una Vida	Plains grass/shrub	Plateau grass/shrub	Pinon-juniper wood	Dune grass/shrub
		Late Pueblo II		
Upper Kin Klizhin	Plains grass/shrub	-	-	Plateau grass/shrub
Hogback	Plains grass/shrub	-	Desert badland	Plateau grass/shrub*
Standing Rock	Plains grass/shrub	Dune grass/shrub	-	Pinon-juniper wood
Pueblo Pintado	Plateau grass/shrub	Plains grass/shrub	Pinon-juniper wood	Ponderosa forest Desert badland?
Kin Ya'a	Plains grass/shrub	Plateau grass/shrub	Pinon-juniper wood	Ponderosa forest*
Dalton Pass	Plains grass/shrub	Plateau grass/shrub	Pinon-juniper wood	Ponderosa forest
Muddy Water	Plains grass/shrub	-	Plateau grass/shrub Pinon-juniper wood	Ponderosa forest
Casamero	Plains grass/shrub Plateau grass/shrub	Pinon-juniper wood	-	Ponderosa forest
Allantown	Pinon-juniper wood	Plains grass/shrub	-	Ponderosa forest
		Late Pueblo II Chaco Canyon Chacoan Structues		
Pueblo Alto	Plateau grass/shrub	Plains grass/shrub	Dune grass/shrub	Desert badland Pinon-juniper wood
		Early Pueblo III		
Lowry	Pinon-juniper wood	Plateau grass/shrub Riparian wood	-	-
Escalante	Pinon-juniper wood	Plateau grass/shrub Riparian wood	-	Ponderosa forest?
Ida Jean	Pinon-juniper wood	Plateau grass/shrub Riparian wood	-	Ponderosa forest?
Chimney Rock	Pinon-juniper wood	Ponderosa forest	Riparian wood Plateau grass/shrub	-
Site 41	Plateau grass/shrub	Plains grass/shrub Riparian wood Pinon-juniper wood	-	Ponderosa forest?
Site 39	Plateau grass/shrub	Riparian wood Plains grass/shrub	Pinon-juniper wood	-
Aztec	Plains grass/shrub Riparian wood	Plateau grass/shrub	-	Pinon-juniper wood
Salmon	Plains grass/shrub Riparian wood	-	Plateau grass/shrub -	Pinon-juniper wood Desert badland
Twin Angels	Desert badland	Plateau grass/shrub Plains grass/shrub	-	-
Halfway House	Plateau grass/shrub	-	Desert badland	Pinon-juniper wood
Pierre's	Desert badland Plains grass/shrub	Plateau grass/shrub	-	-
Bis sa'ani	Desert badland Dune grass/shrub Plains grass/shrub	Plateau grass/shrub	-	Pinon-juniper wood
Greenlee	Plains grass/shrub	-	-	Pinon-juniper wood
Kin Klizhin	Plains grass/shrub	-	Desert badland	Plateau grass/shrub*
Bee Burrow	Plains grass/shrub	Plateau grass/shrub		*
Grey Hill Springs	Dune grass/shrub Plains grass/shrub	-	-	-
Haystack	Plateau grass/shrub	Plains grass/shrub	Pinon-juniper wood Volcanic badland	Ponderosa forest
Village of the Great Kivas	Plains grass/shrub	Pinon-juniper wood	Ponderosa forest	-
Houck	Plains grass/shrub	Pinon-juniper wood	-	Ponderosa forest
		Early Pueblo III Chaco Canyon Chacoan Structures		
Casa Chiquita	Plains grass/shrub	Plateau grass/shrub	Dune grass/shrub	Desert badland Pinon-juniper wood
Kin Kletso	Plains grass/shrub	Plateau grass/shrub	Dune grass/shrub	Desert badland Pinon-juniper wood
New Alto	Plateau grss/shrub	Plains grass/shrub	Dune grass/shrub	Desert badland Pinon-juniper wood
Pueblo del Arroyo	Plains grass/shrub	Plateau grass/shrub	Dune grass/shrub	Desert badland Pinon-juniper wood
Tsin Kletsin	Plateau grass/shrub	-	Plains grass/shrub	Desert badland Dune grass/shrub Pinon-juniper wood
Wijiji	Plains grass/shrub	Pinon-juniper wood Plateau grass/shrub	-	Desert badland Dune grass/shrub

* - Dune grass/shrub not known, but possibly present
** - Occupation during period conjectural

Table 32 Ecological zone frequency at Chacoan structures

Chacoan structure	On-site			1 km			5 km			10 km			Totals			Total
	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	
							Early Pueblo II									
Wallace	1	1	-	-	1	-	-	-	-	-	-	1	1	2	1	4
Sterling	2	-	-	-	-	-	-	2	-	-	-	-	2	2	-	4
Kin Bineola	1	-	-	-	-	-	-	-	-	-	1	-	1	1	-	2
Skunk Springs	-	1	-	1	-	-	-	-	-	-	1	-	1	2	-	3
Peach Springs	1	-	-	1	-	-	-	2	-	-	-	-	2	2	-	4
El Rito	1	1	-	-	-	1	-	-	1	-	-	-	1	1	2	4
Guadalupe	-	1	-	1	-	-	-	1	-	-	-	1	1	2	1	4
Totals	6	4	-	3	1	1	-	5	1	-	2	2	9	12	4	25
Mean													1.3	1.7	1.6	3.6
Std. Dev.													.5	.5	.8	.8
							Early Pueblo II Chaco Canyon Chacoan Structures									
Penasco Blanco	-	1	-	2	-	-	-	1	-	-	-	-	2	2	-	4
Pueblo Bonito	1	-	-	-	1	-	-	-	-	1	2	-	2	3	-	5
Chetro Ketl	1	-	-	-	1	-	-	-	-	1	2	-	2	3	-	5
Hungo Pavi	1	-	-	-	1	-	-	1	-	1	1	-	2	3	-	5
Una Vida	1	-	-	-	1	-	-	1	-	1	-	-	2	2	-	4
Totals	4	1	-	2	4	-	-	3	-	4	5	-	10	13	-	23
Mean													2	2.6	-	4.6
Std. Dev.													0	.55	-	.55
Total Mean																4.0
Std. Dev.																.85
							Late Pueblo II									
Upper Kin Klizhin	1	-	-	-	-	-	-	-	-	-	1	-	1	1	-	2
Hogback	1	-	-	-	-	-	-	1	-	-	1	-	1	2	-	3
Pueblo Pintado	-	1	-	1	-	-	-	1	-	-	1	1	1	3	1	5
Standing Rock	1	-	-	1	-	-	-	-	-	-	1	-	2	1	-	3
Kin Ya'a	1	-	-	-	1	-	-	1	-	-	-	1	1	2	1	4
Dalton Pass	1	-	-	-	1	-	-	1	-	-	-	1	1	2	1	4
Muddy Water	1	-	-	-	-	-	-	2	-	-	-	1	1	2	1	4
Casamero	1	1	-	-	1	-	-	-	-	-	-	1	1	2	1	4
Allantown	-	1	-	1	-	-	-	-	-	-	-	1	1	1	1	3
Totals	7	3	-	3	3	-	-	6	-	-	4	6	10	16	6	32
Mean													1.1	1.8	.7	3.6
Std. Dev.													.3	.7	.5	.9

Table 32 Continued

Chacoan structure	On-site L	On-site P	On-site M	1 km L	1 km P	1 km M	5 km L	5 km P	5 km M	10 km L	10 km P	10 km M	Totals L	Totals P	Totals M	Total
Late Pueblo II Chaco Canyon Chacoan Structures																
Pueblo Alto	-	1	-	1	-	-	1	-	-	-	2	-	2	3	-	5
Totals	-	1	-	1	-	-	1	-	-	-	2	-	2	3	-	5
Mean													2	3	-	5
Total mean																3.7
Std. Dev.																.95
Early Pueblo III																
Lowry	-	1	-	1	1	-	-	-	-	-	-	-	1	2	-	3
Escalante	-	1	-	1	1	-	-	-	-	-	-	1	1	2	1	4
Ida Jean	-	1	-	1	1	-	-	-	-	-	-	1	1	2	1	4
Chimney Rock	-	1	-	-	-	1	1	1	-	-	-	-	1	2	1	4
Site 41	-	1	-	2	1	-	-	-	-	-	-	1	2	2	1	5
Site 39	-	1	-	2	-	-	-	1	-	-	-	-	2	2	-	4
Aztec	2	-	-	-	1	-	-	-	-	-	1	-	2	2	-	4
Salmon	2	-	-	-	-	-	-	1	-	-	2	-	2	3	-	5
Twin Angels	-	1	-	1	1	-	-	-	-	-	-	-	1	2	-	3
Halfway House	-	1	-	-	-	-	-	1	-	-	1	-	-	3	-	3
Pierre's Site	1	1	-	-	1	-	-	-	-	-	-	-	1	2	-	3
Bis sa'ani	2	1	-	-	1	-	-	-	-	-	1	-	2	3	-	5
Bee Burrow	1	-	-	-	1	-	-	-	-	-	-	-	1	1	-	2
Greenlee	1	-	-	-	-	-	-	-	-	-	1	-	1	1	-	2
Kin Klizhin	1	-	-	-	-	-	-	1	-	-	1	-	1	2	-	3
Grey Hill Springs	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
Haystack	-	1	-	1	-	-	1	1	-	-	-	1	2	2	1	5
Village of the Great Kivas	1	-	-	-	1	-	-	-	1	-	-	-	1	1	1	3
Houck	1	-	-	-	1	-	-	-	-	-	-	1	1	1	1	3
Totals	14	11	-	9	11	1	2	6	1	-	7	5	25	35	7	67
Mean													1.3	1.8	.4	3.5
Std. Dev.													.6	.8	.5	1.0
Early Pueblo III Chaco Canyon Chacoan Structures																
Casa Chiquita	1	-	-	-	1	-	1	-	-	-	2	-	2	3	-	5
Kin Kletso	1	-	-	-	1	-	1	-	-	-	2	-	2	3	-	5
New Alto	-	1	-	1	-	-	1	-	-	-	2	-	2	3	-	5
Pueblo del Arroyo	1	-	-	-	1	-	1	-	-	-	2	-	2	3	-	5
Tsin Kletsin	-	1	-	-	-	-	1	-	-	1	2	-	2	3	-	5
Wijiji	1	-	-	-	2	-	-	-	-	1	2	-	2	3	-	5
Totals	4	2	-	1	5	-	5	-	-	2	11	-	12	18	-	30
Mean													2	3	-	5
Std. Dev.													0	0	-	0

L - Lowland zones (Riparian woodland/marsh, Sand dune grass/shrub, Desert plains grass/shrub).
P - Plateau zones (Desert badland, Piedmont plateau grass/shrub, Pinon-juniper woodland).
M - Mountain zones (Ponderosa pine, Sub-alpine forest).

Table 33 Ecological zone representation by sub-regional area

Area	Riparian	Plains Grass	Dune Grass	Plateau Grass	Desert Badland	Pinon-Juniper	Pond Forest	Sub-alpine	Other	Mean No. of zones per site	Std. Dev.
Central Chaco Basin (10 sites)	–	90%	10%	70%	60%	20%	–	–	–	2.5	.5
	–	9	1	7	6	2	–	–	–		
Chaco Basin peripheries and southern valleys (13 sites)	–	100%	15%	62%	–	100%	77%	8%	8%	3.7	.6
	–	13	2	8	–	13	10	1	1		
Chaco Canyon (14 sites)	–	100%	93%	100%	93%	93%	7%	–	–	4.8	.4
	–	14	13	14	13	13	1	–	–		
Northern San Juan Basin (10 sites)	100%	50%	–	100%	20%	90%	50%	–	–	4.1	.6
	10	5	–	10	2	9	5	–	–		

Central Chaco Basin Sites	Chaco Basin Peripheries and southern valleys	Chaco Canyon	Northern San Juan Basin
Kin Bineola	Skunk Springs	Penasco Blanco	Wallace
Hogback	Peach Springs	Pueblo Bonito	Lowry
Twin Angels	Kin Ya'a	Chetro Ketl	Escalante
Halfway House	El Rito	Hungo Pavi	Ida Jean
Pierre's	Guadalupe	Una Vida	Chimney Rock
Grey Hill Springs	Standing Rock	Pueblo Alto	Site 41
Bee Burrow	Dalton Pass	Casa Chiquita	Site 39
Upper Kin Klizhin	Muddy Water	Kin Kletso	Sterling
Greenlee	Casamero	New Alto	Salmon
Kin Klizhin	Allantown	Pueblo del Arroyo	Aztec West
	Village of the Great Kivas	Tsin Kletsin	
	Haystack	Wijiji	
	Houck	Bis sa'ani	
		Pueblo Pintado	

Slightly over half (56%) of all ecological zones occur within one km of the outlier community economic range (Table 34). Two or more ecological zones occur within 1 km of 82% of all Chacoan structures (Table 35). Six of the eight Chacoan structures that are not situated within 1 km of a zone change are located within the central Chaco Basin (Table 35). Zones most frequently represented within 1 km are plains grass/shrub, plateau grass/shrub, riparian, and pinyon-juniper woodland. Unsurprisingly, the plains and plateau grass/shrub lands are the most ubiquituous, while the riparian and pinyon-juniper woodland zones are more limited to specific sub-regional areas (Tables 33, 34).

From 1 to 5 km, few new ecological zones are encountered, with a correspondingly low number of zone changes (Tables 34 and 35). Between 5 and 10 km, however, a greater number of new ecological zones are encountered with a correspondingly greater number of zone changes. The most frequent new zones are pinyon-juniper woodland and ponderosa pine forest reflecting higher altitudes, desert badland, and dune grass/shrub. The majority of the new pinyon juniper woodlands occur at Chaco Canyon and other central basin locations.

Selection for plains grass/shrub, plateau grass/shrub and riparian zones may reflect their use not only as agricultural areas and sources of irrigation water, but also for floral and faunal exploitation. The plains grass/shrub land was undoubtedly relied upon as a collecting area for seasonal wild seed crops and as a hunting area for rabbits, prairie dogs, and antelope. Riparian zones had value as sources of more mesic plant species, and as entrapment areas for large mammals. The plateau grass/shrub land and the pinyon-juniper woodland zones are transitional between lowland and mountain zones, with many species of plants and mammals characteristic of each. Pinyon, juniper, yucca, and opuntia were no doubt important economic plants, while important faunal resources included rabbit, mule deer, and elk (Fry and Hall 1975; Nickens 1977:65).

Selection of agricultural areas at the edge of plateau grass/shrub and pinyon-juniper woodland zones would be advantageous because of the optimal temperature and rainfall conditions. Although rainfall is almost certainly superior at higher elevations, and temperature conditions superior at lower ones, the combination of the two is best at woodland elevations (Plog 1978:66). The pinyon-juniper woodland, then, would seem to be a very important economic zone, and its absence near some outliers may be seen as a reflection of increasing population density and the necessity of utilizing less than ideal environments.

From the ponderosa/pine forest zone, the importance of large conifers for construction material has already been discussed. Shrubs, herbs, and grasses were undoubtedly also collected for food, medicinal, and ceremonial purposes. Hunting was probably one of the more important economic aspects of this zone, although communities at the foot of mountain areas may have waited for turkey, mule deer, elk, and mountain sheep to move into lower elevations in the fall (Ford 1968). Exploitation of lithic materials (Washington Pass chert and yellow-brown chert) occurring within mountain zones is an empirical fact and is discussed later in this chapter.

Table 34 Ecological zone representations by distance and sub-regional area

	Central Chaco Basin (10 sites)	Chaco Basin periphery and southern valleys (13 sites)	Chaco Canyon area (14 sites)	Northern San Juan Basin (10 sites)	Total	%
On-site 1 km						
Riparian	-	-	-	9	9	9
Plains	9	13	13	5	40	39
Dune	1	2	2	-	5	5
Plateau	4	6	14	7	31	30
Badland	2	-	1	-	3	3
Pin-jun.	-	5	1	6	12	12
Ponderosa	-	1	-	1	2	2
Sub-alpine	-	-	-	-	-	-
Total	16	27	31	28	102	100
				Percent of all zones		56
5 km.						
Riparian	-	-	-	1	1	3
Plains	-	-	1	-	1	3
Dune	-	-	5	-	5	17
Plateau	-	2	-	3	5	17
Badland	3	-	1	1	5	17
Pin-jun.	-	6	3	1	10	33
Ponderosa	-	1	-	-	1	3
Sub-alpine	-	1	-	-	1	3
Other	-	1	-	-	1	3
Total	3	11	10	6	30	99
				Percent of all zones		16.5
10 km						
Riparian	-	-	-	-	-	-
Plains	-	-	-	-	-	-
Dune	-	-	6	-	6	12
Plateau	3	-	-	-	3	6
Badland	1	-	11	1	13	26
Pin-jun.	2	2	9	2	15	30
Ponderosa	-	8	1	4	13	26
Sub-alpine	-	-	-	-	-	-
Total	6	10	27	7	50	100
				Percent of all zones		27.5
Grand Total	25	48	68	41	182	100

Table 35 Sub-regional ecological zone frequency by distance

	Central Chaco Basin (10 sites)	Chaco Basin periphery and southern valleys (13 sites)	Chaco Canyon area (14 sites)	Northern San Juan Basin (10 sites)	Total	%
On-site/1 km No. of zones						
1	6	1	1	-	8	17
2	2	10	10	3	25	53
3	2	2	2	6	12	25
4	-	-	1	1	2	4
Total	10	13	14	10	47	99
5 km No. of zones						
1	3	5	10	2	20	80
2	-	3	-	2	5	20
3	-	-	-	-	-	-
4	-	-	-	-	-	-
Total	3	8	10	4	25	100
10 km No. of zones						
1	6	10	2	6	24	69
2	-	-	8	-	8	23
3	-	-	3	-	3	9
4	-	-	-	-	-	-
Total	6	10	13	6	35	101

Of probable lesser economic importance are the dune grass/shrub and desert badlands. While the former has substantial potential as both a plant-gathering area (seed crops and herbs) and agricultural zone (Reher and Witter 1977) its spatial extent is limited. Although undoubtedly relevant to the survival of some Chaco Basin communities, its overall importance was probably less than that of other zones. Perhaps of least importance from an overall perspective is the badland desert, with relatively little to offer in floral or faunal resources. Its primary economic importance was probably as a source of lithic materials and pottery clay (Warren 1976, 1977).

In summary, the 10 km economic ranges of communities with Chacoan structures vary significantly in ecological zone diversity. Areas of greatest zonal diversity are believed to have been more capable of supporting major prehistoric population concentrations. These are found around the peripheries of the Chaco Basin, in major valleys to the south and east (Rio Puerco East, Rio Puerco West, Rio San Jose), and in the northern San Juan River, and Great Sage Plain areas. In contrast, the Chaco Canyon and central Chaco Basin areas, as indicated by lesser zonal diversity, do not appear to have been as well suited ecologically to support Anasazi populations.

Discussion

From the preceeding, it is apparent that the physical and biotic environment of outliers is quite variable. Substantive variability between communities in precipitation, water availability, soil quality, availability of small and large conifers, and overall ecologic diversity have been documented.

Although only a limited number of environmental variables have been examined, they provide an initial basis for postulating differences in the capability of San Juan Basin environments to support prehistoric Anasazi populations. While differences are discernible on a site by site level, an overall, more generalized approach appears to have the most explanatory value since many variables correlate with major sub-regional geographic areas. Precipitation conforms least to this scheme since annual rainfall is highly variable -- though mean annual rainfall generally correlates with altitude.

Based on the higher mean annual rainfall, superior water and soil quality, proximity to conifer resources, and higher effective ecologic diversity, environments of outliers around the peripheries of the Chaco Basin are seen to be the best suited to support concentrated populations. In contrast, central Chaco Basin environments do not appear to be as well suited, as indicated by slightly less mean annual rainfall (critical within the semiarid San Juan Basin), poorer quality soils, greater distances to conifers, and less effective ecologic diversity. Outliers located within the central Chaco Basin would have been closer to resources available in the plains grass/shrubland zone, yet the relatively greater agricultural richness and environmental diversity within the economic ranges of other communities would have more than compensated for this. Many important floral and faunal resources of the plains grass/shrub land also occur in other zones present in the northern area.

These general environmental differences appear to have some explanatory potential with regard to region-wide settlement patterns, in that they establish a possible need for resource exchange (Gall and Saxe 1977; Isbell 1978; Service 1962, 1975). If the Chaco Basin peripheries, southern valley locations, and Northern San Juan Basin environments were more favorable, communities should have been established in these areas first. Settlement system data appear to support this expectation since the majority of Early Pueblo II/Late Pueblo II outlier communities are located around the Chaco Basin peripheries or in similarly suitable environments to the north and south of the Chaco Basin.

Given this, the early presence of several major Chacoan structures within Chaco Canyon, followed by continued population growth and the appearance of more Chacoan structures through early Pueblo III, appears contrary to the predicted settlement location strategy. This suggests that the Chaco population was supported economically not only by the canyon environment, but as the center of a regional community and road system its economic range actually extended throughout the San Juan Basin via intercommunity exchange. Road linkage between central basin and widely separated peripheral areas suggests that canyon residents were attempting to maximize the variability present in the higher diversity outlying areas.

Resources that may have been exchanged between the canyon and the outliers include agricultural food crops, firewood, animal products (especially bone, hides, dried meat), and wild plant products (wild seeds, yucca fiber, basketry materials, pinyon nuts, herbs). Lithic and ceramic materials definitely were exchanged, as discussed below, and it is probable that materials derived from sources outside the San Juan Basin such as cotton, salt and turquoise were also. Because of the large size of conifer timbers and cutting requirements specific to the buildings in which they were to be incorporated, it is doubtful that they were obtained by exchange. Rather, they were probably obtained by groups sent out to procure roofing material for specific structures.

The relatively poor environment of Chaco Canyon is perhaps the best clue to understanding Chaco's rise to a position of pre-eminence within the regional system. Stress in the San Juan Basin, as the result of resource scarcity, population growth, unpredictable crop yields and the inability to counter these effects by migration or exchange with immediately adjacent areas (Judge 1979; Schelberg 1979; Toll 1978), probably would have affected Chaco Canyon communities first. This would be due to the lack of effective environemntal diversity in Chaco Canyon, the environmental homogeneity of other central basin areas, and the greater distance to basin periphery areas (cf. Rathje 1971). A shift to redistributive exchange, allowing direct acquisition of substantial volumes of resources not available within the central basin, may have been the most viable of several options. The mechanisms and evolution of such a system of exchange are still unclear, particularly the means of leverage used by Chaco to stimulate formal exchange with the peripheral communities that would have had little to gain in return.

One possibility, given the early architectural expertise of Canyon residents, is that the outlying Chacoan structures and great kivas were constructed by Chaco labor crews in exchange for foodstuffs and resources over a several-year period. The collected goods would have subsidized the part-time specialists, provided for canyon needs, and perhaps allowed some re-investment to other areas affected by climatic perturbations. Once such a relationship was established with several outlying areas, the diversity of contacts and exchange goods controlled by Chaco may have resulted in its emergence as a trade center, possibly with the eventual appearance of incipient marketplaces (Toll 1978). Initial management of construction labor and inter-community exchange by a few individuals residing in the Chaco Canyon Chacoan structures could have resulted in the emergence of a controlling elite who capitalized upon resource deficiencies and climatic perturbations to indebt their local labor and goods-producing populations. Through calculated strengthening of their own positions, perpetuation and growth of the system was enabled, eventually resulting in a ranked and seemingly complex society.

While redistribution may have been a primary cause in spawning this type of system, it would be erroneous to suggest that redistribution was the only means of system integration. Political and ceremonial spheres of influence were undoubtedly of importance and may initially have provided the ties that allowed the initiation of redistribution. Future investigations will have to probe these aspects in depth.

Outlier Site Type Variability and Morphology

Throughout the San Juan Basin, Anasazi sites comprising the outlying communities of the Pueblo II and Early Pueblo III periods display a great deal of variability in size, shape and architecture. Mounds over 4 m high, containing the remains of multistoried structures, often with large enclosed plazas and great kivas, have floor areas amounting to thousands of square meters. At the other end of the size continuum are sites consisting of no more than a single room, feature, or scatter of cultural debris that encompass only a few square meters. In the following discussion a more quantified approach to site size variability within and between Chacoan structures and small houses is attempted.

Previous investigations of small houses associated with outliers have provided a basic understanding of their morphological and architectural variability, and only a brief discussion will be presented here. The primary concern will be with small house size in relation to the size of Chacoan structures.

Chacoan structures or "towns" (as Vivian and Mathews 1965, and Vivian 1970a, 1970b have referred to them) have also been discussed in terms of their morphology and architecture, but only from the perspective of the Chaco Canyon Chacoan structures or individual outliers (Eddy 1977; Morris 1928; Pippin 1979; Roberts 1932, 1939; Vivian 1970a, 1970b; Vivian and Mathews 1965). With the exception of the recent work by Marshall et al. (1979), no comparative data on a region-wide sample of Chacoan structures have been provided. Both the latter study and this one indicate that the Chacoan structure or town site type should be expanded to include an entire range of more moderate sized, and even small structures. The purpose of the ensuing discussion is to redefine, in part, the morphology and architecture of this site type, in addition to presenting data on variability in size. The latter is utilized as the basis for postulating a hierarchy of Chacoan structures throughout the San Juan Basin and surrounding areas.

Small Houses

A complete discussion of small-house morphological and architectural variability over the entire area encompassed by outliers is beyond present means. For relatively detailed treatment of village morphology and architecture north of the San Juan River, the reader is referred to Martin (1929, 1930) for the Lowry area, to Reed (1979) for the Dominguez Ruin (a small house site associated with Escalante), to Eddy (1977), Roberts (1930), and Truell (1975) for the Chimney Rock vicinity, and to Morris (1939) for the San Juan-Animas-La Plata River areas.

South of the San Juan, in the Chaco Basin, small houses are described by Cassidy and Bullard (1956), Marshall and Chapman (1972), Reher (1977), Sciscenti and Greminger (1962), and Wendorf and Lehmer (1956). Within Chaco Canyon specifically Bradley (1971), Brand et al. (1937), Dutton (1938), Kluckhohn and Reiter (1939), Maxon (1963), Truell (1979, 1980), Vivian (1970a, 1970b), Vivian and Mathews (1965), and Windes (1976a, 1976b, 1976c, 1978b) have documented small house sites in varying detail.

To the southeast, south and southwest of the Chaco Basin, Gladwin (1945), Olson and Wasley (1956), and Smith (1964) have discussed small house archaeology of the upper San Jose and Rio Puerco West drainages. Farther west along the Rio Puerco West, between Zuni and Holbrook, Gumerman and Olson (1968), Roberts (1931, 1939) and Wasley (1960) have described these sites.

The survey information data on villages presented here in chapters 2, 3, and 4 does not alter significantly published conceptions of village morphology and architecture. As such, the description of small house morphology presented in chapter 1 is considered adequate for present purposes.

Small House Size Range

Table 36 attempts to quantify the sizes of small house architectural areas (including the house mound and plaza area with known kivas) at a large number of outliers. With the exception of the three commun-

Table 36 Small house size variables

Community/ Site No.	Estimated Site Area (m^2)	Estimated Mound Height[1] (m)	Estimated No. of Stories	Estimated No. of Rooms[2]	Estimated No. of 2nd Story Rooms	Estimated No. of Kivas	Estimated Time Periods
Site 41							
Bldg. V	260	1.0+	1	27	-	1	PI-LPIII
Bldg. VIII	245	1.5	1?	32	1?	2+	EPIII-LPIII
Bldg. XII	259	1.5	1	3+	-	?	PII-EPIII
Bldg. XIII	150	1.3	1	5+	-	?	EPIII-LPIII
Chimney Rock							
5AA86	227	1.75	1	7	-	0	EPII-EPIII
5AA92	226	.75-1.0	1	7	-	0	EPII-EPIII
Escalante							
Dominguez	89	.75	1	4	-	1	EPIII
Lowry							
Unit 1	321	.25-.50	1	11	-	3	EPIII
Unit 3	374	.50-.75	1	21	-	4	EPIII
Pierre's							
P-1	70	.50	1	7	-	0	EPIII
P-3	105	.50	1	7	-	1?	EPIII
P-4	65	.50	1	4	-	1?	EPIII
P-5	100	.25-.50	2?	4+	1?	0	EPIII
P-8	180	.25	1	?	-	2	EPIII
P-9	115	.50-.75	1	5	-	0	LPII-EPIII
P-10	95	.25-.50	1	10?	-	0	LPII-EPIII
P-12 Unit A	80	.25-.50	1	4	-	1?	EPIII
P-12 Unit B	25	.25	1	1-2	-	?	EPIII
P-13	145	.50	1	7	-	1?	LPII-EPIII
P-15	70	.50	1	10?	-	0	EPIII
P-16	105	.50	1	4	-	1?	EPIII
Bis sa'ani							
B-16	80	.25-.50	1	5?	-	1?	LPII-EPIII
B-20	35	1.0	1	5?	-	1	EPIII
B-23	80	.50-.75	1	3-5?	-	?	EPIII
B-25	25	.25-.50	1	3-5?	-	?	EPIII
B-27	30	.25	1	4-6?	-	?	EPIII
B-28	65	.50	1	7	-	?	EPIII
B-29	-	.50	1	5-10	-	?	LPII-EPIII
Pueblo Pintado							
29Mc139	246	1.2	2?	21	7?	2	PII-PIII
29Mc163 Unit A	252	2.0	2?	19	5?	1	PI-PIII
29Mc163 Unit B	488	2.0	2?	20	2?	2?	PI-PIII
29Mc164	528	1.0	1	3-5+	-	2	LPII-LPIII
29Mc167	77	1.0	1	2-3	-	1	PI-PIII
29Mc175	239	1.0	1	14	-	2	PII-PIII
Bee Burrow							
LA13803	106	-	1	8	-	1	LPII-EPIII
BB-7	50	-	1	6	-	?	EPIII
BB-10	134	-	1	8	-	?	EPIII
BB-13	360	-	2?	22	?	1?	LPII-LPIII
BB-16	324	-	1?	24	?	?	LPII-EPIII
BB-21	48	-	1	5	-	?	EPIII
BB-24	256	-	1	15	-	?	EPIII
BB-25	144	-	1	9	-	?	EPIII
BB-29	45	-	1	3	-	?	LPII-EPIII
BB-43	252	-	1	16	-	?	LPII-EPIII
BB-47	140	-	1	11	-	?	LPII-EPIII
Kin Ya'a							
29Mc111	210	1.0	1	12	-	1	PI,LPII-EPIII
29MC119	93	-	1	6+	-	?	PI-PIII
29Mc128	70+	-	1	6	-	?	PI-EPIII
29Mc141	46+	.5	1	3-4	-	1	PI-EPIII
29Mc142	88+	.25	1	7+	-	1	PII-PIII
29Mc144	72+	.35	1	2-3	-	?	PII-PIII
29Mc146	84	.50	1	2+	-	1	PI-PIII
29Mc156	27+	.50	1	4+	-	?	PI-PIII
29Mc157	55	2.5	1	8+	-	1	PI-PIII
Muddy Water							
MW-2	324	.75	1	15	-	1	LPII-EPIII
MW-4	40	.75	1	4	-	?	EPIII
MW-8	400	1.0	1	16	-	?	PI-LPIII
MW-13 Unit 1	81	.25	1	5-6	-	?	LPII-EPIII
NW-13 Unit 2	18	-	1	2	-	?	LPII-EPIII
NW-16	273	.75	1	20	-	?	LPII-EPIII
NW-29	144	.75	1	8	-	?	EPIII
NW-36	27	.25	1	3	-	?	LPII-EPIII
NW-43	364	.50	1	15	-	?	EPII-EPIII
NW-48	45	.50	1	4	-	?	LPII-EPIII
NW-49	49	1.0	1	15	-	1	LPII-EPIII
NW-54	144	.75	1	12	-	?	LPII-EPIII
Kin Klizhin							
29SJ339	81	-	1	1+	-	?	EPIII
29SJ1344	144	.3	1	2+	-	1	EPIII
Kin Bineola							
29Mc149	104	1.0	1	4	-	1	PIII
29SJ1578	78	1.0	1	3	-	?	PII-PIII
29SJ1579	360	1.5	2?	15+	3-4?	1+	PI-PIII

Table 36 Continued

Community/ Site No.	Estimated Site Area (m^2)	Estimated Mound Height[1] (m)	Estimated No. of Stories	Estimated No. of Rooms[2]	Estimated No. of 2nd Story Rooms	Estimated No. of Kivas	Estimated Time Periods
Peach Springs							
PS-1	425	1.0-1.5	1	15?	-	1	BMIII/PI-LPIII
PS-2	580	1.0-1.5	1	15?	-	?	EPII-EPIII
PS-3	275	1.0	1	15?	-	?	EPII-EPIII
PS-4	405	1.0-1.5	1	15	-	1+	EPII-LPIII
PS-5	90	1.5	1	5	-	?	LPII-LPIII
PS-11	450	2.0-2.5	2?	20	3-4?	2	EPII-LPIII
PS-12	495	1.0-1.5	1	15	-	?	LPII-EPIII
PS-14	75	.5-.75	1	10?	-	?	LPII-EPIII
PS-15	265	1.0-1.5	1	20	-	2	LPII-LPIII
PS-18	450	1.0-1.5	1	15?	-	2?	LPII
PS-20	145	1.0-1.25	1	15	-	1?	LPII-LPIII
PS-21	135	1.0	1	15	-	1?	LPII-EPIII
PS-22	340	1.0	1	15	-	?	EPIII
PS-24	255	1.0	1	15	-	1	LPII
PS-25	180	.5-.75	1	15	-	1?	LPII
PS-26	440	1.0-1.5	1	20	-	2?	LPII-EPIII
PS-27	109	.75-1.0	1	10	-	?	LPII-LPIII
PS-28	110	.75-1.0	1	7	-	1	LPII-LPIII?
PS-28	170	.75-1.0	1	20	-	2?	LPII-LPIII
PS-29	255	1.0-1.5	1	30	-	1?	BMIII/PI-LPII,LPIII
PS-31	340	.25-.50	1	15	-	1	LPII
PS-32	190	1.0-1.5	1	15	-	1?	LPII-EPIII
PS-33	510	.75-1.0	1	25	-	?	LPII
PS-34	120	.75-1.0	1	10	-	1?	LPII-LPIII
PS-37	125	1.0-1.5	1	10	-	?	EPIII
PS-38	220	.75-1.0	1	15	-	1?	LPII-EPIII
PS-39	55	.50-.75	1	5	-	?	LPII
PS-40	110	.50	1	8	-	?	EPIII
PS-42	220	.75-1.0	1	15	-	1	EPIII
PS-43	155	.50	1	8	-	1	LPII
PS-45	220	.75-1.0	1	15	-	1	EPIII
Grey Hill Sp.							
GH-1	65	1.4	1	4	-	?	EPIII
GH-2	490	1.75	1	14	-	?	EPIII
GH-6	96	1.0	1	8	-	?	EPIII
Casamero							
C-2	45	.5	1	5	-	?	EPII-LPII
C-6	27	.25	1	3	-	?	EPII-LPII
C-7	72	.50	1	6	-	?	EPII-LPII
C-9	27	.25	1	6	-	?	EPII
C-10	40	.25	1	3	-	?	EPII
C-12	114	.25	1	10	-	?	EPII-LPII
C-14	30	.25	1	3-4	-	?	EPII-LPII
Haystack Locality A							
H-1	400	2.25	2	12	8?	2?	EPII-EPIII
H-2	105	.25	1	6	-	?	EPII-LPII
H-3	30	.25	1	3	-	1?	EPII-EPIII
H-4	36	.25	1	3	-	?	EPII-EPIII
Locality D							
H-1	45	.25	1	6	-	?	EPII-LPII?
H-2	63	.50	1	6	-	?	EPII-LPII?
H-3	84	.50	1	5	-	?	EPII-LPII?
El Rito							
KK-1 Prov 1	176	.30	1	8	-	2	LPII
KK-2 Prov 2	121	.50	1	3	-	1	LPII
KK-2 Prov 3	75	.45	1	2-3	-	1	LPII
KK-19	137	.30	1	?	-	1	LPII
KK-41	60	.65	1	4	-	?	LPII
KK-53	189	.45	1	12	-	1	EPII-LPII
KK-64 Prov 1	75	.40	1	4	-	1	LPII
KK-71	65	.50	1	6	-	1	LPII
KK-75	323	.40	1	12	-	1	PI, LPII
KK-78	96	.80	1	4	-	1	PI,LPII, EPIII
KK-89	29	.40	1	2	-	1	LPII,EPIII
KK-100	180	1.30	1	6	-	1	LPII
KK-103	53	.40	1	3	-	1	LPII
Allantown							
Unit 3	208	.45	1	6	-	1	EPIII
Chaco Canyon							
29SJ394 (Bc 50)	341	2.40	2	30	6	4	EPII-LPIII
29SJ395 (Bc 51)	680	2.10	1	45+	-	6	EPII-LPIII
29SJ750 (Leyit Kin)	396	2.50	1	19+	-	3	PI-LPIII
29SJ589 (Bc 236)	237	1.70	1	10+	-	1	LPIII
29SJ1912 (Lizard H.)	270	2.40	2	16	1+?	3	EPII
29SJ633	252	2.00	1	12-15	-	3	EPIII-LPIII
29SJ627	280	1.0-1.25	1	17	-	3	PI-EPIII
29SJ827 (Bc 362)	201	.5-.75	1	18	-	3	EPIII
29SJ399 (Bc 59)	321	1.0-1.5?	1	16+	-	5	PI-LPIII
No. of Cases	141	127	142	140		82	
Mean	179	.9	1.1	10.2		1.4	
Std. Dev.	140	.6	.3	7.3		1.0	

1 - Where a mound height range is shown, the maximum height has been used to calculate the mean and standard deviation.

2- Where a room number range is shown for an individual site, the median of this range has been used in calculating the overall site room mean and standard deviation.

ities surveyed intensively, the sites represented are only a sample of the known small houses at each outlier. The sample chosen includes both excavated and unexcavated sites and is intended to be representative of the range of village sizes present.

The sample of 141 individual house mounds from 137 sites (Table 36, includes small house architectural areas ranging in size from 18 to 680 m^2, with a mean size of 179 m^2. Mound heights vary from .25 to 2.5 m, with a mean of .9 m. A few multistory small houses (two stories only) occur, but the great majority are single story structures. The number of rooms range from 1+ (more rooms presumed) to 45, with a mean of 10.2 rooms. From one to six kivas per small house were documented, with a mean of 1.4 kivas.

This size range suggests relatively little variability when compared to that which will be documented for Chacoan structures in the following pages. Even so, at least two factors probably reduce variability in small house size even more. One is that many of the larger sites were occupied over the course of several temporal periods. Excavations in villages with long occupations often reveal that portions of a site were abandoned before other portions were constructed (Kluckhohn and Reiter 1938, Morris 1939). In short, the total number of rooms present is not necessarily indicative of the number of rooms in use at any one time. By the same token, small houses occupied only for short intervals are much more likely to have had all rooms in use.

Second, it is probable that some of the smallest small house sites were somewhat more substantial than surface data indicate. Many of the smallest houses at Bis sa'ani, for example, are partially covered by aeolian or alluvial fill or have been partially destroyed by badland erosion. It is probable that those small houses at the extremes of the size range were most affected by these two factors.

On the basis of Table 36, it is suggested that the 179 m^2 mean and the 140 m^2 standard deviation provide a rough size continuum for small houses in the San Juan Basin. Further examination to determine if size groupings occur within this range is unwarranted considering the very small size of the sample and the lack of reliability of surface measurements.

Chacoan Structures

Until recently studies of Chacoan structures have been restricted to those in Chaco Canyon and a limited number of outliers, emphasizing them as large, multistoried structures (Vivian 1970a, 1970b; Vivian and Mathews 1965). It is now apparent that an entire range of small-to-moderate sized structures, often of one story and with a relatively small number of rooms and kivas, should be included. The identification of these sites as Chacoan structures is justified both by their general conformance to previously defined morphological and architectural criteria and by their large size in relation to other contemporary sites within the outlier communities.

Previous investigations have relied on a complex of morphological and architectural attributes -- including structure orientation, planned site layout, site symmetry, multistory construction, Chacoan style core and veneer masonry, large rooms with high ceilings, and Chacoan style kivas -- to define Chacoan structures (Hayes 1981; Vivian 1970a, 1970b; Vivian and Mathews 1965). To document variability not previously recognized, earlier chapters of this study described the morphology and architecture of Chacoan structures in some detail. This information is summarized in Tables 37 through 41, and provides the basis of the ensuing discussion.

Because many of the Chacoan structures are unexcavated or are known solely from previous descriptions, it has not been possible to document the presence of some important diagnostic criteria in each instance. Thus, our approach to Chacoan structure identification does not employ a fixed set of criteria, all of which must be present for a structure to qualify. Generally, if the layout and architectural features of a site are unclear or unknown, its recognition as a Chacoan structure is based on its greater size relative to contemporary sites in the community. Conversely, if a site is only slightly larger than its adjacent contemporaries, its inclusion may be warranted by a strong complex of morphological and architectural attributes known to be distinctive of Chacoan structures. Admittedly this method of site identification makes it difficult to categorize those that have little exposed architecture and are only slightly larger than surrounding sites, or those that occur in relative isolation.

In the following discussion diagnostic attributes such as structure planning, core and veneer Chacoan-style masonry, room size, ceiling height, roofing materials, Chacoan kivas, and structure size from the perspective of additional outlier data are re-evaluated. On the basis of this examination, hierarchical and functional differences among both outlying and Canyon Chacoan structures are suggested.

Structure Planning

Vivian, addressing the subject of Chacoan structure layout as exemplified by those in the Canyon, notes that they reveal a "formal regularity in development and layout" which results in "an ordered, compact, and well defined structure, marked by constant symmetry on a single axis" (1970a:157-162). While all architectural structures are planned in the sense that their construction requires forethought, as Lekson et al. (1982) point out, Chacoan structures seem to have been designed from an integrative perspective so that the final structure was a continuous, interconnecting, predictable structure. It is such construction, with the large roomblock as the basic unit or module, that distinguishes Chacoan structures in the canyon itself. Since each roomblock includes several suites or units of interconnected rooms, this construction is clearly of greater scale and involves greater coordination of planning and labor than construction efforts at small houses where the planned unit is commonly no larger than a single suite of 3-4 rooms.

Table 37 Structure planning and masonry types at Chacoan structures

Chacoan Structure	Large-scale Planning	Indeterminate	Small-scale Planning	Core and Veneer	Compound	Simple	Indeterminate (no exposed masonry)
Salmon	x			x			
Sterling		x		x			
Site 39	x			x	x		
Site 41		x		x			
Aztec West	x			x			
Chimney Rock	x?			x			
Wallace Ruin		x			x	x	
Ida Jean	x			x			
Escalante			x	x	x	x	
Lowry Ruin			x	x			
Hogback		x					x
Twin Angels		x		x			
Halfway House		x		x*			
Pierre's House A		x					x
House B		x		x			
Site 6		x		x*			
Bis sa'ani		x		x			
Pueblo Pintado	x			x			
Greenlee Ruin		x		x			
Upper Kin Klizhin		x		x			
Bee Burrow		x		x			
Kin Ya'a		x		x			
Muddy Water Hurley Ruin		x					x
Site 1		x			x*		
Site 33		x		x*			
Dalton Pass		x					x
Kin Klizhin		x		x			
Kin Bineola	x			x	x?		
Standing Rock		x		x*			
Peach Springs		x		x	x		
Grey Hill Springs			x	x			
Skunk Springs		x			x		
Casamero		x		x	x		
Haystack		x		x*			
El Rito		x			x		
Guadalupe			x	x		x	
Village of the Great Kivas			x				x
Allantown		x		x[1]			
Houck		x		x			
Chaco Canyon Chacoan Structures							
Penasco Blanco	x			x	x		
Casa Chiquita		x		x			
New Alto	x			x			
Pueblo Alto	x			x			
Kin Kletso	x			x			
Pueblo del Arroyo	x			x			
Pueblo Bonito	x			x	x	x	
Chetro Ketl	x			x			
Tsin Kletsin	x			x			
Hungo Pavi	x			x			
Una Vida	x			x	x		
Wijiji	x			x			

* - Only tops of walls exposed
1 - Masonry at Allantown exposed by Roberts (1939) is no longer visible

Table 38 Mean room size at Chacoan structures

Chacoan Structure	Total Ests. Rooms	Est. Ground Rooms	Ground Story Meas.	% Ground Story Meas.	Mean Size[1] (m^2)	Std. Dev.	Coefficient of Variability (%)
Salmon	175	120	94	78	18.5	9.2	50
Sterling	25	25	4	16	21.0	7.7	37
Site 39	40	25	24	96	9.5	5.4	57
Site 41	75	60	37	62	9.0	3.9	43
Aztec West	405	220	212	96	14.0	10.9	78
Chimney Rock	55	35	24	69	9.0	6.7	74
Wallace	73	51	48	94	5.5	1.9	35
Ida Jean	55	35	10	29	6.5	3.2	49
Escalante	25	25	12	48	9.5	2.4	25
Lowry	34	21	21	100	11.0	4.8	44
Hogback	10	10	-	-	-	-	
Twin Angels	17	17	17	100	12.5	6.3	50
Halfway House	12	12	-	-	-	-	-
Pierre's House A	15	15	12	80	5.0	1.6	32
House B	13	12	12	100	11.5	6.0	52
Site 6	18	14	14	100	13.5	10.4	77
Bis sa'ani	37	35	27	77	8.0	4.0	50
Pueblo Pintado	135	75	64	85	13.5	9.0	67
Greenlee	15	15	15	100	9.5	2.7	28
Upper Kin Klizhin	25	20	-	-	-	-	-
Bee Burrow	11	11	11	100	16.5	7.5	45
Kin Ya'a	44	25	23	92	21.0	10.9	52
Muddy Water Hurley Ruin	25	20	7	35	17.0	11.2	66
Site 1	22	15	15	100	12.5	3.6	29
Site 33	7	7	7	100	17.5	7.1	41
Dalton Pass	20	15	-	-	-	-	-
Kin Klizhin	18	15	9	60	21.5	16.3	76
Kin Bineola	230	110	110	100	14.5	6.3	43
Standing Rock	35	25	-	-	-	-	-
Peach Springs	30	20	-	-	-	-	
Grey Hill Springs	1	1	-	-	-	-	
Skunk Springs	45	25	-	-	-	-	
Casamero	26	20	20	100	10.0	5.6	56
Haystack	26	20	19	95	20.0	9.0	45
El Rito	55	-	-	-	-	-	-
Guadalupe	25	25	20	80	10.5	5.1	49
Village of the G.K.	18	18	18	100	6.0	3.2	53
Allantown	100	50	-	-	-	-	-
Houck	9	9	9	100	10.0	2.1	21
Penasco Blanco	215	120	119	99	25.5	14.5	57
Casa Chiquita	80	40	19	47.5	4.0	1.1	28
New Alto	51	28	28	100	8.5	1.7	20
Pueblo Alto	130	130	115	88	17.0	11.0	65
Kin Kletso	135	53	53	100	9.5	2.4	25
Pueblo del Arroyo	290	120	148	51	13.5	5.1	38
Pueblo Bonito	695	325	613	88	12.5	7.2	58
Chetro Ketl	580	200	105	18	13.5	6.4	47
Tsin Kletsin	115	50	39	78	6.5	5.5	85
Hungo Pavi	150	85	62	73	23.5	13.2	56
Una Vida	160	100	80	80	18.3	9.9	54
Wijiji	190	100	98	98	6.0	2.5	42
				Overall Mean	12.6		
				Overall Std. Dev. = 5.4			

1 - Mean sizes have been rounded to the nearest .0 or .5 m
a - Calculations based on room measurements from Marshall et al. (1979)
b - Mean and standard deviation from Lekson et al. (1982). Measured rooms at Pueblo Bonito, Chetro Ketl, and Pueblo del Arroyo include upper story rooms
c - Overall mean and standard deviation do not include sites with less than 40% sample

Table 39 Chacoan structure ceiling height and conifer species[1]

Chacoan Structure	Ceil. Height	PP	DF	WF	PNN	P	J	F	POP	Non-con.	Total
Salmon	-*	232	21	4	1	-	113	11	-	-	382[c]
Site 39	2.3	-	-	-	-	-	-	-	-	-	-
Site 41	-*	-	-	-	-	-	5	-	-	-	5[d]
Aztec West	2.9–3.4	-	-	-	-	-	-	-	-	-	-
Chimney Rock	2.1	32	9	-	-	-	1	5	-	-	47
Wallace	1.5[a]	-	-	-	-	-	26	-	-	-	26
Ida Jean Ruin	2.1	29	-	-	-	-	3	-	-	-	32
Escalante	2.3	4	-	-	-	-	30	-	-	-	34
Lowry Ruin	2.0–2.6	1?	-	-	6	-	13	-	-	-	20
Twin Angels	-*	-	-	-	-	-	-	-	-	-	-
Pierre's House B	-	2	-	2	-	-	-	-	-	-	4
Bis sa'ani	2.5–2.8	-	-	-	-	-	-	-	-	-	-
Pueblo Pintado	-	2	-	-	1	1	-	-	2	-	6
Pueblo Alto	3.8–4.0[b]	74	6	-	3	-	-	1	-	-	84
Pueblo del Arroyo	2.3	35	-	-	-	-	-	-	-	-	35
Pueblo Bonito	2.5	61	7	2	1	38	7	-	-	-	116
Una Vida	2.2–2.6	12	1	2	3	-	2	-	-	-	20
Hungo Pavi	-	13	-	-	-	-	-	-	-	-	13
Kin Kletso	2.3–2.7	9	-	-	-	-	-	-	-	-	9
Penasco Blanco	-	36	6	-	3	4	-	-	-	-	49
Casa Chiquita	-	1	-	-	-	-	-	-	-	-	1
Tsin Kletsin	-	2	-	-	-	-	-	-	-	-	2
Wijiji	-	1	-	-	-	-	-	-	-	-	1
Chetro Ketl	-	157	11	41[e]	-	2	1	-	-	-	212
Bee Burrow	2+*	-	-	-	-	-	-	-	-	-	-
Kin Ya'a	-	18	-	-	-	-	-	-	-	-	18
Kin Klizhin	-	1	-	-	-	-	-	-	-	-	1
Kin Bineola	-	15	-	-	-	-	-	-	-	-	15
Casamero	2.1+	1	-	-	-	-	-	-	-	-	1
Guadalupe	-	60	2	-	23	-	1	2	2	1	91[f]
Village of the Great Kivas	2.1–2.7	-	-	-	-	-	-	-	-	-	-
Totals		798	63	51	41	45	202	19	4	1	1224

1 - Ceiling heights usually reflect only one or a few rooms at a Chacoan structure unless a range is given. At Pueblo del Arroyo (n = 143 rooms) and Pueblo Bonito (n = 410 rooms) the mean height is that shown. Speciated timbers are dated dendrochronological specimens in almost all instances; although some of these dates are no longer valid (i.e., Bannister 1965). Timbers with cutting dates (1200s) that clearly reflect post-Chacoan system occupation are not included.

Ceiling Heights

* - Ceilings are high, but exact dimensions are not known
a - A total ceiling height of 3 m may have been obtained when first story ceilings were removed, leaving rooms open to second story ceilings
b - Actual floor to ceiling heights at Pueblo Alto probably exceeded these dimensions, as no viga sockets remained in standing walls

Timber Species

c - Specimens recovered through the 1977 field season
d - Aztec West Ruin has dated timber, but species are not reported
e - Identification uncertain, either Abies concolor or Picea glauca, although the former seems more likely in view of subsequent identifications (i.e., Robinson et al. 1974)
f - Includes all dated and undated structural timber

Abbreviations

PP - Ponderosa pine
DF - Douglas fir
WF - White fir
PNN - Pinon pine
P - Unidentified pine
J - Unidentified juniper
F - Unidentified fir
POP - Aspen
Non. con. - Other non-coniferous

Table 40 Outlier Chacoan structure kiva morphology

Chacoan Structure	Kiva	Pilasters[1]	Ventilator	Recess	Vaults	Sipapu	Kiva Style
Salmon	Tower kiva	Horiz. log (8)	Subfloor	Shallow bench	East & west	+	Chaco
Site 39	Kiva 5	-	Lateral	-	-	-	Ind.
Site 39	Kiva 6	Vert. mason(8)	Subfloor	Keyhole	-	-	S.J.
Chimney Rock	East kiva	Horiz. log	Subfloor	Shallow bench	West	-	Chaco
Chimney Rock	West kiva	?	Lateral	?	?	?	Ind.
Ida Jean	Kiva A	Horiz. log (6)	Subfl. (lat.)	Shallow bench	West	Sealed	Chaco
Ida Jean	Kiva B	Horiz. log (6)	?	Shallow bench	?	?	Chaco
Escalante	Kiva A	Horiz. log (8)	Subfloor	Shallow bench	West	+	Chaco
Lowry Ruin	Kiva F	-	Lateral	-	-	?	Ind.
Lowry Ruin	Kiva B	Vert. mason(7)	Subfloor	Keyhole	-	-	S.J.
Lowry Ruin	Kiva D	Vert. mason(6)	Lateral	Shallow bench	-	-	Chaco?
Twin Angels[a]	Kiva 2	?	Subfloor	Shallow bench	?	?	Chaco
Casamero	Kiva A	?	Lateral	Keyhole	-	+	S.J.
Guadalupe	Room 2	-	?	Shallow bench	?	?	Ind.
Guadalupe[b]	Room 4	-	?	?	?	?	Ind.
Village of the GK	Kiva A	-	Subfloor	Keyhole	West	+	Chaco?
Village of the GK	Kiva C	-	Subfl. & lat.	Keyhole & bench	West	-	S.J.?
Houck[c]	Kiva	?	?	Recess?	?	?	Ind.
Houck	Kiva	?	Subfloor	?	?	?	Ind.

1 - Figure in parentheses indicates number of pilasters.
a - It is uncertain if this kiva was fully excavated.
b - Bench may have been removed during Late Pueblo III occuaption. Little is known of the Guadalupe kivas which have suffered both from extensive natural erosion and vandalism prior to excavation.
c - Both Houck kivas were severely vandalized prior to excavation, but one appears to be D-shaped.

<u>Abbreviations</u>
Ind. = Indeterminate
S.J. = San Juan

Table 41 Chacoan structure size and related attributes by size groups

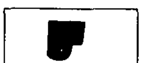
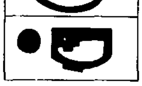
Chacoan Structure	Est. Floor Area (m^2)	Shape	Est. Mound Height (m)	Est. No. of Stories	Est. No. of Rooms	Est. No. of Kivas	Est. No. of Great Kivas[1]
Large							
Chetro Ketl	23,395		9.0*	4	580	16	2
Pueblo Bonito	18,530		10.0*	4	695	33	3
Aztec	15,030		8–9*	3	405	28	1
Penasco Blanco	15,010		4.6	3	215	7	4
Mean	17,991						
Std. Dev.	3,964						
Medium							
Pueblo del Arroyo	8,990		5.3+	4	290	15	1?
Una Vida	8,750		5.8*	3	160	6	2
Salmon	8,320		4.5–5.0	2–3	175	1	1
Pueblo Alto	8,260		3.5	1	130	15	–
Kin Bineola	8,225		5.0–6.0	3	230	10	1?
Hungo Pavi	8,025		6.1*	3	150	1	1
Pueblo Pintado	5,935		6.0–7.0	3	135	9	1?
Mean	8,072						
Std. Dev.	999						
Small							
Tsin Kletsin	3,552		3.3	3[a]	115	4	–
Allantown	3,460		4.5–5.0	3	100	5	1
Site 41	2,875		3.0–4.0	2	75	3	1
Kin Kletso	2,640		6.1*	3	135	5	–
Wijiji	2,535		4.8	3	190	2	–
Chimney Rock	2,535		4.0	2	55	2	–
Kin Klizhin	2,395		3.0–4.0	2[b]	18	3	–
Haystack	2,055		3.0–3.5	2	26	4	1

Table 41 Continued

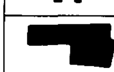
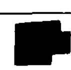
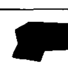
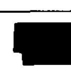
Chacoan Structure	Est. Floor Area (m^2)	Shape	Est. Mound Height (m)	Est. No. of Stories	Est. No. of Rooms	Est. No. of Kivas	Est. No. of Great Kivas[1]
Skunk Springs	1,935		2.5–3.0	2	45	3	1
Peach Springs	1,880		4.0	2	30	1	1
Kin Ya'a	1,845		3.0–4.0	2[c]	44	3	-
Sterling	1,685		?	1?	25	1	-
Casa Chiquita	1,460		3.9	3	80	2	-
Guadalupe	1,400		4.0–5.0	1?	25	3	-
Muddy Water Hurley Ruin	1,205		3.5	2	25	2?	-
Wallace	1,080		3.0–4.0	2	73	5	-
Bis sa'ani	1,040		3.0	2	37	5	-
Lowry Ruin	870		3.0–4.0	2	34	3	1
Dalton Pass	825		3.0	2	20	3	1
El Rito	795		3.0	3	55	4	1
Site 39	730		2.6	2	40	2	-
Ida Jean	695		2.0–2.5	2	55	2	1
New Alto	645		2.5	2	51	1	-
Casamero	635		2.5–3.0	2	26	2	1
Standing Rock	630		3.0–3.5	2	35	?	-
Village of the Great Kivas	590		2.5–3.0	1	18	2	1
Muddy Water Site 1	575		2.7	2	22	1	-
Pierre's Site 6	505		2.5–3.0	2	18	2	-
Upper Kin Klizhin	470		2.5–3.0	2	25	1	-

Table 41 Continued

Chacoan Structure	Est. Floor Area (m²)	Shape	Est. Mound Height (m)	Est. No. of Stories	Est. No. of Rooms	Est. No. of Kivas	Est. No. of Great Kivas[1]
Twin Angels	470		2.5	1	17	2	-
Escalante	455		2.5-3.0	1	25	1	-
Bee Burrow	450		3.0	1	11	2	-
Muddy Water Site 33	380		1.7	1	7	2	-
Pierre's House B	315		3.0	2	13	1	-
Pierre's House A	255		2.0	1	15	3	-
Greenlee Ruin	255		2.0	1	15	1	-
Grey Hill Springs	215		1.5	1	1	1	-
Hogback Ruin	205		2.5	1	10	1	-
Houck Ruin	200		1.8	1	9	2	-
Halfway House	145		2.0	1	12	?	-
Mean	1172						
Std. Dev.	955						

* - Indicates approximate height of standing masonry.
1 - Includes great kivas which are structurally part of the Chacoan structure or separate, but within 100 m.
a - Hayes (1981) suggests three stories for a few rooms; Lekson et al. (1982) argue for two stories only.
b - Three-story tower kiva
c - Five-story tower kiva

In the majority of instances it is difficult to document empirically that the outlying Chacoan structures conform to this pattern, since the ground plans and construction sequences of 27 structures at 23 outlying locations (Table 37) are either obscured by overlying debris or require detailed studies not yet performed. Information at only seven outlier structures is sufficient to allow the delineation of large roomblock construction units. With the exception of Salmon Ruin, even at these seven the exact size of the units and dates of construction are conjectural.

Five other outlier structures have building units, indicated by architectural data and tree-ring dates, which cannot be termed large-scale compared to the seven noted above. Four of these (Escalante, Lowry, Guadalupe, and Village of the Great Kivas) consist of several small, agglomerated building units. The remaining site (Grey Hill Springs) is too small to have involved large-scale modular construction.

Although it is impossible to quantify the size of roomblock additions at the seven outliers with large scale units, the overall size (Table 41) and construction dates for these sites suggest that they could be comparable to the mean construction unit sizes calculated by Lekson et al. (1982) for the Canyon Chacoan structures (approximately 725 to 2500 m^2). It is also possible that comparable construction units exist at the remainder of outliers that are 725 m^2 or larger or that fall within one standard deviation (289 m^2) of this figure (Table 41). This leaves only seven structures less than 400 m^2 that clearly could not have been constructed in units comparable to those in Chaco Canyon. Presumably, these sites involved relatively minor planning and coordination.

At the more diminuitive outlying structures another perspective can be gained through comparison of planning at these sites with surrounding small houses. As is illustrated by the survey of Pierre's community, the scale of Houses A and B is minor in comparison to Chaco Canyon structures. But if these two structures were constructed in one or two intervals of activity, planning was certainly involved and the units are much larger than those at any adjacent Pierre's community small house sites.

Masonry

Core and veneer masonry has long been recognized as the dominant wall construction technique in Chacoan structures at Chaco Canyon (Vivian 1970a, 1970b; Vivian and Mathews 1965). As shown in Table 37, it is also dominant at outlying Chacoan structures, although compound and simple masonry occur with lesser frequency. In the majority of instances where these latter types do occur, they date prior to the eleventh century advent of core and veneer masonry. In the remaining cases simple or compound masonry occur only at small structures where the greater load-bearing capabilities of the core and veneer technique would not have been requisite.

A second aspect of masonry considered distinctive to Chacoan structures is "Chaco style" masonry. Here, such masonry includes the large number and wide variety of masonry styles documented by Hawley (1934, 1938), Judd (1964), and Vivian and Mathews (1965). These styles employ coursed slabs, blocks, and spalls, or combinations thereof, to produce a number of distinct masonry patterns. "Banding", or the alternate layering of courses of different stone thicknesses, is one such technique associated with Chacoan structure masonry. In view of the absence or minimal exposure of masonry at about half the outlying Chacoan structures, the following comments must be considered tentative.

At virtually all outlying Chacoan structures with exposed masonry, stylistic similarities to Chaco Canyon are apparent. The similarities are general, however, and it is often difficult or impossible to identify masonry at outliers as an intentional reproduction of any of the Chaco Canyon styles. Variations of Hawley's Type I are identifiable at all the early Chacoan structures where masonry is exposed. Most later masonry is a combination of unbanded blocks and slabs, or predominantly slab, approximating Hawley's Types IV and V. No masonry of marked similarity to Hawley's Types II and III is known. In general, little of the masonry at outliers approaches the fine craftsmanship and intricacy of banded styles seen at Pueblo Bonito, Penasco Blanco, and Chetro Ketl. A final style of masonry that appears to be associated with some later outliers is that dominated by large, shaped blocks, resembling the McElmo masonry of Chaco Canyon and the Mesa Verde area, although this varies substantially from site to site.

While availability of stone material is unquestionably a factor determining a masonry style, variability in styles present at certain Chacoan structures through time (e.g., Peach Springs), or between adjacent structures (e.g., Ida Jean, Wallace Ruin), suggests that material was not the sole determinant. Similarly, substantial variation in craftsmanship, particularly between the Chacoan and subsequent occupations at some sites (e.g., Salmon, Lowry, Village of the Great Kivas), suggests that craftsmanship was not constrained by the physical limitations of local stone. While the effects of material type on the resulting product are recognized to be substantial, the possibility that stylistic and qualitative differences in masonry may have reflected the hierarchical or functional position of a site should receive furthur investigation. Supporting this idea is the apparent limitation of the elaborate banded styles of the late 1000s (Hawley's Types II and III) to large Chacoan structures in Chaco Canyon, and the subjective impression that masonry at many of the large canyon structures is qualitatively better than that present at many of the smaller outliers.

Room Size

Although the large size of rooms in Chacoan structures in Chaco Canyon has long been apparent, attempts to examine room size quantitatively are relatively recent. As an example of large rooms, Vivian (1970a) has cited rooms of 2.4 x 4.6 m (ca. 11.0 m^2) in Pueblo del Arroyo, while Hayes (1981) has documented 100 rooms at Pueblo Bonito averaging 5.5 x 2.9 m or $16m^2$ per room. The substantial size difference between these two examples of "large" rooms raises questions about variability in Chacoan structure room size; thus the attempt here to quantify room size at both outlying and Chaco canyon Chacoan structures.

Table 38 shows the mean room size and standard deviation for all measurable rooms in the ground story of each structure. A number of factors, including obscure rubble outlines and possible alteration of rooms by later occupants, limit the accuracy of the results; and the data must be seen in this light. At Chacoan structures where over 40% of the ground floor rooms or room outlines were measurable, it is assumed they are representative of rooms at the site. The size is also assumed to reflect the room sizes of upper stories, since these generally duplicate the shape and size of rooms directly below them (c.f. Judd 1964; Morris 1928). Including the Chaco Canyon Chacoan structures, room sizes (Table 38) range from a mean high of 25 m^2 at Penasco Blanco to 4.0 m^2 at Casa Chiquita (Figure 147). An overall mean of 12.6 m^2 (calculated from each individual site mean) establishes the average figure to which Chacoan structure room sizes can be compared.

Relative to the mean room sizes of small houses such as Bc 50-51 (n = 39 $\bar{x}$ = 9.0 m^2); Chacoan-structure rooms of 9 m^2 or less are not large. Thus it is proposed that no Chacoan structure room size below 10 m^2 should be considered large. However, the estimation of small house size ranges is admittedly little more than an educated guess, since no one has documented a large sample of small house room sizes throughout the San Juan Basin.

The great range of variability of mean room sizes of Chacoan structures raises the question of whether they vary with other attributes such as site size (discussed below). A chi-square test to determine if mean room size at combined large and medium sites (Table 41) was larger than that of the small sites was significant at the .01 level (X^2 = 11.2, df = 1). A parametric t-test yielded results significant at the .05 level (t = 3.6, df = 35). This may well reflect hierarchial differences between Chacoan structures in which larger rooms were associated with larger sites, perhaps to accomodate ranking or specific functions requiring large room areas.

A different dimension of room size variability is illustrated on an individual site basis by standard deviations (Table 38) and on a comparative basis by coefficients of variation (CV)(Figure 148). From the equalizing perspective of the latter (Thomas 1976:82-85), it is apparent that regardless of overall size, many sites have comparable variability in room size. The lowest coefficients of variation (<30%) are encountered exclusively at small Chacoan structures with mean room sizes of less than 13 m^2. One suggestion is that sites with limited variability in room size may represent a functionally distinct subpopulation within the small group. Lekson and Judge (1978) have suggested that a number of these sites in Chaco Canyon, termed McElmo pueblos (Kin Kletso, Casa Chiquita, New Alto), may have been utilized

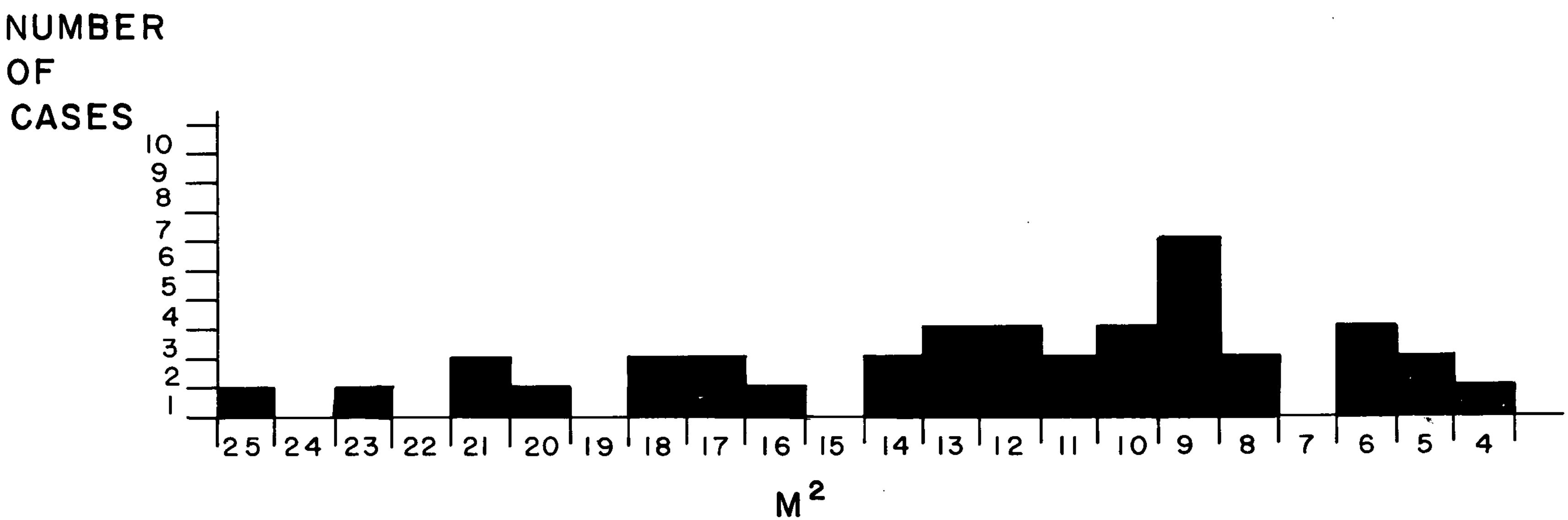
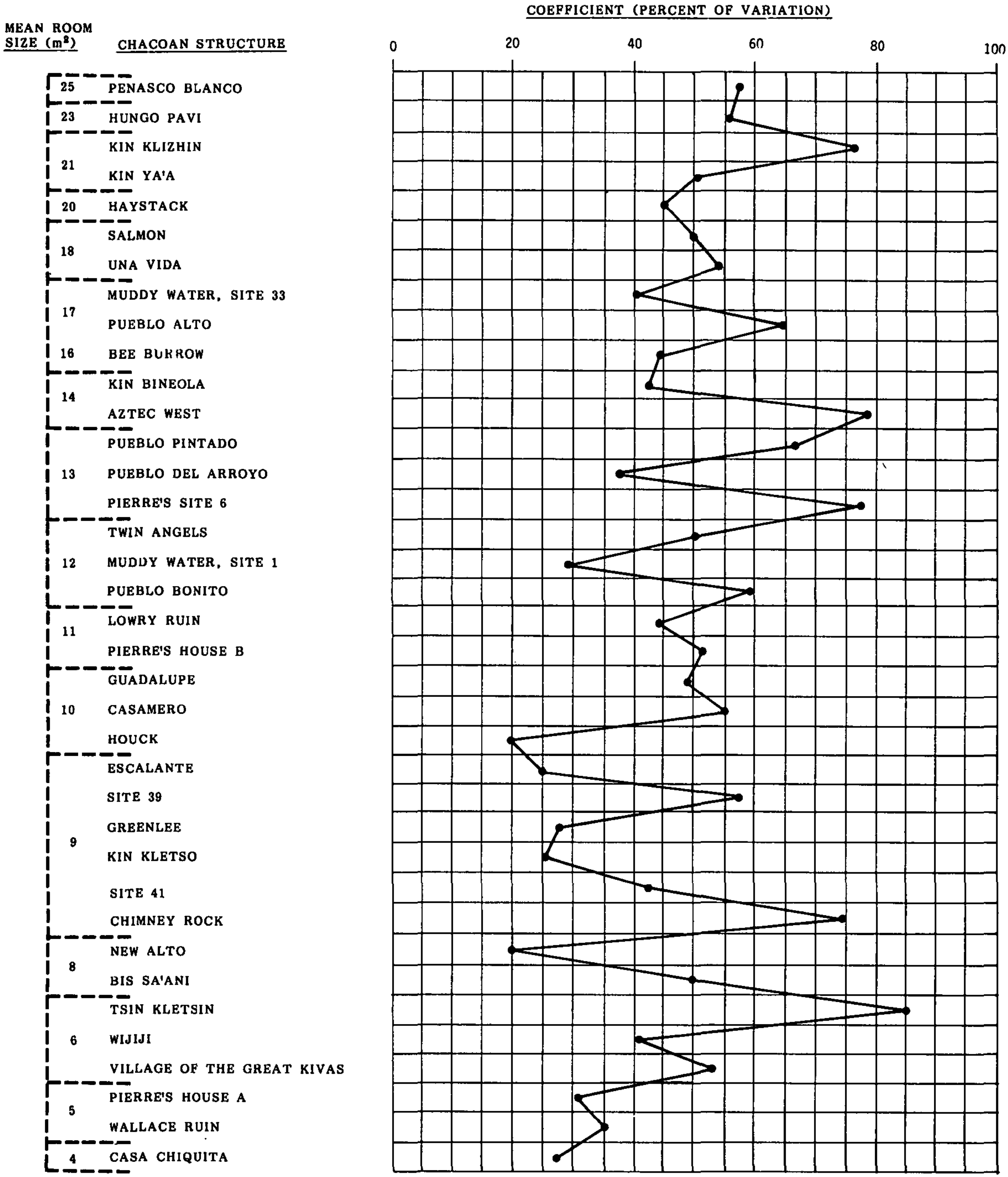


Figure 147. Mean room size by site. Histogram of mean room size (square meters) per Chacoan structure by frequency of Chacoan structures (excludes sites with less than 40% room sample).

The coefficients of variation (see formula below) allow direct comparison of variability (expressed in percent) in room sizes between Chacoan structures with different room size means. High percentages indicate correspondingly great room size variability.

$$(CV = \frac{100 \times \text{site room size Std. Dev.}}{\text{site room size } \bar{x}})$$



Note: Coefficients of variation have not been calculated for sites with less than a 40% sample.

Figure 148. Room size coefficient of variation.

primarily for storage, with only a small caretaker popultion in residence.

The greater ranges of room-size variability encountered at the majority of Chacoan structures suggest use for habitation and/or special functions. One might assume that moderate variability in room size would occur at sites used primarily for habitation, since room sizes would reflect only a moderate range of size and functional diversification (storage, living and grinding rooms). Incidentally, calculation of CV percentages for two small house sites (29SJ627 and 629) excavated by the Chaco Center (Truell 1980; Windes 1978b) appears to support such an assumption (CV = 36% and 49% respectively). Without a larger sample of sites, however, it is impossible to determine how representative these two examples are, or what range of CV percentages might be expected for habitation sites in general.

At Chacoan structures where specialized functions requiring specialized rooms are proposed, a higher range of CV variability might be expected. At Pueblo Alto where only about 20% of the structure is thought to have been utilized for habitation purposes (Windes 1979:personal communication), a CV of 64% appears supportive of such functional diversity. However, caution is advised against the assumption that room size variability correlates completely with functional differentiation. At the Chimney Rock Chacoan structure, for example, a high CV percentage (72%) reflects the presence of two sizes of storage rooms; those associated with room suites and small cubicles surrounding the kivas. Still the items stored probably were functionally distinct (secular vs. religious).

Clearly these are only tentative suggestions for approaching the analysis of room size in Chacoan structures -- a problem only heightened by the characteristic lack of artifacts and features in many excavated Chacoan structure rooms. Traditionally such negative artifactual evidence has been a primary criterion in proposing use of the room for storage. Here, however, the multiplicity of room sizes suggests a corresponding variety of functional types. Further, a great number of barren rooms contain areas far in excess of what would appear to have been required for storage, even at a major redistributional center. For example, Lekson and Judge (1978) estimate that a "bumper crop of corn" from all of Chaco Canyon could be stored unshelled in the two back rows of rooms at Chetro Ketl.

Ceiling Height and Roofing Materials

A third dimension of room size, ceiling height, has been included in previous discussions of Chaco Canyon Chacoan structures (Hayes 1981; Vivian 1970a; and Vivian and Mathews 1965), but no quantified treatment on a multi-site basis has been presented.

Of the 16 Chacoan structures where ceiling heights are recorded (Table 39), 14 have heights of 2.1 m (7 ft) or over, which we consider high. However, the representativeness of these values may be questioned since a single room measurement is often considered characteristic of an entire site. At the only two Chaco Canyon sites (Pueblo Bonito and Pueblo del Arroyo) where ceiling heights from a large number of rooms have been recorded, substantial variation exists between rooms in the same story and between rooms in different stories (Judd 1959, 1964). This variability indicates that a single measurement may not be representative of the site as a whole.

There is some indication, illustrated by a 2.9 m average ceiling height from five large and medium Chacoan structures that their ceilings may have been higher than those at eight small Chacoan structures ($\bar{x}$ = 2.2 m). These latter sites, however, comprise only 20% of the small Chacoan structures. Considering the variability which may be present, the lower mean ceiling height for the small structures is particularly tentative.

In addition to height, a distinctive aspect of Chaco Canyon Chacoan structure ceilings is the utilization of large conifer timbers, primarily ponderosa pine (Pinus ponderosa) with lesser quantities of Douglas fir (Psuedotsuga menziesii) and white fir (Abies concolor), for main and secondary roof support beams. Table 39 lists the species of dated timbers recovered from Chacoan structures, documenting that large conifer species comprise the majority of sampled timbers at 19 Chacoan structures. Large conifers occur in numbers equal to other wood species (primarily pinyon and juniper) at one site and are not present, or are less common than other species, at five sites.

While the data do suggest that large conifer species account for the majority of beams at Chacoan structures, the number of dated, and thus identified, beams is relatively small. It is also probable that a lower percentage of juniper, pinyon and non-conifer specimens have been dated, hence selection against their representation in the present sample.

Large conifer beams are most common at nine of the 11 large and medium Chacoan structures where identified and are dominant at ten of the 14 small structures. The dominance of large conifers in the larger sites is not surprising considering the massive loads borne by architectural beams of large-roomed multistory structures. Whether there is significantly less use of large conifers at smaller Chacoan structures is uncertain. It is perhaps realistic to view the use of large conifer species at certain small structures such as Pierre's House B and even small villages (P-15), as a reflection of resource availability. The possible use of large conifers for all structures in the Pierre's community where little timber suitable for roofing is available locally, in contrast to the use of pinyon and juniper at such Chacoan structures as Lowry Ruin and Escalante where large pinyon and juniper are locally abundant, appears to support this interpretation. Until samples from a greater number of communities are accumulated, however, it will have to remain tentative.

Chacoan Kivas

A final distinctive aspect of Chaco Canyon Chacoan structure architecture is the kiva. The architectural features of "Chacoan" kivas revealed by excavations at Pueblo del Arroyo (Judd 1959:59) and Pueblo Bonito (Judd 1964:177) commonly include a subfloor ventilator, six to ten log pilasters, a shallow southern bench recess, and a western subfloor vault. In many instances a sipapu is absent.

In Table 40 the known features of kivas at outlying Chacoan structures are shown. Of the small sample of 19 excavated, eight have at least two "Chacoan" style features each. Four kivas have predominantly non-Chacoan features, and there is insufficient information to categorize the remaining seven. This sample shows substantial variability in kiva furnishings, particularly among sites and to a more limited extent between kivas within the same site. The kivas at Salmon, Chimney Rock, Ida Jean, and Escalante generally display strong Chacoan features, as does the Twin Angels kiva to the extent exposed by partial excavation. At Village of the Great Kivas a mixture of features characteristic of both Chaco and San Juan kivas are present, while the kivas at Lowry, Site 39, and Casamero display predominantly San Juan or Mesa Verde style features. At three sites -- Chimney Rock, Site 39, and Lowry Ruin -- one of the kivas present lacks distinctive features, resulting in a relatively barren structure with no obvious architectural affinities to any tradition.

With such a small sample of kivas, it is difficult to identify factors which may have affected kiva variability. Present evidence does not suggest any correlation between kiva morphology and site size.

Site Size

The Chacoan structures represented by the major Chaco Canyon examples are large, architectural edifices (Hewett 1936; Lekson et al. 1982; Vivian 1970a, 1970b; Vivian and Mathews 1965; Windes:in progress). As has been emphasized, recognition of outlying Chacoan structures adds an entire range of much smaller structures.

In the preceding pages tentative correlations between site size and certain morphological and architectural features were discussed. Table 41 illustrates further morphological variability in Chacoan structure shape, number of stories, rooms, kivas, great kivas, and mound height in relation to size. Measurement of the size of Chacoan structures has been accomplished here by calculating the total floor area of the enclosed portions of each site, including all upper stories and plaza areas. Since many Chacoan structures are unexcavated, and because maps of some are approximations based on pacing and field sketches, considerable refinement of the area estimations shown in Table 41 will be necessary in the future.

Of basic importance to the analysis of Chacoan structure sizes is the assumption that once portions of the site were constructed, they remained in use until the collapse of the Chacoan system in the late twelfth century. The lack of pre-twelfth century refuse deposits in rooms or kivas of excavated Chacoan structures (Carlson 1966; Eddy 1977; Judd 1959; Morris 1928, 1939) generally supports such an assumption, although certainly a few rooms in some Chacoan structures (e.g., Pueblo Bonito) were abandoned prior to 1130-1150. Thus the site size data represent Chacoan structures only at the apex of their development. Considerably more detailed information on the construction sequences of Chacoan structures is necessary before a diachronic picture of development will be possible.

The variability in size of Chacoan structure is substantial, ranging from 23,395 m^2 at Chetro Ketl to a mere 145 m^2 at Halfway House. The range is not continuous, but apparently clusters into three size groups, termed here large, medium and small on the basis of exclusiveness in size, range, and standard deviation (see below).

As indicated in Table 41 mound height and the number of stories, rooms and kivas generally correlate with the size of the site. Less predictable correlation with site size occurs in the shape of Chacoan structures and the frequency of great kivas. The largest Chacoan structures typically form "D", "L", "E", or "O" shapes as a result of extending room blocks and enclosing plazas. These shapes also occur among small sites; but as site size decreases, the enclosed shapes become progressively rarer and are replaced by rectangular blocks with unenclosed plaza areas.

Great kivas occur most consistently, and in greatest frequency per site, at the large and medium Chacoan structures. They are less frequent at small Chacoan structures and disappear almost completely in the lower end of the small range of Chaco structures.

It is proposed that these differences in size, morphology, and architecture provide evidence of an hierarchy of Chacoan structures. Community and regional settlement pattern data presented also suggest such a hierarchy. On the basis of size, four Chacoan structures may be placed in the large size grouping ($\bar{x}$ = 17,991 m^2, s.d. = 3964 m^2). Although nearly 5,000 m^2 separate Chetro Ketl (23,395 m^2) and Pueblo Bonito (18,530 m^2), these two sites are substantially larger than either Penasco Blanco or Aztec.

Clearly Penasco Blanco and Aztec are very important Chacoan structures, yet their smaller size and less centralized locations suggest perhaps they did not perform the same level of economic, political, or ceremonial functions as Pueblo Bonito and Chetro Ketl.

As shown in Table 41 close comparability in size between the seven members of the medium size grouping ($\bar{x}$ = 8072 m^2, sd = 999 m^2) suggests similarity in importance and ranking order. Although Pueblo Alto and Pueblo del Arroyo are situated in the central, high-density, site complex in Chaco Canyon, their smaller size suggests secondary rank. The location of all but two first- and second-order sites in the Chaco Canyon area supports the road system evidence identifying the canyon as the center of a regional system. However, the presence of Aztec and Salmon in the San Juan area does raise the possibility of the late emergence of additional central places.

The largest of the small sites is less than one-half the size of the average second-order site. Thus these small structures clearly constitute a third, lower level order of the hierarchy. Unlike the group of intermediate-level sites, which form a tight size cluster, the third-order group of Chacoan structures is larger in number, includes more variability is size, and is spatially very dispersed. Although third-order sites occur in Chaco Canyon, the majority are outliers. A further hierarchial division within this group may be substantiated in the future.

Miscellaneous Structures

At least two of the small Chacoan structures, Twin Angels, and Halfway House appear to be isolated without associated communities. The position of both on the Great North Road suggests the possibility that they were waystations for goods or travelers. Bee Burrow, on the Southwest road, may also be of this type, although in this instance a community is located 2 km to the east. In this community, O'Laughlin (1980) noted one centrally located site with 22 ground floor rooms, an intramural kiva, a rear tier of probable two story rooms, and an enclosed plaza. From O'Laughlin's description, it seems quite possible that this site is also a Chacoan structure, perhaps the administrative center of the community. The Bee Burrow structure, on the other hand, being somewhat removed from the community, may have had a different and specialized function dependent primarily on the roadway.

Other Chacoan structures in our sample may also be road houses, but until more data are obtained and a complex of distinguishing attributes more thoroughly defined, further identification is not possible. Isolation from high density site clusters, association with a road, and small size (less than 500 m^2) are attributes common to all three of the sites just discussed. Although not isolated, possibly the smaller structures at sites that have more than one Chacoan structure, such as Muddy Water and Pierre's, may also be of this type.

The McElmo sites, another variant of the Chacoan structures, are known primarily in Chaco Canyon from such examples as Casa Chiquita, New Alto, and Kin Kletso. Their distinguishing attributes include compact room blocks, few kivas, no plazas or trash mounds, small rooms with little size variability, and blocky masonry. Lekson and Judge (1978:16) note that one or two of the McElmo sites occur in direct association with virtually each of the first and second order Chacoan structures in Chaco Canyon, and suggest that they were used for storage. A few small outlying Chacoan structures, such as Pierre's House A and Escalante, may also be McElmo sites.

A final variant of the Chacoan structure is Grey Hill Springs -- a single kiva with an associated large and partially enclosed room, and a small plaza. A ceremonial function for this structure is readily suggested, but its relationship with roads or a surrounding community is uncertain. A few small house sites have been documented in the immediate vicinity (Marshall et al. 1979), and an isolated room with high standing walls of core and veneer masonry is located ca. 200 m to the south. The nearest known Chacoan structure, Whirlwind House, located 5 km to the north, is associated with a number of small house sites. However, it is unclear whether the Grey Hill Springs unit and Whirlwind House are part of the same community (see Marshall et al. [1979] for a detailed discussion of both the Grey Hill Springs and Whirlwind House areas).

The proliferation of Early Pueblo III Chacoan structures, as well as distinct types such as road houses, McElmo structures, kiva units, and possibly other unique structures (Talus Unit #1, Hubbard Ruin at Aztec) particularly in the early twelfth century, is indicative of the apparently increasing complexity and specialization of the Chacoan system just prior to its collapse. Possibly this reflects the separation of specific Chacoan structure functions into separate buildings, where previously they were undertaken in different portions of a single structure. These must remain little more than speculative thoughts, however, until a number of these specialized structures are more thoroughly investigated.

Summary Comments

A polythetic approach to the identification of Chacoan structures has been attempted since some attributes previously considered characteristic do not occur at all outliers, or cannot be identified without excavation. It has been emphasized that identification of Chacoan structures is aided by consideration of structure size relative to the size of other sites in the outlier community. This criterion is particularly important with regard to the more diminutive structures which, if viewed in isolation, might otherwise remain unrecognized. The possibility exists that other morphological attributes, such as large scale planning, may also vary on a relative basis. Whatever future studies reveal, it is clear that the large, conspicuous and distinctive characteristics of outlying Chacoan structures would become less so if removed to Chaco Canyon.

Although some overlap in attribute ranges exists, there is little doubt that virtually all the sites identified here as Chacoan structures are physically distinct from small houses, with correspondingly distinct social roles and functions. Further, differences between Chacoan structures suggest distinctive, perhaps heirarchical, roles and functions. The identification of small Chacoan outliers with associated communities as low-level administrative centers for community level economic, political, and ceremonial functions accounts for such structures at Peach Springs, Bis sa'ani, and possibly P-6 at Pierre's, as well as most other small sites. Similarly, the large and medium structures (possibly occupied by elites) have been proposed as administrative centers for major road systems, their attendant communities and the Chacoan system as a whole. If a more specific and descriptive term for these 11 prominent Chaco Canyon and outlying Chacoan structures is appropriate, the term <u>greathouse</u> (Morris 1928, 1939) is ideally suited.

Outlier Lithics and Ceramics

An attempt has been made to identify intrusive lithics (chipped stone) and ceramics at outliers in order to examine resource exchange in the San Juan Basin. Previous studies have already indicated exchange of some ceramics (Toll et al. 1980; Windes 1977a) and lithics (Cameron 1982).

A preliminary assumption, based on ethnographic exploitation patterns cited earlier in this chapter, is that 10 km was the spatial limit of everyday resource exploitation. Resources from outside this area are thus considered to be intrusive. Acquisition was probably through exchange or, alternately, large quantities of the resource were obtained during extended collecting trips of the type documented by Crane (1928:135), Simmons (1942), and Titiev (1927).

Because most of the lithic and ceramic collections are from limited surface samples, it cannot be assumed they accurately represent variability in lithic and ceramic materials during all periods of a site's occupation. Thus the data have only general temporal applicability, the majority of specimens in the samples probably reflect refuse deposited during Late Pueblo II - Early Pueblo III -- the periods best represented in trash mound and surface deposits at the Chacoan structures. Further, no claim is made that the quantities of lithic or ceramic materials found at outlying Chacoan structures or other individual sites are representative of the community as a whole.

Because of these sampling limitations, the main focus of this discussion is aimed at discerning distributional and quantitative patterns observable over substantial geographic areas involving several outliers. It is on this level that the available collections are assumed to have some interpretive value and are utilized to infer subregional and regional exchange patterns.

Lithic Material Types and Distributions

In Appendix D, Table 1 lithic material types recorded for outliers, and in some instances adjacent community sites, are shown according to the numerical coding system devised by Helene Warren (1967, 1979). In a number of instances closely related lithic types have been lumped into larger groups, as indicated in the Appendix D, Table 1 key. At sites where lithics have not been typed by the Warren classification, they have been placed in miscellaneous unidentified chert, chalcedony, petrified wood, or other categories.

Data on lithic material types for outliers north of the San Juan River are quite sparse. Although almost all of the northern sites have been extensively excavated or tested, little lithic data are available, due to early sampling methods (frequently only the tools were kept) or inadequate reporting. The recent Salmon excavations (Irwin-Williams 1972, 1973, 1975, 1976), as well as excavations by Bradley (1974) at the Wallace Ruin, should provide definitive information on these sites within the near future.

Generally, intrusive lithic materials at outliers and associated community sites north of the San Juan River are limited in number and account for an almost insignificant proportion of the total lithic assemblage. Obsidian (varieties and sources represented are uncertain) is the only intrusive type documented at more than one locality. If better data were available, it might be expected that Washington Pass chert (#1080) and Brushy Basin chert (#1040) would be represented as well (the former perhaps in very minor percentages). The absence of Brushy Basin material at Escalante is conspicuous in view of its nearby occurrence in exposures of the Morrison Formation (Craig et al. 1955).

Within the Chaco Basin, lithic materials at outliers are in most instances quantifiable and identified by a standarized classification system. Cherts, chalcedonies, and silicified woods generally comprise at least 80-90% of the lithic assemblages of Chaco Basin Chacoan structures as well as those of small houses in communities examined during the intensive survey (Appendix D, Table 1). Similar percentages for these classes of materials are found at Chaco Canyon survey sites (Jacobson 1977), as well as from excavated sites in the canyon (Cameron 1982). Cherts and chalcedonies are generally less frequent than silicified wood, ranging in percentage at the outliers sampled from 13% to nearly 71%, with an overall mean of 33%. A comparable range of percentages is indicated by the Chaco Canyon Chacoan structure surface samples (Appendix D, Table 1), although the mean percentage (45%) is higher. Cherts and chalcedonies at excavated Pueblo II-III sites in Chaco Canyon range from 18% at 29SJ627 to 34% at Pueblo Alto (Cameron 1982).

Of the cherts, chalcedonies, and woods, the latter two can generally be considered local materials. Most are areally widespread in lag gravels, or in the case of woods, occur in the Fruitland, Kirtland, and Ojo Alamo Formations. Materials of more limited spatial distribution, such as lithic type #1042, tend to occur only on sites in the immediate area of the source.

Only a few of the chert material types are clearly intrusive. They vary substantially among outliers from a trace to 45% of the lithic assemblages. This variability in distribution and quantity of intrusives suggests that their frequencies may be directly related to distance from the source. In some instances this appears to be true; in others, it is apparently not.

The two major chert materials exchanged were Washington Pass chert (#1080) and yellow brown chert (#1072). Washington Pass chert is derived from the single Chuska Mountain source after which it is named (Warren 1967:121), and the #1072 yellow brown chert is presently known only from the Oso Ridge area at the eastern end of the Zuni Mountains (Whitmore 1978). Thus one would expect a fall-off in percentages of both types toward the more distant central and northeastern portions of the Chaco Basin, and in fact both cherts each account for about 1-10% of the total lithic assemblage sampled at outliers in those areas. In

Chaco Canyon, however, the percentages of #1080 increase greatly at some of the major Chaco Canyon sites, while the percentages of #1072 at these same sites remain as low as the percentages found outside the canyon (Appendix D, Table 1). The percentages of #1080 at Pueblo Alto (23%), Pueblo Bonito (44%) and Chetro Ketl (55%) are most comparable to that at Skunk Springs (34%) which is only about 20 km from the Washington Pass source. Thus, with respect to Washington Pass chert, Chaco Canyon appears as an exception to the expected fall-off rate.

Type #1072 is absent from the Skunk Springs sample though not surprisingly, given the 130 km distance to known sources of yellow brown chert. Warren notes that Washington Pass chert is the primary lithic material throughout site aggregations in the northern Chuska Valley, while #1072 is present only as a "few fragments in scattered localities" (1967:121, 132). Instead, the highest percentages of #1072 within the Chaco Basin are found at Muddy Water (33%), Peach Springs (21%), Standing Rock (14%), and Kin Ya'a (10%), with Washington Pass chert ranging from 1-12% at these same outliers. The relatively high percentages of #1072 suggests the possibility of undocumented #1072 sources along Lobo Mesa, or alternately, that unusual amounts were traded into this area. The high percentages of debitage and unutilized flakes at the Peach Springs community suggests that quantities of both #1080 and #1072 arrived in raw chunks or cores. A similar situation is indicated at sites 29SJ627, 29SJ633 and Pueblo Alto in Chaco Canyon, where raw material vastly outnumbers prepared tools (Cameron 1982).

Other lithic material types which were exchanged throughout the Chaco Basin include a variety of Morrison Formation (Brushy Basin) cherts, quartzites and claystones (#1020, #1022, #1040, #1430, #2201 and #2205). Some of the material identified as Pedernal chert (#1090, #1091) may also be intrusive; although this is uncertain since Pedernal-like chert also occurs in local Chaco Basin gravels. On the basis of the present samples (Appendix D, Table 1) the percentages of these materials at outliers and Chaco Canyon Chacoan structures are quite low and are thus of minimal value in documenting prehistoric exchange.

Presently, obsidian is documented at only seven basin outliers in very minor quantities (Appendix D, Table 1). In all instances the obsidians identified are either from the Jemez Mountain (Valle Grande-Redondo Peak, #3520) source or from Grants Ridge (#3510). Types #3530 (Polvadera Peak) and #3550 (Red Hill) are also documented from excavated sites in Chaco Canyon but are not represented in any of the outlier samples in appreciable quantities.

X-ray flourescence analyses of obsidian from Chaco Canyon excavations indicate that the Red Hill material may be more common in Chaco Canyon than previously supposed and, because of its visual similarity to the Grants Ridge material, may have been previously misidentified as Grants Ridge obsidian (Sappington and Cameron 1981). However, since the majority of the identifiable obsidian at Chaco Basin outliers and Chaco Canyon Chacoan structures appears to be Valle Grande-Redondo Peak material, rather than Grants Ridge (even though this source is substantially more distant than Grants Ridge), it is doubtful that much of the outlier obsidian is actually Red Hill. Similar dominance by the

Valle Grande-Redondo Peak obsidian is indicated in excavated samples from Chaco Canyon sites 29SJ633 and Pueblo Alto (Cameron 1982). Warren (1967:130) also implies that the #3520 obsidian is by far the most common in the Chuska Valley communities, with the Grants Ridge and Polvadera Peak varieties accounting for only minor percentages.

Considering the size of the surface samples obsidian frequencies are high at Haystack and El Rito. All three outliers are so close to the Grants Ridge source area (ca. 15-30 km) that obsidian could have been obtained directly by the community inhabitants. Although the obsidian from Haystack appears to be entirely from Grants Ridge, it is interesting to note that 7.5% of the El Rito obsidian has been identified as Valle Grande-Redondo Peak material (Allan and Gauthier 1976: Appendix F, Table 1), even though the center of the El Rito community is only 15 km from Grants Ridge. The type of obsidian represented at Casamero is unknown. Warren (1979:personal communication) suggests that the physical properties of the Jemez Mountain material are better suited for tool manufacture than the Grants Ridge material, a factor that may well be critical to understanding the wide distribution and possible preference for the former.

Although obsidian comprises a consistently low percentage of the total lithic assemblage at individual Chacoan structures and communities, the regionwide spatial distribution of the material identifies it as a lithic exchange material of some importance. Information from Chaco Canyon excavations (Cameron 1982) and from the Chuska Valley survey (Warren 1967) suggests that much of the exchange of obsidian involved large flakes, and, less frequently, prepared tools. Cores and debitage comprise only a minor portion of the assemblages.

In contrast to the Chaco Basin proper, outliers south of the basin are marked by a variety of major types of lithic materials. Much of this is certainly due to the spatial dispersion of the southern outliers, ranging from the Rio Puerco West to the Rio Puerco East, with each area having its own local materials. Haystack, Casamero, and El Rito form a close group where similarities may be seen. At these sites, from 56 to 88% of the sampled assemblages are cherts or chalcedonies. The substantial percentages of yellow-brown chert (#1072) at Haystack (13%), El Rito (28%), and Casamero (12%) are probably a function of proximity to the eastern Zuni Mountain source. Washington Pass chert (#1080) is present in small amounts at El Rito, but has not been identified at Haystack or Casamero. Silicified woods at all three sites comprise only a small percentage of the assemblages, possibly reflecting a lack of suitable local material.

At Guadalupe, Pippin (1979:96-99) indicates that much of the chert and chalcedony (75% of the early "Chacoan" lithic assemblage) resembles Pedernal chert but that most of it was probably derived from local gravels. Obsidian, represented by only two flakes (1%), is believed to be from the Polvadera Peak source (#3530).

Far to the west, at the other end of the southern outlier range, much of Roberts' (1932:145) jasper at the Village of the Great Kivas and Allantown could be yellow brown chert (#1072); but without examinaation of the collections, absolute determination is impossible. While sources of #1072 are documented only at the eastern end of the Zuni Mountains, the occurrence of the same geologic deposits along the length of Zuni uplift suggests #1072 could outcrop in a number of locations over a substantial distance. Other than obsidian, other non-local lithic material types are not identifiable at these sites.

Ceramics

As with lithic materials, ceramic samples were often limited to surface collections which may reflect certain occupational intervals more accurately than others. Late Pueblo II to Early Pueblo III ceramics are probably best represented and Early Pueblo II or Late Pueblo III material most poorly. The following discussion is oriented toward defining generalized ceramic patterns which appear at a substantial number of sites.

In addition to classification by ware and type, recent ceramic studies have recognized the importance of discriminating temper types to permit identification of the area of manufacture. In the San Juan Basin this is particularly true of trachyte temper which can be readily recognized by simple visual examination during preliminary classification. More detailed studies performed with the aid of a binocular microscope are also of great value in identifying other less conspicuous tempering materials.

Ware Identifications

Appendix D, Table 2 categorizes ceramics from outliers according to ceramic ware. As shown, outliers and associated communities north of the San Juan River are dominated by San Juan wares. Cibolan, Tusayan, and Chuskan wares are the most common intrusives; but at most northern sites these do not comprise more than 1-2% each and cumulatively only 2-3%, suggesting only minor ceramic exchange. Although quantified samples are not available for all the northern outliers, the relative percentages of the intrusives appear to vary with distance from the area of presumed manufacture. Cibolan and Chuskan wares, for example, appear most consistently at the southernmost outliers, while Tusayan wares occur more consistently and in greater numbers at the northern outliers in the Great Sage Plain, adjacent to the Tusayan ceramic areas of the lower San Juan. The most apparent exception to this overall distributional pattern is at Lowry Ruin, where "Cibolan" sherds comprise 16% of the early ceramics. As discussed earlier, however, Martin's (1936) classification of these sherds as Cibolan is probably unjustified in view of current identification practices. Most of Martin's Wingate Black-on-white would be classified today as local Mancos Black-on-white.

South of the San Juan River, Cibolan wares dominate the ceramic assemblages at all but Skunk Springs, Hogback, and Twin Angels. The dominance of Chuska series wares at Skunk Springs (80%) and other Chuska Valley sites is well documented (Peckham and Wilson 1965; Windes

1977a). Cibolan wares at Skunk Springs total 11%, similar to the percentage range documented for other Chuska Valley outliers (see Marshall et al. 1979). The dominance of San Juan wares at Twin Angels, and the co-occurrence of both Chuskan and San Juan wares at Hogback, reflect the nearness of both sites to the San Juan River and, in the case of the latter site, its position on the eastern periphery of the Chuska Valley. Similarly, the mixed ceramic assemblage of Grey Hill Springs is not surprising in view of its position intermediate between the southern Chuska Valley and the rest of the Chaco Basin. So, too, the mixed assemblage of Houck reflects its position peripheral to the Tusayan and Mogollon areas.

At the remainder of the Chaco Basin outliers as well as outliers southeast and southwest of the basin, intrusive wares of each tradition rarely account for more than 6-9% cumulatively, with the exception of Chuskan trachyte-tempered ceramics. Mogollon wares and Cibola wares from the Acoma and lower Rio Puerco East areas (categorized as "other") expectably are slightly more common at the southernmost outliers. Tusayan intrusives, although widespread, occur in little more than traces at most outliers. San Juan wares occur at a substantial number of both outliers and Chaco Canyon structures. They account for 1-6%, and largely reflect the appearance of McElmo and Mesa Verde Black-on-white. However, without detailed temper and paste analyses, the place of manufacture of these two types cannot be effectively determined (Toll et al. 1980).

Chuskan ceramics are variable in distribution and are represented by quantities which account for as much as 29% of the ceramic sample assemblage at some outliers and Chaco Canyon structures. A more detailed discussion of these is provided below.

Temper Analyses

As shown in Appendix D, Table 3 detailed temper analyses have been performed on samples from several outliers and Chaco Canyon Chacoan structures. Although only some portions of the San Juan Basin are relatively well represented, these samples do provide valuable information on the exchange of pottery made with two distinct types of rock temper, andesite/diorite and trachyte (sanidine basalt), that were used extensively in both painted and utility vessels (Judd 1954:234-238; Shepard 1939; Toll et al. 1980; Vivian and Mathews 1965; Warren 1967, 1976, 1977; Windes 1977a). Sandstone or sand/sherd tempers comprise a third class of tempering materials which may have future potential for analyzing ceramic exchange, but more work is necessary before areas of manufacture of these can be accurately delineated (Toll 1981; Toll et al. 1980; Warren 1976, 1977).

Andesite/diorite temper

Two varieties of igneous rock, andesite and diorite, were used extensively for temper in sherds north of the San Juan River. Both materials occur as float cobbles on terraces along the La Plata, Animas, and San Juan River Valleys (Shepard 1939:251-252; Toll et al. 1980). Enough is known about the geologic distribution of these tempering materials to distinguish those outliers where the raw material is clearly local from those where it is intrusive.

At the Salmon site, andesite/diorite tempers are present in over 90% of 26,877 culinary sherds examined for temper (Franklin 1979a, Appendix D, Table 3). Carbon and mineral black-on-white wares from this site are also predominantly tempered with local andesite/diorite (Franklin 1979b). Analysis of 18 carbon black-on-white sherds from Site 41 similarly revealed the presence of crushed andesite/diorite temper in 72% (Shepard 1939:275). The occurrence of these tempering materials in high percentages of the ceramics at sites within the area where the andesite/diorite occurs in terrace deposits leaves little doubt that the crushed rock tempered vessels were locally produced (Franklin 1979a, 1979b, 1979c; Shepard 1939).

While it is not possible to determine that vessels were actually manufactured in the immediate community, it is reasonable to assume this. Strengthening the assumption that crushed rock tempered vessels are local products are sherd refiring tests that show the clay of these sherds oxidizes the same color as local clays (Franklin 1979b, Shepard 1939:275). The fact that a substantial percent of the Site 41 sherds are buff-fired and Salmon sherds red-fired tends to indicate two local varieties produced in the vicinity of each site.

At the remainder of the sites represented in Appendix D, Table 3, sherds tempered with crushed andesite/diorite occur at Chacoan structures or at associated sites substantial distances from where the cobbles occur. In each instance, these sherds are believed representative of imported vessels. Such sherds occur at several of the outliers and associated small house sites in the northern and central portions of the Chaco basin, but the percentages are almost invariably low (1-4%), particularly where a more reliable and sizeable sample is present. One exception in Chaco Canyon is Chetro Ketl where 2161 andesite/diorite carbon painted sherds account for 15%. One possible explanation for this difference is that the Chetro Ketl sample may be slightly later (ca. 1150-1200) than the samples from other sites.

Basis for such an interpretation is provided by a recent temper study of late carbon ceramic types recovered during excavations at sites 29SJ633, 29SJ627, and Pueblo Alto in Chaco Canyon (Toll et al. 1980). The authors demonstrate that ceramic exchange with the San Juan area was increasing in the mid-1100's, and that this increased exchange brought a concomitant and substantial decrease in trade for Chuskan carbon ceramics. General agreement with this change in exchange patterns is suggested by the relatively high percentages of Chuskan carbons at the majority of the remaining outliers and Chaco Canyon structures documented in Appendix D, Table 3 if it assumed that these assemblages are earlier (ca. 1000-1125).

The lack of ceramic samples from northern outliers other than Salmon and Site 41 prevents analysis, but the locations of Site 39, Sterling, and Aztec within the andesite/diorite area suggests these sites are potential ceramic manufacturing sources for the influx of andesite/diorite tempered carbon pottery.

Trachyte Temper

Trachyte, or sanidine basalt, occurs primarily in the Washington Pass and Beautiful Mountain lava flows of the Chuska Mountains, and their respective drainage areas such as the Sanostee Wash. Cobbles of the basalt occur along the beds and terraces of Sanostee Wash to its junction with the Chaco Wash, and along the Chaco as far north as its junction with the San Juan River (Warren 1967:110-12, Windes 1977a: 286). Thus, as Windes has emphasized, trachyte temper and trachyte-tempered Chuskan vessels are locally available or native to the Chuska Valley and to the areas immediately west of the Chaco River and north to the San Juan River.

At the Salmon site, trachyte-tempered sherds total approximately 7% of the culinary sherds in a sample reported by Franklin (1979a and Appendix D, Table 3 herein). Franklin also notes that in some of the early Chacoan strata at Salmon, trachyte-tempered Chuska sherds comprise as much as one-third of the culinary pottery. Although the lack of temper analyses at other northern San Juan sites prevents comparison visual analyses do indicate the presence in minimal quantities of both carbon and culinary trachyte-tempered wares at Site 39 and Site 41 (McKenna 1976). Vivian (1959) similarly reports trachyte-tempered culinary pottery from the Hubbard Mound at Aztec, a site occupied contemporaneously with the Aztec West Ruin. This apparent widespread distribution of trachyte-tempered pottery probably will be extended to most San Juan River area outliers, once further temper investigations are performed.

Documentation of variability in temper types over the occupational span of northern sites such as Salmon, Aztec, and others should be particularly instructive with regard to the suggested dominance of andesite/diorite tempered ceramics. Increasing use of locally made andesite/diorite vessels is one possible explanation for the noted decrease in intrusive trachyte-tempered Chuskan vessels at Salmon over time.

The occurrence of trachyte-tempered pottery is better documented at sites in the Chaco Basin where it occurs in quantities from 1-38% (Appendix D, Table 3). Comparing these with the data on ceramic wares (Appendix D, Table 2), it is apparent that where trachyte-tempered ceramics occur in appreciable quantities, graywares account for the great majority of trachyte-tempered sherds and are clearly a major import item. Carbon and mineral painted trachyte-tempered sherds probably account for much lower percentages of the assemblages.

Examination of Appendix D, Table 2 and 3 suggests that trachyte-tempered wares are less frequent at Chacoan structures and associated community sites southwest of Chaco Canyon and along the southern perimeters of the Chaco Basin. Higher percentages are documented at Kin Klizhin (10%) and Kin Bineola (22%) (Appendix D, Table 2) which are located more directly in the exchange path between the Chuska Valley and Chaco Canyon. Within the canyon, the highest percentages of trachyte-tempered ceramics are documented for Penasco Blanco, Pueblo Alto, Pueblo Bonito, Chetro Ketl, and Pueblo del Arroyo, with a range of 21-29%. These very comparable sample percentages contrast with a much lower representation of Chuskan ceramics at Tsin Kletzin (5%).

Because most of the Appendix D, Table 2 samples are from surface contexts reflecting mixed Late Pueblo II - Early Pueblo III depositions, particularly long temporal spans are not represented. Therefore, it is not generally possible to observe changes in the frequency of trachyte-tempered vessels over time. In Chaco Canyon, however, Shepard's (1939) pioneering study of sherds from stratigraphic tests excavated by Judd at Pueblo Bonito indicates increasing amounts of trachyte-tempered ceramics through Pueblo II deposits, with their peak occurring during Late Pueblo II and Early Pueblo III. Temper analyses of ceramics from site 29SJ627 and Pueblo Alto in the Canyon substantiate this increase of trachyte-tempered ceramics over the same time period (Toll 1980:personal communication). Whether a parallel increase in frequency occurs at the outliers in the central basin is unknown.

To the south of the Chaco Basin the lack of systematic temper identification prevents assessment of trachyte occurrence at outliers on the Rio Puerco West and the Rio San Jose. No trachyte was found in ceramics from Pippin's excavations at Guadalupe on the Rio Puerco East. It is our impression that only negligible quantities of trachyte-tempered ceramics are present at the remaining southern outliers.

The major sources of trachyte-tempered vessels can be narrowed to several large Pueblo II - Pueblo III communities in the Chuska Valley, including Skunk Springs, Newcomb and Tocito (Figure 1). Depletion of timber resources needed for pottery firing may have increasingly restricted ceramic manufacture at some of these communities, perhaps aiding the shift to reliance on northern ceramics.

Summary

In the preceding pages an attempt has been made to identify intrusive lithic and ceramics materials, their natural source areas, and their geographic and temporal distribution to the extent allowed by incomplete and sparse data.

Of the half-dozen lithic material types that appear to have been exchanged, obsidian, though often present in only small quantities, is the material that appears to have most potential for ubiquitous distribution among the outliers investigated. Obsidian from the Valle Grande-Redondo Peak source in the Jemez Mountains is the most widely distributed of the known sources and may also have been the most frequently used obsidian.

Other intrusive lithic materials with sources occurring nearer the economic range of communities with Chacoan structures do not have as wide a geographic distribution as obsidian but generally are present in greater quantities. Washington Pass chert, with its source in the central Chuska Mountains, is represented in samples throughout the western and central portions of the Chaco Basin, with minor frequencies at sites on the northern and southern basin perimeters. It is most common at communities in the Chuska Valley (where it is by our definition an intrusive material but is within extended collecting range) and in Chaco Canyon. Yellow-brown chert (with a known source in the eastern Zuni Mountains) is distributed throughout the Red Mesa Valley (again as an intrusive material but within extended collecting range) and much of the Chaco Basin. Remaining lithic types, including Pedernal chert and a variety of Brushy Basin materials, are present in small quanti- ties at a limited number of outliers. Larger samples and better documentation of the source areas of the latter materials will be required before a better perspective on their occurrence, importance, and distribution will be realized. At present it is often difficult to determine whether these are local or intrusive types.

San Juan, Chuskan, and Cibolan tradition ceramic wares are indigeenous to certain portions of the area encompassed by outliers; but they occur as intrusives in other portions, along with Tusayan, and Mogollon wares. Temper analysis, complemented by paste studies, indicate that San Juan andesite/diorite-tempered ceramics are indigenous to the San Juan River Valley and its major tributaries. Vessels tempered with these igneous materials occur in relatively minor percentages as intrusives throughout the eastern and central portions of the Chaco Basin. More substantial percentages are indicated during the late 1100s and early 1200s by excavation data from Chaco Canyon. These data suggest a shift to greater reliance on northern manufactured ceramics with a concomitant decrease in Chuskan trade wares (Toll et al. 1980). The limited geographic distribution of andesite/diorite cobbles in the San Juan River area suggests that ceramics tempered with them may eventually be identified as intrusives at more westerly and northern San Juan sites.

Trachyte-tempered vessels manufactured in the Chuska Valley are major intrusives in the central and eastern portions of the Chaco Basin, particularly Chaco Canyon. They occur in minor quantities at communities along the southern periphery of the Chaco Basin and in the San Juan and La Plata River Valley communities. Exchange of trachyte-tempered vessels is documented as far back as late Basketmaker III - Early Pueblo I times, but the greatest volume of exchange appears to have occurred during Pueblo II and Early Pueblo III (Toll et al. 1980).

The lack of ceramic and lithic samples from some outliers and associated communities, the lack of temporal refinement, and in some instances the questionable validity of small samples, serve to limit our analysis of exchange at the regional level. However, the available data do suggest exchange distribution patterns that could be tested in the future by comprehensive, temporally-controlled sampling designs.

When the known distributions of the major lithic and ceramic exchange materials are compared, it appears that certain of these exchange items may be related to the major road systems defined earlier. Yellow brown chert (#1072), for example, occurs in highest percentages at Southeast road outliers near its known Zuni Mountain source (Table 42). At outliers associated with other road systems, as well as at major Chaco Canyon structures, the mean percentages of yellow-brown chert are much lower (with the notable exception of the Peach Springs-Standing Rock-Muddy Water outliers). As mentioned earlier, these high percentages at the latter sites could indicate a Lobo Mesa source for #1072.

The distributions of Washington Pass chert and trachyte-tempered ceramics are apparently similar. Both sources are in the Chuska Valley, and Skunk Springs is the nearest outlier in our sample. A comparison of the percentages of trachyte-tempered ceramics and Washington Pass chert at Skunk Springs with other West and (conjectural) Northwest road outliers shows a substantial drop-off for both exchange items (Tables 43 and 44). Even lower percentages are encountered at outliers associated with other road systems. At Chaco Canyon some continued drop-off for trachyte-tempered ceramics is indicated, but there is a definite resurgence of Washington Pass chert.

In general, the spatial and quantitative distributions of all three of these exchange materials indicate that the highest percentages occur in areas where the materials are local (≤10 km) or available within a relatively short distance. Intrusive materials remain high in frequency at outliers within the same road system as the source outlier when compared to those associated with other road systems (Tables 42, 43, and 44). It is also evident that the highest percentages and most consistent occurrences of intrusive items outside the source system are in contiguous systems, such as the Northwest and West roads, rather than between non-contiguous, spatially-distant road systems. It should be remembered, however, that not all outliers in all road systems were sampled and that some portions of the San Juan Basin are very poorly represented (e.g., Great Sage Plain, Chuska Valley).

In Chaco Canyon, representation of one exchange item (#1072) is lower than elsewhere. However, Washington Pass chert occurs in higher percentages here than elsewhere, while trachyte-tempered pottery occurs more frequently in Chaco than at outliers associated with other, non-source road systems.

The higher percentages of intrusive items at outliers associated with, or contiguous to the source road system, and the higher percentages in some instances at Chaco Canyon Chacoan structures suggest that exchange items may have been funneled along the roads and that the road systems therefore have integrity as exchange corridors. If exchange occurred only between sites in the vicinity of the source area, we would not necessarily expect higher percentages for more distant outliers in the source road system compared to outliers outside the source road system. Nor would we expect the substantial percentages of #1080 and trachyte-tempered ceramics in Chaco Canyon, given its distance from those source areas.

Table 42 Yellow-brown chert (#1072) distribution in different system areas[1]

Source-West Road

	#	%
Skunk Springs	66	34

West-Northwest Roads

	#	%
Hogback	4	11
Kin Klizhin	4	11
Kin Bineola	7	6
Standing Rock	6	3
Peach Springs	92	4*
Grey Hill Springs	11	13**

n = 6
Mean = 8%
Std. Dev. = 4

Chaco Canyon

	#	%
Penasco Blanco	31	4
Pueblo Alto	37	23
Pueblo Bonito	175	44
Chetro Ketl	125	55
Tsin Kletsin	13	12
Una Vida	9	6

n = 6
Mean = 24%
Std. Dev. = 21

Sites associated with other road systems

	#	%
Salmon	448	1
Pierre's	2	-*
Bis sa'ani	2	-*
Pueblo Pintado	7	2
Upper Kin Klizhin	0	-
Bee Burrow	11	6*
Kin Ya'a	1	1
Muddy Water	10	12
Haystack	0	-
El Rito	4	1*

n = 10
Mean = 2%
Std. Dev. = 4

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1 - For purposes of this table, it has been assumed that outliers with no known road associations are components of the nearest known road system. Chacoan structures or community sites with samples of less than 30 lithic specimens have not been included unless combined with samples from other sites associated with the outlier.
* - Includes all samples from Chacoan structures and associated community sites.
**- Samples from LA 18239 and 18243, two small house sites, associated with Grey Hill Springs Chacoan structure.

Table 43 Washington pass chert (#1080) distribution in different system areas[1]

Source-West Road

	#	%
Skunk Springs	350	80

West Road

	#	%
Hogback	53	60
Grey Hill Springs	75	31*
Kin Klizhin	15	10
Kin Bineola	56	20
Peach Springs	27	14*

n = 5
Mean = 27%
Std. Dev. = 20

Chaco Canyon

	#	%
Penasco Blanco	64	28
Pueblo Alto	58	23
Pueblo Bonito	142	23
Pueblo del Arroyo	419	28
Chetro Ketl	127	21
Tsin Kletsin	15	5
Una Vida	27	15

n = 7
Mean = 20%
Std. Dev. = 8

Sites associated with other road systems

	#	%
El Rito	1	2
Haystack	0	-
Muddy Water	0	-
Bee Burrow	1	-
Upper Kin Klizhin	4	4
Twin Angels	20	3
Site 41	4	-
Site 39	32	1
Casamero	1	1
Salmon	2160	1
Pierre's	26	16
Bis sa'ani	32	38
Pueblo Pintado	64	7
Kin Ya'a	2	-

n = 14
Mean = 5%
Std. Dev. = 10

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1 - For purposes of this table, it has been assumed that outliers with no known road associations are components of the nearest known road system. Larger and more reliable samples in Appendix D, Table 2 have been chosen over those in Appendix D, Table 3 where possible.

* - Value presented is a cumulative figure including Chacoan structure(s) and selected associated sites.

Table 44 Trachyte tempered ceramic distribution in different system areas[1]

Source-Southeast Road

	#	%
Casamero	16	12
Haystack	10	13
El Rito	75	28*

n = 3
Mean = 18%
Std. Dev. = 9

Chaco Canyon

	#	%
Penasco Blanco	3	1
Pueblo Alto	1	1
Pueblo Bonito	10	3
Chetro Ketl	2	1
Tsin Kletsin	7	6
Una Vida	1	1

n = 6
Mean = 2%
Std. Dev. = 2

Sites associated with other road systems

	#	%
Hogback	0	-
Pierre's	7	1*
Bis sa'ani	7	1*
Muddy Water	28	33
Pueblo Pintado	4	1
Upper Kin Klizhin	2	5
Kin Klizhin	1	3
Bee Burrow	17	9*
Kin Bineola	4	3
Standing Rock	24	14
Kin Ya'a	17	10
Peach Springs	468	22*
Grey Hill Springs	8	9**
Skunk Springs	0	-

n = 14
Mean = 8%
Std. Dev. = 10

1 - For purposes of this table, it has been assumed that outliers with no known road associations are components of the nearest known road system. Chacoan structures or community sites with samples of less than 30 lithic specimens have not been included unless combined with samples from other sites associated with the outlier.
* - Includes all samples from Chacoan structures and associated community sites.
**- Samples from LA 18239 and 18243, two small house sites, associated with the Grey Hill Springs Chacoan structure.

7

SUMMARY AND FINAL COMMENTS

Utilizing data from three intensively surveyed outliers and 33 other outliers documented by field reconnaissance and existing archaeological literature, this study has examined a regionwide sample of Chacoan structures from the San Juan Basin. Chronology, environment, morphology and architecture, settlement pattern, and exchange of lithic and ceramic materials have been analyzed as aspects of the prehistoric social system addressable with survey data.

To summarize briefly, substantial clusters of contemporaneous Anasazi sites, termed communities, are recognized from Basketmaker III (ca. 500) through late Pueblo III (ca. 1300). Prior to early Pueblo II, small houses and a great kiva are the major site types comprising these clusters, but by about 900-975 larger structures termed Chacoan structures first appear. These become a standard feature of substantial population clusters by about 1130, the last decade with known construction. The singularity, greater size, and distinctive morphology and architecture of Chacoan structures, compared to the small houses, clearly identifies them as prominent structures within the community. This prominence is supported by their location within high-density site clusters and their association with prehistoric roads by which inter-community linkage was achieved between outlying areas and Chaco Canyon itself. Although the specific functions of Chacoan structures remain conjectural, it is proposed that the largest structures may have been residences of local elite, as well as regional or sub-regional administrative and exchange centers. If so, the appearance of these sites signals the formal participation of individual communities within an extensive regional system, as well as the emergence of a ranked society.

Analysis of present, as well as past, San Juan Basin environments, indicates a great deal of variability both in annual precipitation and in the relative suitability of environments throughout the basin for agrarian populations. Based on examination of ecological diversity within a 10 km radius of each outlier, the most suitable areas appear to be the Chaco Basin peripheries and areas to the north (San Juan River and tributaries, Great Sage Plain) and south (Rio Puerco East and West, Rio San Jose). Areas in the central and eastern portions of the Chaco Basin, including Chaco Canyon itself, appear to be less suitable and have less effective ecological diversity.

Substantial population growth and over-exploitation of a limited resource base (particularly in Chaco Canyon) by population clusters in the semi-arid, central portions of the Chaco Basin, may have provided the impetus for the emergence of formalized exchange by about 900 as a means of buffering environmental perturbations and obtaining resources unavailable locally. Although the exact mechanisms of this exchange are not currently understood, particularly with respect to the goods or services that Chaco Canyon provided in return, documentation of several major road systems interlinking outliers with the Chaco Canyon communities indicates that the area integrated by the system was large and diverse. Few prehistoric roads have been defined beyond the edges of the Chaco Basin; thus the extent of interaction with the most distant outliers is unknown, although some integration is probable.

It is apparent that the known roads transect a variety of environments, ultimately leading from Chaco Canyon to ecologically diverse areas on the periphery of the Chaco Basin. This divergent pattern of "road systems" appears quite efficient since it selects for maximum resource diversity and is not dependent on a single source area or resource system. Examination of the spatial distribution of exchanged lithic and ceramic materials suggests that outliers and road systems funneled goods to the central Chaco Basin, and to Chaco Canyon specifically, as indicated by the higher percentages of some exchange materials there.

That Chaco should be a "magnet" for intrusive goods is not surprising in view of the arguments made for it as the center of the road system and as a marginal environmental area with little effective ecological diversity. However, the relatively high percentages and diversity of key lithic and ceramic exchange items at Chaco Canyon structures, in contrast to the substantially lower percentages and less diversity at some outlying communities, suggest that the canyon sites may not have functioned effectively as redistribution centers.

Given the generally lower percentages of intrusive items at many outliers not associated with a given source-road system, we would question whether many of these items derived from one road system, yet found in another, are the result of formal redistributive exchange through the Chaco Canyon centers. Instead this may result from more direct exchange between spatially proximate communities of different systems. Roads linking different systems are not seen as necessary to this exchange, although one such road has been documented. Such exchange may have been organized on a reciprocal basis between actual or fictive kinship relations. Undoubtedly, some exchange items did pass through Chaco Canyon enroute to outlying locations, as borne out by the occurrence of yellow-brown chert at Pierre's site and trachyte-tempered ceramics at Bis sa'ani; yet the nearness of both of these communities to Chaco precludes a test of the latter's redistributive role. Given this and the small percentages involved, all of the exchange could have been reciprocal.

Previously, it was suggested that Canyon sites such as Pueblo Alto (North Road), Penasco Blanco (Northwest Road), Pueblo Bonito and/or Chetro Ketl (West and Southwest roads), and Una Vida (Southeast Road), may have functioned as administrative centers and entry points to the canyon for their respective road systems. If so, one might expect the highest percentages of trachyte-tempered ceramics to occur at Penasco Blanco, the postulated entry point and administrative center for the Northwest Road system and Chuska Valley imports. In fact, only one other Chaco Canyon structure sampled (Pueblo del Arroyo) has a comparably high percentage (28%) of trachyte-tempered sherds. However, Washington Pass chert at Penasco Blanco shows the lowest percentage (4%) of any of the Chaco Canyon structures sampled. In turn, yellow-brown chert at Una Vida, the supposed entry administrative center for the Southeast Road, amounts to only 1%, a figure which is comparable to, or less than, that at other sites.

Continuing this hypothesis, the highest overall percentages of all intrusive materials might be expected to occur at the centralized and hierarchically pre-eminent structures of Pueblo Bonito and Chetro Ketl. Here again, the data are somewhat equivocal (Table 44). Trachyte-tempered ceramics occur at both these sites in percentages comparable to those at three other Chaco Canyon Chacoan structures (Penasco Blanco, Pueblo Alto, Pueblo del Arroyo) but are substantially higher than the percentages at two others (Una Vida and Tsin Kletsin). With respect to Washington Pass chert, however, the percentages at Pueblo Bonito and Chetro Ketl are far above those of the other sites sampled. Thus, while there are some data to substantiate the hypothesis, other data do not support it. Clearly much more work must be done.

From the temporal standpoint, it is apparent that exchange was ongoing from the inception of the sedentary agricultural adaptation within the San Juan Basin if not before. Early exchange may have been entirely reciprocal as Judge (1979) postulates; but given environmental limitations of the Canyon area, as well as resource depletion and the long distances to areas of substantial environmental diversity, Chaco may have been forced to establish a more formal exchange mechanism. Linkage of canyon Chacoan structures to distinct areas on the basin periphery certainly had occurred by Early Pueblo II. Exchange with spatially separate periphery outliers would seem to be an extremely efficient means of capitalizing on the potential range of environmental and resource diversity. Given interaction with such a wide range of outliers and the unpredictability and variability of annual precipitation, the Chaco Canyon sites would appear to have had substantial potential for emerging as major exchange centers.

The fact that exchange items such as ceramics and lithics do not appear to have been redistributed in quantity does not necessarily indicate that food and other potential exchange items were similarily consumed rather than redistributed. This must be considered, however; and it poses the question of what goods or services the Chaco Canyon centers may have provided in return for consumed items.

One possibility is that actual construction of outlying Chacoan structures and great kivas was performed in exchange for resources. Another is that the acquisition and distribution of exchange items occurring less frequently in the archeological record, such as obsidian, salt, cotton and turquoise (none of which have known source areas within the San Juan Basin), could have been administered by a Chaco elite. Use of some of these latter items as symbols of status and ceremonial sanctification would have served to promote regional integration, as well as to maintain exchange flows and relationships, even when subsistence oriented goods were not being exchanged (Flannery 1968; Parsons and Price 1977:180-183; Toll 1978:40-43). If Chaco Canyon was a storage and exchange point for some internally and externally derived goods, marketplace exchange may eventually have been established as well (Toll 1978).

While initiation of formal exchange is proposed to have been one major response to increasing population and scarcity of key resources in the central Chaco Basin, other modes of "intensification", agricultural as well as social, have been recognized (Grebinger 1973; Judge 1979; Toll 1978:48-66; Vivian 1970a, 1970b). Agricultural intensification, in the form of large water control systems (Vivian 1972), and social intensification in the form of greater social control for greater labor output, must be viewed along with increasingly formal exchange as interacting, symbiotic elements, which positively reinforce each other and result in increasing cultural complexity (Flannery 1968). As Toll emphasizes, these types of intensification are "enablers" for each other; agricultural intensification probably cannot proceed without social adjustments to produce more labor and cooperation "and at least some forms of exchange are to a degree reliant on the first two types of intensification" (1978:49). Thus, although little attempt has been made here to explore the relationship of agricultural and social intensification with the development of formal exchange, a symbiotic relationship is assumed with exchange figuring prominently in the appearance of an initial settlement hierarchy in the 900-975 interval. Subsequent development to a multiple-level settlement hierarchy by the twelfth century, with comcomitant social differentiation, must be seen as a result of increasing exchange, agricultural, and labor management needs, all progressively amplified by increasing population. Self enhancement and perpetuation of roles by the elite undoubtedly also played a substantial role in increasing social complexity.

Although economic, political and ceremonial interaction between the Chacoan structures would have been crucial to the canyon's emergence as a regional center, it does not seem necessary to assume that the regional system was originally controlled and administered by any single elite group resident in a single structure. The eventual emergence and control of the road and outlier system should be seen as an evolutionary development, taking place perhaps relatively late as the ranked social system matured. In fact, fluctuations in the volume of exchange items from different outlying road systems may reflect in part the ebb and flow of elite power at the respective Chaco Canyon structures.

Settlement data, site size, and morphological and architectural characteristics point to hierarchial relationships at the community, road system (i.e., sub-regional), and regional levels. Chacoan structures in the small size range are identified as lowest level or third-order sites, probably the administrative-exchange centers for individual communities since they appear to be hierarchially super-ordinate only to their own community small house sites. The group of medium Chacoan structures with relatively centralized locations (in or near Chaco Canyon) is much smaller in number but marks higher, secondary level sites that are proposed to have been occupied in part by higher status individuals who were charged with administrative functions over all communities within specific outlying road systems. The location of a number of these sites at entry points to Chaco Canyon suggests that they may have controlled movement of goods on roads and supervised canyon-outlier interchange, including resource exchange as well as political and ceremonial interaction.

The implementation and coordination of exchange and interaction in Chaco probably facilitated the evolution of ranking there and eventually, perhaps during the late eleventh and certainly by the early twelfth century, a third hierarchical level may have evolved, with control of the entire regional system assumed by the elite of one or two Chaco Canyon structures. These sites were probably Pueblo Bonito and/or Chetro Ketl, as indicated by their great size, central location, and probable interchange position with respect to all incoming roads.

The great size of Aztec and Salmon Ruins, the largest sites outside the Chaco Canyon area, is indicative of the of the emerging prominence of the northern San Juan area late in the evolution of the Chaco system. This is supported by northern influence on Chaco Canyon ceramics as seen both in increasing exchange and popularity of northern ceramic techniques and designs (Toll et al. 1980). These factors and the tremendous build-up of outliers in the north during the 1075-1130 period raise the possibility that by the end of this interval the San Juan area was rivaling Chaco Canyon in importance and influence as a regional center.

The 50-year summer precipitation drought from 1130 to 1180 probably affected communities throughout the San Juan Basin, but the effects of such a drought could have been most severe in the central Chaco Basin where even minor reductions in precipitation may have destroyed crops. On the other hand, the perennial water sources of the San Juan area would have lessened the effect of such a drought there. If Chaco Basin communities were at that time dependent to any extent on northern food crops, a cut-off of food exchange to the south may have been all that was necessary to effect the decline of Chaco Canyon and the Chaco Basin portions of the system. The complete lack of Chacoan structure construction subsequent to the drought, the abandonment of sites at many outliers, and in some instances probable abandonment of entire outlying communities, leave little doubt of the demise of the Chacoan-based system by the late 1100s or early 1200s. Integration of some San Juan area outlier communities into a new northern system may have occurred during the mid-1200's, with some more favorable localities in the Chaco Basin also occupied, but supporting reduced populations.

The aspects of the Chaco Canyon based regional system discussed here have produced preliminary, tentative results which are limited both by the quantity and quality of existing data. However, archaeological survey, which is the means of basic data recovery here, would appear to be the only feasible manner in which future studies can address archaeological problems of regional magnitude. While it is certainly conceded that the kinds of analyses and anthropological conclusions that can be drawn from the surfaces of archaeological sites are limited, the creativity of the survey archaeologist in collecting data, proposing hypotheses, and arriving at conclusions is the ultimate key to understanding regional systems.

APPENDIX A: CERAMIC ANALYSIS

by

Stephen H. Lekson

Goals

The requirements for ceramic analysis at each site or survey area are listed below:

1) Produce evidence of occupation approximately contemporary with the Pueblo II-III (ca. 900-1220) sites in Chaco Canyon.
2) Establish similarity of all or part of the ceramic assemblage at the surveyed site to Chaco series types.
3) Temporal identification of earlier or later occupations at each site; particularly, occupations immediately preceding or following (1) above.
4) Produce general summaries or characterizations of observed ceramic assemblages in surveyed areas.

Limitations and Methods

Two pragmatic considerations severely restricted the type of analysis that could be employed. First, no collections were to be made. Second, a minimum amount of time was to be spent recording sites.

Several forms of analysis were available to deal with ceramic materials in the outlier survey; these included the standard typology, some form of attribute analysis, and Roberts' (1927) design-based classification of ceramics from several of the larger sites at Chaco Canyon.

Typology for Chaco decorated and utility wares has a long-standing tradition of taxonomic confusion. Types are not well defined, although several (occasionally conflicting) systems exist (Cibola White Ware Conference [1958]; Hawley [1936]; Olson and Wasley [1956]; Vivian and Mathews [1965]; Wendorf and Lehmer [1956]; Windes [1977a,1978a], among others; as well as Hayes' typology from the Chaco survey and the preliminary sorting classifications of the Chaco Center, both unpublished). Ceramic series from regions surrounding the central Chaco area (and expected in the survey) range from well defined (Peckham and Wilson [1965], and Windes [1977a] for the Chuska Valley; Abel [1955] and Breternitz et al. [1974] for the San Juan River Valley) to described (Hargrave [1964] for the Prewitt district; Gladwin [1945] for the Red Mesa Valley) to unknown (in the upper Chaco, Torreon, and Arroyo Chico drainages). Altogether, the types presumed indigenous to the Chaco drainage and surrounding areas are very numerous and quite variable in degree of definition. Moreover, the practicality of the standard typology in noncollecting situations is questionable. For these reasons, the standard typology was not used.

Some form of attribute analysis -- more as a substitute for the standard typology than an approach to a specific problem -- was considered. A comprehensive attribute analysis (e.g. Bennett 1974) is clearly unsuited to rapid field assessment, and careful selection of relevant attributes would be required. Such an approach would require a broad, analytical review of the region's ceramics prior to the formulation of attributes. Time was not available for such a study which might have eclipsed the actual survey analysis in scope and results. In short, attribute analyses appeared to be more powerful, and more time consuming, than the ceramic goals for the survey required.

The most easily observed, and perhaps the most indicative, aspect of decorated ceramic types is, of course, design. While design or design styles lack the temporal and geographic precision of standard types, a review of the typological literature suggested that design styles in ceramic assemblages might have analytical utility in the chronological assessment of surveyed sites. The addition of paint type and presence or absence of polishing as ancillary observations appeared to produce a workable analytical framework to approach the goals for the ceramic analysis within the limitations outlined above. Finally, it was clearly possible to develop such a framework before the field portion of the survey began; therefore, a design-style based framework was selected for the outlier survey ceramic analysis. As described below, Roberts' (1927) classifications appeared somewhat too limited in temporal and geographic range and, naturally, did not include typologic divisions made by later workers. Using Roberts as a general guide, an expanded series of styles was defined for use in the survey operations.

It was not anticipated that every sherd would be examined at any site. At a few smaller sites, nearly all sherds were observed and recorded; however, at most sites, only a small fraction of the surface ceramic material could be examined. An approximation of the composition of the ceramic assemblage, based on a large areal sample of the site, was felt to be more useful than a numerically accurate record of a fractional sample of sherds representing a very limited area of the site (and perhaps, assemblage). For this reason, numerical accuracy was deemphasized; and at sites with large numbers of ceramics, the percentage composition of ceramic assemblages at each site was estimated. As often as possible, this estimate was based on numerical data from one or more transect samples; but in every case, the percentages represent the author's estimations, either directly, or secondarily (i.e., estimations of the validity of transect tabulations compared to other portions of the site). Confidence in these estimates should decrease as the estimated total number of sherds increases; and all percentage composition data obtained during the survey should be treated as very approximate, perhaps conveying slightly more information than a rank ordering of the same material. (Note: Subsequent to this writing

Powers decided to present ceramic frequencies, instead of percentages in Appendix B, Tables 4, 5, and 6, since at sites with a very small number of sherds, the percentages could be misleading. Thus at those sites where only percentages were originally tabulated, approximate frequencies have been calculated from the percentages.)

At several reconnaissance sites, non-ceramic information was recorded very quickly. To avoid delay, ceramic data on these sites were limited to presence and abundance of styles and types.

Varying terrain and artifact deposition (as represented by surface density) affected areal sampling tactics. The total number (estimated) of sherds varied greatly among the Bis sa'ani, Peach Springs, and Pierre's survey areas; and to a much lesser extent, the number of sherds varied among sites within each of these areas. While the estimated total number of sherds at each area is certainly inaccurate, the difference in the magnitude of the estimates offers a reasonable index of the mass of ceramic material available. At Bis sa'ani, this estimate was 5,000 sherds, while Pierre's may have had 250,000 sherds; and at Peach Springs at least 1,000,000 sherds were present.

In the Bis sa'ani area, sites were characterized by small numbers of sherds (about 150 sherds at each ceramic site) in low density scatters over a relatively small area. Pierre's sites generally had a large number of sherds (about 10,000 per site) in moderate densities over large areas of steep slope. Sites in the Peach Springs area had very large numbers of sherds (about 15,000 per site) concentrated in trash mounds.

The observation of a maximum number of sherds in a broad areal sample of each site, within a limited time, required the use of three sampling tactics. On relatively small scatters of dispersed (low density) material, such as at many Bis sa' ani sites, an attempt was made to examine sherds in every part of the site and, hopefully, every sherd on the site. On large scatters of dispersed material, such as Pierre's sites, the site area was sampled with transects walked at intervals of 2-3 m, generally examining only those sherds larger than 4-5 cm (greatest dimension). At large dense scatters, such as the trash mounds at Peach Springs, one or more transects, each about 1 m wide, were used; and every sherd larger than 2 cm (approximately) was recorded within them. The remainder of large dense scatters was walked in 2 to 3 m interval transects to note presence or absense of styles and types and to confirm the general representation of the first transect(s). In all cases, it was necessary to examine both sides of every sherd. This required the temporary removal of sherds; however, they were replaced as closely as possible to their original positions.

Design Styles

The concept of design styles is defined in Colton and Hargrave (1937). Although the first major study of Chacoan ceramics utilized design styles for its basic organization (Roberts 1927), subsequent work has emphasized the standard Southwestern typological approach. Design styles have been used (Wendorf and Lehmer 1956:xv) or discounted (Hargrave 1964:28) in typological studies of Chaco area ceramics; however, to the author's knowledge, no formal study of design has been carried out in this region since Roberts' work until Washburn's (in progress) symmetry analysis. Research subsequent to Roberts work suggests that Roberts design classifications may not cover the entire temporal or geographic range expected within the outlier survey area.

After a review of the ceramic literature, decorative aspects of expected types were extracted and -- so far as possible -- synthesized in a series of "styles," some of which were previously defined in the literature and some of which were created or bent for the purposes of this survey. References will be given to illustrations in readily accessible publications which typify what the author had in mind for each style.

Temporal spans for each style were given in terms of the Pecos Classification system as adapted by Hayes (1981) from the survey of Chaco Canyon. These estimates, based on available literature and discussions with other workers, are very preliminary. They are intended less to define temporal span of a style as an entity than the occurrence of that style on the expected types in the survey area. The ware styles are defined as follows:

Utility Wares

Utility (non-decorated) sherds were classified by styles of surface treatment. Almost all utility sherds were of gray wares; however, a few plain brownware sherds were observed at sites in the Peach Springs area.

Plain gray: Plain gray included all non-polished pieces on which all coiling had been obliterated. This class would include any of the established plain utility types, lower portions of neck or shoulder textured types, etc. Plain gray has no particular value as a temporal indicator after Pueblo I.

Banded gray: This includes a clapboard or neck banded types such as Kana-a Gray (Hawley 1936), Tohatchi Banded (Olson and Wasley 1956:Figure 260), and Mancos Gray (Breternitz et al. 1974:Figure 6).

Ribbed gray: This refers to narrow, semi-cylindrical coils, as on the exterior of Los Lunas Smudged (Mera 1935:Plate XVI, upper two rows).

Pueblo II corrugated: This refers to Hawley's Exuberant Corrugated (Hawley 1939:50, Plate 8) renamed Tseh-so Corrugated (Hargrave 1964:35) and other types showing very high indentation relief and relatively wide coils (see also Olson and Wasley 1956:Figure 243).

Pueblo II/Pueblo III corrugated: This includes such types as Chaco (Hawley 1936), Coolidge (Olson and Wasley 1956:371, Figure 243), Blue Shale (Peckham and Wilson 1965), and Mancos (Breternitz et al. 1974) corrugated, and other types of generally medium coil width and relatively low indentation relief.

Pueblo III corrugated: This refers to corrugated types with medium or narrow coils, partially smoothed, and with very low indentation relief. This class would include parts of Hunter Corrugated (Peckham and Wilson 1965) and Mesa Verde Corrugated (Breternitz et al. 1974). (See also Rohn [1971:Figure 163, upper two rows]).

As the names of the corrugated classes might suggest, corrugated styles represent three divisions of a continuous range of stylistic variation. Pueblo II and Pueblo III classes were used restrictively; that is, only sherds with very high indentation relief were classified as Pueblo II, while only sherds with very low indentation relief were classed as Pueblo III. All sherds that were not clearly Pueblo II or Pueblo III types were classified as Pueblo II/Pueblo III corrugated.

Black-on-white ware

Black-on-white wares included plain white sherds, and sherds decorated in mineral or carbon paint on a white background.

Plain white: This includes all polished whiteware sherds without decoration or with fragments of designs too small to be classified (e.g. single lines, small portions of solid geometrics, etc).

Basketmaker III/Pueblo I style: This class is actually composed of several styles which characterize such early types as Chapin and Piedra Black-on-whites (Breternitz et al. 1974), La Plata Black-on-white (Hawley 1936), Lino Black-on-gray (Colton 1955), San Marcial Black-on-white (Mera 1935), and some Kiatuthlanna Black-on-white (Gladwin 1945) designs. These styles will not be described here. For this survey, it was sufficient that these types could be segregated in a single class indicative of a Basketmaker III or Pueblo I time period.

Kana-a style: This style is characterized by multiple fine lines paralleling the outline of angular solid elements, generally pendant from the rim of the vessel. The style appears on Kana-a Black-on-white (Colton 1955), White Mound and some Kiatuthlanna Black-on-whites (Gladwin 1945:Plates I, XI, XII, and XXII b, c, and e), and on some pottery classified as Red Mesa Black-on-white (Wendorf and Lehmer 1956:Figure 118). The style was described by Colton and Hargrave (1937).

Red Mesa style: Red Mesa style, as used in this survey, includes three distinct sub-styles: "longitudinal hatching" (Gladwin 1931), grids (checkerboards), and a residual category including motifs and elements associated with Red Mesa Black-on-white, such as scrolls, ticked lines, scalloped triangles, etc. Several of these elements are shared with the Kana-a style and later styles; however, when found in isolation, these elements were classified as Red Mesa Style. "Longitudinal hatching" is probably a development of Kana-a style but differs in the use of thin parallel lines. In the Red Mesa style, these lines are used as framers of simple bands or band-like elements in off-set quartered designs (illustrations of this sub-style are in Roberts [1927:Figures 23 and 24]; see also Gladwin [1931]). Grids refer to any "checkerboard" arrangement and any pattern of filling elements used in checkerboards; again, these motifs may occur in earlier or later styles; but when found in isolation, they were classified as Red Mesa. The "residual" category probably includes the bulk of designs classified as Red Mesa. These would include single or multiple band arrangements of opposed linear figures (Gladwin 1945:Plate XXIX, a and b) or portions of such designs. Two other styles were used in this analysis that may be associated with the Red Mesa style. These were squiggle-hachure Dogoszhi style and Puerco style. Squiggle-hachure appears on later types in the Chaco area and is easily segregated, while Puerco style (with some modifications -- see below) has a published description (Carlson 1970). For these reasons, squiggle-hatchure and Puerco style were treated separately.

Straight-hachure Dogoszhi style (Colton and Hargrave 1937): This includes the decoration on types such as Dogoszhi Black-on-white (Colton 1955), Gallup Black-on-white (Hawley 1936), and some Mancos Black-on-white (Breternitz et al. 1974). As used here, straight-hachure Dogoszhi style excludes solid elements.

Squiggle-hachure Dogoszhi style: This is identical to straight-hachure but employs squiggle line hatching. Again, solid elements did not occur in this style.

Sosi style (Colton and Hargrave 1937): This appears on a wide variety of types, including Sosi Black-on-white (Colton 1955), Escavada Black-on-white (Wendorf and Lehmer 1956), Taylor and Toadlena Black-on-whites (Peckham and Wilson 1965) and some Mancos Black-on-white (Breternitz et al. 1974). As used in this survey, Sosi style was restricted to wide linear designs only; barbed wide lines were classified as Flagstaff style.

Flagstaff style (Colton and Hargrave 1937): This can be seen as a variety of Sosi style involving wide, barbed, and often opposed linear elements very similar to Carlson's (1970) Holbrook style, excluding pendant dots. Thinner framing lines, grid panels, or hatched panels are also excluded from this class, although these elements appear on Flagstaff Black-on-white (Colton 1955). Flagstaff style, as defined here, appears on Sosi Black-on-white, Toadlena Black-on-white, Chaco "solid" (Roberts 1927), and Puerco Black-on-white (Gladwin 1931).

Puerco, Wingate, and Tularosa styles: These follow the published definitions of Carlson (1970) with certain modifications. In the Puerco style, grids are excluded, and parallel hatched, sectioned bands are emphasized. Wingate style was amended to include opposed hatched and solid elements present in Gallup Black-on-white (Hawley 1936) or Chaco Hachure A and B (Roberts 1927).

McElmo and Mesa Verde styles: These are closely related designs utilizing simple strip bands of repeated and often opposed heavy solid elements (McElmo) and similar designs with multiple parallel framing lines (Mesa Verde). Exterior decoration and rim ticking were occasionally considered indicators of Mesa Verde style, but the definitions used here are perhaps more restrictive than the range of designs described for McElmo and Mesa Verde Black-on-whites in the literature of that area. McElmo style appears on the named type (Kidder 1924:Plate 27; Breternitz et al. 1974), the Chaco Variety of McElmo (Vivian and Mathews 1965), some Red Mesa Black-on-white, and Nava Black-on-white (Peckham and Wilson 1965). Mesa Verde style is generally limited to the named type but may also appear on such types as Gallisteo Black-on-white and other northern Rio Grande types (Stubbs and Stallings 1953).

In addition to the style of design, two technological attributes were noted on each black-on-white sherd. The first was the presence or absence of polishing. The eroded condition of many sherds made this observation difficult and occasionally impossible; however, no sherds were noted in which polishing was definitely absent (e.g. White Mound Black-on-white or Lino Black-on-gray or related types). The second observation was of the nature of the paint used. The separation of carbon and mineral paints on visual evidence is frequently difficult; however, in most cases the author is fairly confident that this distinction was correctly made.

Redwares

Redware sherds included plain red surfaced pieces, mineral paint black-on-red and black-and-red-on-orange types, and iron and/or manganese (?) and kaolin (?) decorated black-and-white-on-red types.

Black-on-red styles Basketmater III/Pueblo I: This style is a conglomerate category intended to isolate earlier redwares such as Bluff and Deadman's Black-on-reds (Breternitz et al. 1974). As with Basketmaker III/Pueblo I "style" for black-on-white wares, these styles will not be described here.

Thick line styles: These include the Sosi and Flagstaff styles described above for black-on-white wares and would include some part of Puerco Black-on-red (Carlson 1970; Colton and Hargrave 1937).

Puerco and Wingate styles: These styles are taken without modification from Carlson (1970).

Black-and-red-on-orange: All black-and-red-on-orange pieces observed during the survey appeared to be Citadel Polychrome or a very similar type (Colton and Hargrave 1937).

Black-and-white-on-red: Almost all black-and-white-on-red sherds found during the survey appeared to be White Mountain Redwares of either the Wingate or St. Johns Polychrome types. Most carried a Wingate style of design.

Comments

For any reader even vaguely familiar with the ceramics of Northwestern New Mexico, it should not be necessary for the author to emphasize that the style classifications used here were not intended to supplant Roberts' system or the existing typology. The analysis presented here represents an ad hoc and not entirely successful solution to a specific research problem which required rapid, in-the-field assessment of ceramics from (presumably) Late Pueblo II/Early Pueblo III sites in the survey areas. In terms of the specified goals for the ceramic analysis, the system presented here was probably adequate; however, a vast amount of ceramic information pertinent to the research objectives of the outlier survey was not (or could not be) recorded, and the information recorded is necessarily imprecise.

APPENDIX B: TABLES RELATED TO CHAPTERS 2, 3, and 4

Appendix B, Table 1

Microenvironmental zone and vegetative associations
of the Bis sa'ani survey area

Site Number	Microenvironmental zone	Vegetation Association
Bis sa'ani Chacoan Structure	B	1
B-1	G	3
B-2	G	5
B-3	B	1
B-4	C	5
B-5	C	6
B-6	C	5
B-7	C	3
B-8	C	3
B-9	C	1
B-10	G	2
B-(11)	D	5
B-12	C	1
B-(13)	H	7
B-14	F	3
B-15	D	3
B-16	F	3
B-17	D	2
B-18	D	2
B-(19)	B	1
B-20	B	2
B-(21)	B	2
B-22	B	3
B-23	G	3
B-24	D	1
B-25	B	1
B-26	B	3
B-27	B	1
B-28	B	3
B-29	A	6
B-30	B	2
B-(31)	D	5
B-(32)	D	5
B-(33)	D	5
B-(34)	D	5
B-(35)	D	5
B-(36)	D	5
B-(37)	D	5
B-(38)	D	5
B-(39)	D	5
B-(40)	H	8
B-41	H	7
B-(42)	H	7
B-(43)	A	4

( ) indicates Navajo and lithic (possible Archaic) sites.

Appendix B, Table 2

Microenvironmental zone and vegetative associations of the Peach Springs survey area

Site Number	Microenvironmental Zone	Vegetation Association
Peach Springs Chacoan Structure	A-B	1
PS-1	B	1
PS-2	B	2
PS-3	B	2
PS-4	A-B	2
PS-5	B	2
PS-6	E	3
PS-(7)	F*	2
PS-8	A-B	1
PS-9	F*	2
PS-(10)	F*	2
PS-11	F*	2
PS-12	B-D	2
PS-13	B	1
PS-14	F*	2
PS-15	F*	3
PS-16	B	1
PS-17	B	2
PS-18	B	5
PS-19	B	1
PS-20	B	1
PS-21	B	1
PS-22	B	1
PS-23	B	1
PS-24	B	1
PS-25	B	1
PS-26	B	1
PS-27	B	1
PS-28	C	1
PS-29	I*	1
PS-30	C	1
PS-31	C	1
PS-32	C	2
PS-33	I*	1
PS-34	F*	3
PS-35	F*	3
PS-36	E	3
PS-37	F*	2
PS-38	C	2
PS-39	C	2
PS-40	J*	3
PS-41	F*	2
PS-42	L	2
PS-43	F*	3
PS-44	B	3

Appendix B, Table 2 Continued

Site Number	Microenvironmental Zone	Vegetation Association
PS-45	B	1
PS-46	F	4
PS-47	L	6
PS-(48)	F	4
PS-49	F	4
PS-50	M	2
PS-51	F	3
PS-52	M	4
PS-53	L	6
PS-54	M	4
PS-55	M	4

( ) indicates Navajo sites.
* indicates site is in dune (F*) or alluvial deposit (I*) (J*), but site was probably built on a more substantial substratum.

Appendix B, Table 3

Microenvironmental zone and vegetative associations of the Pierre's survey area

Site Number	Microenvironmental Zone	Vegetation Association
Pierre's Site Chacoan Structures	C	2
P-1	C	6
P-2	C	7
P-3	D	7
P-4	C-D	3
P-5	C	3
P-6 (Chacoan structure)	F	2
P-7	D	3
P-8	D	4
P-9	D	3
P-10	C	3
P-11	C	7
P-12	E	6
P-13	D	3
P-14	D	3
P-15	C	3
P-16	D	3
P-17	C	2
P-18	C	5
P-19	C	5
P-20	C-D	5
P-(21)	B	6
P-(22)	B	6
P-(23)	F	3
P-(24)	F	1
P-(25)	E	6
P-(26)	F	5

( ) indicates Navajo or lithic (possible Archaic) sites.

Appendix B, Table 4
Ceramic ware/style frequencies by site for the Bis sa'ani survey area

Ware/style	Chacoan Str. East Block	Chacoan Str. West Block	Small Houses B-16	B-20 Kiva	B-20 Rooms	B-23	B-25	B-27 Room 3	B-27 Room 4	B-28 House A	B-28 House B	B-29
(GRAY WARES)												
Plain gray	10	1	40	–	30	10	5	–	25	5	1	10
Banded gray	–	1	1	–	–	1	–	–	–	–	–	–
Ribbed gray	3	–	1	–	–	–	–	–	–	–	–	1
P-II corr.	3	–	–	–	–	1	–	–	–	–	–	1
P-II/P-III corr.	225	15	170	1	90	300	15	10	70	15	60	70
P-III corr.	130	5	30	–	–	10	1	–	5	2	35	20
(WHITE WARES)												
Plain white	110	3	200	16	70	150	15	8	30	12	60	40
BM-III/P-I	–	–	1	–	–	–	–	–	1	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–	–	–	1
Red Mesa	–	–	2	–	–	1(1)	–	1	–	–	–	10
Dogoszhi (str.)[a]	2	–	50(1)	–	15	40	2	1	1	1	–	40
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–	–
Sosi	1(1)	–	60(1)	–(3)	5	–(5)	2(3)	–	5(1)	4	2	35(5)
Flagstaff	–(1)	–	1	–	1	–(1)	–	–	1	–	–	1
Puerco	–	–	1(1)	–	–	1	–	–	–	–	–	–
Wingate	–	–	1	–	–	10	–	–	–	–	–	1
Tularosa	–	–	–	–	–	–	–	–	–	–	–	–
McElmo	–(1)	–	–(10)	–	–(25)	–(15)	–(1)	–(1)	–(5)	–(6)	–(15)	–(5)
Mesa Verde	–	–	–	–	–	–	–	–	–	–	–	–
(RED WARES)												
Plain red	1	–	40	–	–	15	1	–	1	2	10	1
BM-III/P-I	–	–	–	–	–	3	–	–	–	–	–	–
Thick line	–	–	10	–	1	–	1	–	1	–	–	1
Puerco	–	–	1	–	–	5	–	–	–	–	–	–
Wingate	–	–	3	1	–	1	–	–	–	–	1	–
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	–	–	–	–	–	–	–	–	–	–	–	–
Total	485	25	612	18	212	548	42	20	140	41	169	233
	(3)	–	(13)	(3)	(25)	(22)	(4)	(1)	(6)	(6)	(15)	(10)
Total estimated surface sherds	500	25	700	21	250	600	50	25	150	50	200	300

Appendix B, Table 4 Continued

Ware/style	Fieldhouses									Non-habitation	
	B-1	B-2	B-5	B-6	B-14	B-17	B-18	B-22	B-26	B-3	B-7
(GRAY WARES)											
Plain gray	65	60	–	5	10	1	8	–	10	40	2
Banded gray	1	1	–	–	–	–	–	–	–	–	–
Ribbed gray	–	1	–	–	–	–	–	–	–	–	–
P-II corr.	–	–	–	–	–	–	–	–	–	–	–
P-II/P-III corr.	90	80	5	100	70	2	15	2	40	15	1
P-III corr.	20	15	–	20	45	–	14	–	–	15	–
(WHITE WARES)											
Plain white	10	20	20	25	50	10	–	14	40	15	17
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–	–	–
Red Mesa	–	–	1	1	5	1	–	–	–	–	–
Dogoszhi (str.)[a]	3	4(3)	2	1	20	3	5	–	2	1	–
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–
Sosi	3(3)	4(8)	15	15(7)	10	8	6	2(2)	–	6(3)	–
Flagstaff	–	–	–	–	–	–	–	–	1	–	–
Puerco	–	–	–	–(1)	–	–	–	–	–	–	–
Wingate	–	–(1)	–	1	1	–	–	–	–	–	–
Tularosa	–	–	–	–	1	–	–	–	–	–	–
McElmo	–	–(1)	–(1)	–	1	–	–(2)	–	–(6)	–	–
Mesa Verde	–	–	–	–	–	–	–	–	–	–	–
(RED WARES)											
Plain red	1	1	1	–	20	–	–	–	1	–	–
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Thick line	–	–	–	–	25	1	1	–	–	–	–
Puerco	–	–	–	–	–	–	–	–	–	–	–
Wingate	1	1	–	–	–	–	–	–	–	–	–
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	–	–	–	–	–	–	–	–	–	–	–
Total	194	187	44	168	258	26	49	18	94	92	20
	(3)	(12)	(1)	(8)	–	–	(2)	(2)	(6)	(3)	–
Total estimated surface sherds	200	200	50	200	270	30	50	20	100	100	20

Appendix B, Table 4 Continued

Ware/style	Scatters								
	B-4	B-8	B-9	B-10	B-12	B-15	B-24	B-30	B-41
(GRAY WARES)									
Plain gray	–	–	–	–	–	–	20	–	–
Banded gray	–	1	–	–	–	–	–	–	–
Ribbed gray	–	–	–	–	–	10	–	–	–
P-II corr.	–	–	–	–	–	–	–	–	–
P-II/P-III corr.	–	–	–	6	–	–	30	–	12
P-III corr.	–	–	–	–	5	–	5	–	–
(WHITE WARES)									
Plain white	–	–	50	–	–	–	8	–	–
BM-III/PI	–	–	–	–	–	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–
Red Mesa	3	–	–	–	–	–	–	–	–
Dogoszhi (str.)[a]	–	1	–	–	–	–	–	–	–
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–
Sosi	–	–	10	4	–	–	–	–	–
Flagstaff	–	–	–	–	–	–	–	–	–
Puerco	–	–	1	–	–	–	2	–	–
Wingate	–	2	–	–	–	–	1	–	–
Tularosa	–	–	–	–	–	–	–	–	–
McElmo	–	–	1	–	–	–	–(1)	–	–
Mesa Verde	–	–	–	–	–	–	–	–	–
(RED WARES)									
Plain red	–	–	–	–	–	–	–	–	–
BM-III/P-I	–	–	–	–	–	–	–	–	–
Thick line	–	–	–	–	–	–	–	–	–
Puerco	–	–	–	–	–	–	–	–	–
Wingate	–	–	–	–	–	–	–	–	–
Black + red/orange	–	–	–	–	–	–	–	–	–
Black + white/red	–	–	–	–	–	–	–	–	–
Total	3	4	62	10	5	10	66	–	12
	–	–	–	–	–	–	(1)	–	–
Total estimated surface sherds	3	4	60	10	5	10	80	–	15

( ) Carbon paint sherds
* Frequencies are estimated from percentage
a Includes Chaco style mineral black-on-white

Appendix B, Table 5
Ceramic ware/style frequencies by site for the Peach Springs survey area

Ware/style	Chacoan Structure						Small houses				
	House*	Trash A	Trash B	Trash C	Trash D	G.K.*	PS-1	PS-2*	PS-3	PS-4	PS-5
(GRAY WARES)											
Plain gray	10	25	220	166	18	10	97	124	127	85	7
Banded gray	1	12	11	36	3	-	56	20	47	28	2
Ribbed gray	1	11	3	6	1	-	10	13	7	4	1
P-II corr.	-	2	3	3	-	-	2	22	12	3	-
P-II/P-III corr.	10	202	22	119	72	5	224	130	75	97	10
P-III corr.	5	78	7	7	-	5	9	10	2	51	9
(WHITE WARES)											
Plain white	10	145	215	1016	296	10	536	211	379	202	16
BM-III/P-I	-	-	-	-	-	-	1	-	-	-	-
Kana'a	-	1	8	8	1	-	2	3	-(3)	1(2)	-
Red Mesa	5	12(3)	32	74(2)	21	-	79	98	192	105	2
Dogoszhi (str.)[a]	1	27(3)	6	32	6	5	37	33	15(1)	16(1)	4(1)
Dogoszhi (squig.)	-	-	-	-	-	-	-(2)	-	-	-	-
Sosi	1(1)	12(7)	6	15(8)	10(2)	-(1)	15(4)	8	3(1)	2(11)	2
Flagstaff	-	-	-	3	1	-	-	-	-	2	-
Puerco	-	2	-	1	1	-	2	-	1	-	-
Wingate	-	2	-	-	-	1	-	-	2	8(4)	-
Tularosa	-	-	-	-	-	-	-	-	-	-	-
McElmo	-(5)	-(5)	-	-(6)	-(2)	-	-(9)	-	-(1)	-(48)	-
Mesa Verde	-	-	-	-(1)	-	-	-(2)	-	-	-(7)	-(2)
(RED WARES)											
Plain red	-	6	-	4	1	-	14	2	8	17	11
BM-III/P-I	-	-	-	-	-	-	-	-	-	-	-
Thick line	-	-	-	1	1	-	-	-	-	7	-
Puerco	-	6	-	-	-	-	-	-	1	2	-
Wingate	1	7	-	5	-	-	7	1	10	10	2
Black + red/orange	-	-	-	-	-	-	-	-	-	-	-
Black + white/red	1	2	-	3	1	1	3	1	7	7	-
Total	46	552	533	1499	433	37	1094	676	888	647	66
	(6)	(18)	-	(17)	(4)	(1)	(17)	-	(6)	(73)	(3)
Total estimated surface sherds	1500	60,000+	55,000+	50,000+	40,000+	1,000	100,000+	50,000	100,000	75,000	100

Appendix B, Table 5 Continued

Ware/style	Small houses											
	PS-11				PS-12							
	House*	Trash A	Trash B	Hearth C*	House C	House D	Trash A	Trash B	PS-14	PS-15	PS-18	PS-20
(GRAY WARES)												
Plain gray	30	14	31	30	10	12	8	18	7	5	3	4
Banded gray	–	2	3	–	5	–	2	2	4	3	2	3
Ribbed gray	–	3	3	–	1	2	1	3	3	4	1	1
P-II corr.	–	1	25	–	–	–	1	1	2	–	–	–
P-II/P-III corr.	30	44	36	80	5	17	32	8	24	23	12	33
P-III corr.	20	17	–	20	3	2	–	–	21	23	3	33
(WHITE WARES)												
Plain white	80	29	55	50	17	35	66	37	18	34	20	56
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–	–	–	–
Red Mesa	20	13	11	10	7	8	31	4	3	–	4	16
Dogoszhi (str.)[a]	5	14	20	10	–	8	28	3	–	15	4	39(1)
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–	–
Sosi	–	12(3)	5(4)	10	3	3(1)	6	1	–	7	1	3(5)
Flagstaff	–	–(1)	–	–	–	–	–	1	–	–	–	–
Puerco	5	1	–	–	–	1	1	–	1	–	–	1
Wingate	–	5	2	–	–	–	–	1	–	2	–	6
Tularosa	–	–	–	–	–	–	–	–	–	–	–	–
McElmo	–(5)	–(4)	–(1)	–	–	–	–(1)	–	–(1)	–(22)	–	–(3)
Mesa Verde	–	–(1)	–	–	–	–	–	–	–	–(2)	–	–(3)
(RED WARES)												
Plain red	–	7	4	–	1	1	1	–	–	5	1	–
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–	–
Thick line	–	3	6	–	–	1	–	1	–	9	–	2
Puerco	–	–	–	–	–	–	–	–	–	1	–	–
Wingate	–	3	3	–	–	–	–	–	–	6	–	5
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	1	3	2	–	–	–	–	1	–	4	–	5
Total	191	171	206	210	52	90	177	81	83	141	51	207
	(5)	(9)	(5)	–	–	(1)	(1)	–	(1)	(24)	–	(12)
Total estimated surface sherds	200	20,000	20,000+	200	1,000	4,000	15,000	10,000	500	1,000	300	25,000+

Appendix B, Table 5 Continued

Ware/style	Small houses										
						PS-27				PS-28	
	PS-21	PS-22	PS-24	PS-25	PS-25	House A	Mound B	House C	House D	House A	House B
(GRAY WARES)											
Plain gray	1	7	8	3	16	–	8	1	–	1	1
Banded gray	3	2	5	–	1	–	–	–	–	–	1
Ribbed gray	–	9	1	–	2	–	–	–	–	–	1
P-II corr.	2	–	–	1	–	–	–	–	–	–	–
P-II/P-III corr.	33	34	8	4	35	3	14	4	5	3	4
P-III corr.	3	7	1	3	4	–	3	1	3	1	2
(WHITE WARES)											
Plain white	11	40	23	3	66	10	–	1	6	11	5
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Kana'a	–	–	4	1	–	–	–	–	–	–	–
Red Mesa	33	64	25	6	13	–	–	–	1	2	2
Dogoszhi (str.)[a]	42	105	6	5	20(1)	2	–	–	2	–	1
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–
Sosi	2	4	1	3	4(1)	–	–	–	–	2(1)	–
Flagstaff	–	–	–	–	–	–	–	–	–	–(1)	–
Puerco	1	3	–	–	1	1	–	–	–	–	–
Wingate	1	1	–	1	–	–	3	–	–	–	–
Tularosa	–	–	–	–	–	–	–	–	–	–	1
McElmo	–	–	–(1)	–(1)	–(6)	–	–(3)	–	–(9)	–(4)	–(2)
Mesa Verde	–	–	–	–	–	–	–	–	–(1)	–(1)	–(1)
(RED WARES)											
Plain red	1	–	1	–	5	2	–	–	3	2	4
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Thick line	–	–	1	–	–	–	–	–	–	–	–
Puerco	–	–	1	–	–	–	–	–	–	–	–
Wingate	–	–	3	1	5	2	5	–	5	2	2
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	–	–	–	–	2	–	1	–	–	2	1
Total	133	276	87	31	174	19	34	7	25	26	25
	–	–	(1)	(1)	(8)	–	(3)	–	(10)	(7)	(3)
Total estimated surface sherds	3,000	30,000	10,000	1,200	20,000	35	50	10	150	40	15

Appendix B, Table 5 Continued

Ware/style	Small houses: PS-28 House C + D	PS-28 Trash E	PS-29	PS-31	PS-32	PS-33	PS-34	PS-37	PS-38	PS-39	PS-40	PS-42
(GRAY WARES)												
Plain gray	-	-	109	7	15	16	10	11	32	3	26	3
Banded gray	-	-	40	1	2	5	1	1	6	-	-	2
Ribbed gray	-	-	5	1	1	7	1	1	3	2	-	-
P-II corr.	-	-	2	-	1	-	-	-	1	-	-	-
P-II/P-III corr.	2	-	67	13	53	7	25	17	4	16	32	22
P-III corr.	1	-	8	-	14	-	6	3	-	3	46	-
(WHITE WARES)												
Plain white	5	-	217	37	57	79	10	12	49	11	46	10
BM-III/P-I	-	-	1	-	-	-	-	-	1	-	-	-
Kana'a	-	-	-(4)	-	-	-	-	-	-(2)	-(1)	-	-
Red Mesa	-	-	68	13	10	29	5	2	25	10(1)	1	12
Dogoszhi (str.)[a]	1(1)	-	28	17	24	17	1(1)	7	7	12	7(1)	22
Dogoszhi (squig.)	-	-	-	-	-	-	-	-	-	-	-	-
Sosi	-	-	8	3	13(2)	1	4	1	-	1	21(5)	1(1)
Flagstaff	-	-	-	1	1	-	-	-	-	-	-(1)	-
Puerco	-	-	2	-	3	1	-	-	1	-	-	-
Wingate	-	-	-	-	-	1	1	1	-	-	-	1
Tularosa	-	-	-	-	-	-	-	-	-	-	-	-
McElmo	-	-	-(8)	-	-(7)	-	-(4)	-(2)	1(2)	-	2(1)	-
Mesa Verde	-	-	-	-	-	-	-(1)	-	-	-	-	-
(RED WARES)												
Plain red	-	-	3	-	6	-	1	6	4	-	1	-
BM-III/P-I	-	-	-	-	-	-	-	-	-	-	-	-
Thick line	-	-	2	-	1	-	3	-	-	-	1	1
Puerco	-	-	-	-	-	-	-	-	-	-	-	1
Wingate	-	-	7	-	2	-	1	2	-	-	1	-
Black + red/orange	-	-	-	-	-	1	-	-	-	-	-	-
Black + white/red	-	-	1	-	-	-	1	-	-	-	-	-
Total	9	-	568	93	203	164	70	64	134	58	184	75
	(1)	-	(12)	-	(9)	-	(6)	(2)	(4)	(2)	(8)	(1)
Total estimated surface sherds	5	-	100,000	850	20,000	20,000	1,000	100	15,000	1,500	20,000	1,000

Appendix B, Table 5 Continued

Ware/style	Small houses									Ancillary Units	
	PS-43	PS-45	PS-46	PS-49	PS-50[b]	PS-52[b]	PS-53[b]	PS-54[b]	PS-55[b]	PS-13	PS-17
(GRAY WARES)											
Plain gray	5	1	300	–	–	–	–	–	–	3	15
Banded gray	6	3	–	–	–	–	–	–	–	–	–
Ribbed gray	3	–	–	–	–	–	–	–	–	–	1
P-II corr.	1	–	–	–	–	–	–	–	–	–	–
P-II/P-III corr.	19	13	–	–	–	–	–	–	–	4	5
P-III corr.	2	4	–	–	–	–	–	–	–	–	1
(WHITE WARES)											
Plain white	30	13	–	–	–	–	–	–	–	8	7
BM-III/P-I	–	2	–	–	–	–	–	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–	–	–
Red Mesa	17	–	–	–	–	–	–	–	–	2	5
Dogoszhi (str.)[a]	18	5	–	–	–	–	–	–	–	7	3
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–
Sosi	3	6(1)	–	–	–	–	–	–	–	3	1
Flagstaff	1	–	–	–	–	–	–	–	–	–	–
Puerco	–	1	–	–	–	–	–	–	–	–	–
Wingate	–	–	–	–	–	–	–	–	–	–	–
Tularosa	–	–	–	–	–	–	–	–	–	–	–
McElmo	–	–(2)	–	–	–	–	–	–	–	–	–
Mesa Verde	–	–	–	–	–	–	–	–	–	–	–
(RED WARES)											
Plain red	–	2	–	–	–	–	–	–	–	1	1
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Thick line	–	–	–	–	–	–	–	–	–	–	–
Puerco	–	–	–	–	–	–	–	–	–	–	–
Wingate	–	1	–	–	–	–	–	–	–	–	–
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	–	–	–	–	–	–	–	–	–	–	1
Total	105	51	300	–	–	–	–	–	–	28	40
	–	(3)	–	–	–	–	–	–	–	–	–
Total estimated surface sherds	150	600	300	*	*	*	*	*	*	300	150

Appendix B, Table 5 Concluded

Ware/style	Ancillary Units					Field houses		Non-hab	Scatters			Misc.	
	PS-19	PS-23	PS-30	PS-44	PS-51	PS-35	PS-41	PS-47	PS-6	PS-8	PS-36	PS-9	PS-16
(GRAY WARES)													
Plain gray	3	–	22	2	–	5	6	7	25	40	–	7	30
Banded gray	1	–	4	–	–	–	3	–	4	5	–	–	1
Ribbed gray	–	–	2	–	–	–	–	–	2	–	–	–	–
P-II corr.	–	–	1	–	–	–	–	–	–	–	–	–	–
P-II/P-III corr.	12	–	7	–	–	–	11	17	45	50	–	12	50
P-III corr.	1	–	–	–	–	3	1	–	–	5	3	1	5
(WHITE WARES)													
Plain white	6	–	53	1	–	4	28	11	38	50	–	2	5
BM-III/P-I	–	–	–	–	–	–	–	–	1	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	1	–	–	–	–
Red Mesa	–	–	5	–	–	–	5	–	25	30	1	2	1
Dogoszhi (str.)[a]	5	–	–	1	–	–	11	1	9	1	5	3	1
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–	–	–
Sosi	–	–	1	–	–	1	2	–	1	1	1	6	1
Flagstaff	–	–	–	–	–	–	–	–	–	–	–	–	–
Puerco	–	–	–	–	–	–	–	–	–	–	–	–	–
Wingate	–	–	–	–	–	–	–	–	2	–	–	1	–
Tularosa	–	–	–	–	–	–	–	–	–	–	–	–	–
McElmo	–	–	–(1)	–	–	–	–	–	–	–(1)	–	–	–
Mesa Verde	–	–	–	–	–	–	–	–	–	–	–	–	–
(RED WARES)													
Plain red	1	–	3	–	–	–	–	–	–	1	–	–	–
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–	–	–
Thick line	–	–	3	–	–	–	1	–	–	–	–	1	–
Puerco	–	–	–	–	–	–	–	–	–	–	–	–	–
Wingate	–	–	1	–	–	–	–	–	–	1	–	–	–
Black + red/orange	–	–	–	–	–	–	–	–	–	–	–	–	–
Black + white/red	1	–	–	–	–	–	–	–	–	–	–	–	–
Total	30	–	102	4	–	13	68	36	153	184	10	35	94
	–	–	(1)	–	–	–	–	–	–	(1)	–	–	–
Total estimated surface sherds	50	–	125	05	–	15	300	50	200	500	40	100	150

( ) Carbon paint sherds
* Frequencies are estimated from percentages
a Includes Chaco-style mineral black-on-white
b Ceramics not tabulated

Appendix B, Table 6
Ceramic ware/style frequencies by site for the Pierre's survey area

Ware/style	Chacoan Structures				Small houses					
	Pierre's Site		Pierre's 6							
	House A & Area C	House B	Trash A	Trash B	P-1	P-3	P-4	P-5	P-8	P-9
(GRAY WARES)										
Plain gray	10	14	-	5	17	5	8	17	8	4
Banded gray	-	15	1	-	-	1	2	2	-	3
Ribbed gray	-	2	-	-	-	-	-	-	-	-
P-II corr.	-	-	-	-	1	-	-	1	-	-
P-II/P-III corr.	38	147	14	30	32	18	24	76	36	52
P-III corr.	11	45	8	15	90	15	38	138	7	3
(WHITE WARES)										
Plain white	16	38	6	10	26	17	17	100	20	15
BM-III/P-I	-	-	-	-	-	-	-	-	-	-
Kana'a	-	-	-	-	-	-	-	-	-	-
Red Mesa	-	5	-	-	-	-	-	1	-	6
Dogoszhi (str.)[a]	9	35(1)	1	2(3)	-	1	1	6	6	3
Dogoszhi (squig.)	-	-	-	-	-	-	-	-	-	-
Sosi	7	13(1)	8(1)	8	6	5(3)	7(1)	29(1)	5(2)	1
Flagstaff	-	1(5)	-	-	-	2	-	17	-	-
Puerco	-	-	-	-(1)	-	-	-	-	-	-
Wingate	2	4	-	1	-	-	-	-	1	-
Tularosa	-	-	-	-	-	-	-	-	-	-
McElmo	-(1)	-	-	-(1)	-(2)	3	4	-	-	-(1)
Mesa Verde	-	-	-	-	-	-	-	-	-	-
(RED WARES)										
Plain red	-	3	1	1	2	-	-	1	1	2
BM-III/P-I	-	-	-	-	-	-	-	-	-	-
Thick line	1	6	-	-	-	-	-	1	-	-
Puerco	-	1	-	-	-	-	-	-	-	-
Wingate	1	8	-	-	-	-	-	-	-	1
Black + red/orange	-	-	-	-	-	-	-	-	-	-
Black + white/red	-	-	-	-	-	-	-	-	-	-
Total	95	337	39	72	173	67	101	389	84	90
	(1)	(7)	(1)	(5)	(2)	(3)	(1)	(1)	(2)	(1)
Total estimated surface sherds	100,000	35,000	100	80	250	150	150	400	300	1,000

Appendix B, Table 6 Continued

Ware/style	Small Houses						Isolated Rooms				
		P-12									
	P-10	Unit A	Unit B	P-13	P-15	P-16	P-2	P-11	P-18	P-19	P-20
(GRAY WARES)											
Plain gray	3	2	–	4	6	–	–	–	–	4	4
Banded gray	1	–	–	3	–	–	–	1	–	–	–
Ribbed gray	–	–	–	–	1	–	–	–	–	–	–
P-II corr.	–	–	–	–	2	–	–	–	–	–	–
P-II/P-III corr.	52	23	3	52	57	7	–	4	–	–	6
P-III corr.	8	15	–	12	20	1	–	–	–	–	1
(WHITE WARES)											
Plain white	11	7	2	22	35	1	–	–	–	–	–
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Kana'a	–	–	–	–	–	–	–	–	–	–	–
Red Mesa	5	–	1	4	–	–	–	–	–	–	1
Dogoszhi (str.)[a]	2	4	–	7	13(1)	1	–	1	1	–	1
Dogoszhi (squig.)	–	–	–	–	–	–	–	–	–	–	–
Sosi	11	3	–	4(2)	30(5)	1	–	2	–	–	12
Flagstaff	–(1)	–	–	2	2	–	–	–	–	–	–
Puerco	–	–	–	–	–(1)	–	–	1	–	–	–
Wingate	1	–	–	–	1	–	–	–	–	–	–
Tularosa	–	–	–	–	–	–	–	–	–	–	–
McElmo	–(2)	–(1)	–	–	1(4)	–	–	–	–	–	–
Mesa Verde	–	–	–	–	–	–	–	–	–	–	–
(RED WARES)											
Plain red	1	–	–	2	2	1	–	–	–	–	–
BM-III/P-I	–	–	–	–	–	–	–	–	–	–	–
Thick line	1	1	–	3	–	–	–	–	–	–	–
Puerco	–	–	–	–	–	–	–	–	–	–	–
Wingate	–	–	–	–	–	–	–	–	–	–	–
Black + red/orange	–	–	–	–	1	–	–	–	–	–	–
Black + white/red	–	–	–	–	–	–	–	–	–	–	–
Total	96	55	6	115	171	12	–	9	1	4	25
	(3)	(1)	–	(2)	(11)	–	–	–	–	–	–
Total estimated surface sherds	100,000+	200	10	2,500	10,000	20	–	10	1	4	50

Appendix B, Table 6 Concluded

Ware/style	Isolated firepit	Non-habitation	
	P-17	P-7	P-14
(GRAY WARES)			
Plain gray	1	3	2
Banded gray	-	1	1
Ribbed gray	1	-	-
P-II corr.	-	-	-
P-II/P-III corr.	8	-	30
P-III corr.	-	2	2
(WHITE WARES)			
Plain white	-	-	8
BM-III/P-I	-	-	-
Kana'a	-	-	-
Red Mesa	-	-	1
Dogoszhi (str.)[a]	-	2	4
Dogoszhi (squig.)	-	-	-
Sosi	-	1	2
Flagstaff	-	-	1
Puerco	-	-	-
Wingate	-	-	-
Tularosa	-	-	-
McElmo	-	-	-
Mesa Verde	-	-	-
(RED WARES)			
Plain red	-	-	-
BM-III/P-I	-	-	-
Thick line	-	-	2
Puerco	-	-	-
Wingate	-	-	-
Black + red/orange	-	-	-
Black + white/red	-	-	-
Total	10	9	53
Total estimated surface sherds	15	10	200

( ) Carbon paint sherds
a - Includes Chaco style mineral black-on-white

Appendix B, Table 7
Lithic material type frequencies by site for the Bis sa'ani survey area

		Chacoan Structure				Small Houses														Fieldhouse											Scatters							Non-hab.	
		East Block	West Block	Total		B-16		B-20		B-23		B-25		B-27		B-28		B-29		B-1	B-2		B-5	B-6	B-14	B-17	B-18	B-22	B-26		B-4	B-8	B-12	B-15	B-24		B-30	B-3	B-7
Material	Type	#	#	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	#	%	#	#	#	#	#	#	#	%	#	#	#	#	#	%	#	#	#
Cherts	1011	1	–	1	3	1	2	–	–	2	4	–	–	–	–	–	–	–	–	1	–	–	2	6	–	–	–	–	–	–	–	–	–	–	1	5	–	2	–
	1040	1	–	1	3	–	–	–	–	1	2	–	–	1	4	–	–	–	–	–	2	5	–	–	–	–	–	–	–	–	–	–	–	–	10	50	–	1	–
	1042	1	–	1	3	–	–	–	–	1	2	3	17	–	–	–	–	2	4	–	–	–	–	2	–	–	2	–	3	15	–	–	–	–	–	–	–	–	–
	1050	–	1	1	3	–	–	–	–	1	2	–	–	1	4	1	2	–	–	–	5	11	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	1051	1	–	1	3	–	–	1	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1052	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1053	–	–	–	–	–	–	–	–	–	–	–	–	1	4	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1070	–	–	–	–	–	–	1	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	1072	–	–	–	–	–	–	–	–	3	6	–	–	–	–	–	–	1	2	–	–	–	–	–	–	–	–	1	1	5	–	–	–	–	–	–	–	–	1
	1080	–	–	–	–	–	–	2	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1090	1	–	1	3	2	4	–	–	–	–	–	–	–	–	1	2	–	–	1	5	11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1091	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1231	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
	1425	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
	1640	1	–	1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Subtotal		6	1	7	21	3	6	4	20	8	15	3	17	3	13	2	4	4	8	4	17	39	2	8	–	–	2	1	4	20	1	1	–	–	11	55	–	5	1
Silicified Woods	1112	5	1	6	18	11	22	4	20	8	15	7	39	3	13	2	4	3	6	2	3	7	–	–	14	–	–	1	4	20	–	3	–	2	–	–	–	–	–
	1113	3	–	3	9	5	10	2	10	4	7	–	–	1	4	3	6	–	–	3	13	30	–	–	6	–	–	–	2	10	2	–	1	–	3	15	1	–	–
	1120	–	1	1	3	1	2	–	–	3	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–
	1130	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1140	1	2	3	9	18	36	4	20	17	31	7	39	8	33	28	57	32	64	–	2	5	–	–	–	1	2	3	6	30	–	–	–	2	6	30	2	–	1
	1142	7	1	8	24	3	6	3	15	9	17	–	–	7	29	12	24	5	10	–	–	–	–	2	–	–	–	–	3	15	–	–	1	–	–	–	–	–	–
	1151	1	–	1	3	2	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Subtotal		17	5	22	67	40	80	13	65	41	76	14	78	19	79	45	92	41	82	5	18	41	–	2	20	1	2	4	15	75	2	3	2	6	9	45	3	–	1
Obsidian	3520	1	–	1	3	1	2	1	5	–	–	–	–	–	–	–	–	–	–	6	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–
Quartzite	4000																																						
	Fine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–
	Medium	–	–	–	–	5	10	2	10	3	6	–	–	–	–	–	–	3	6	–	2	5	–	–	–	–	–	–	1	5	–	–	–	–	–	–	–	–	–
	Coarse	3	–	3	9	1	2	–	–	2	4	1	6	2	8	2	4	2	4	–	7	16	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–
Brushy Basin	2205	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Subtotal		3	–	3	9	6	12	2	10	5	9	1	6	2	8	2	4	5	10	–	9	20	–	3	–	–	–	2	1	5	–	–	–	–	–	–	–	3	–
Total		27	6	33	100	50	100	20	100	54	100	18	101	24	100	49	100	50	100	15	44	100	2	14	20	1	4	7	20	100	3	4	2	6	2	– 100	3	12	2
Estimated Surface Lithics		50	10		60	200		25		300		25		30		60		60		25	75	–	2	20	25	1	4	7	25	–	3	4	2	10	25	–	3	15	2

Appendix B, Table 8
Lithic material type frequencies by site
for the Peach Springs survey area

		Chacoan Structures								Small houses									
		House	G.K.	'A'	'B'	'C'	'E'	Total		PS-1		PS-2		PS-3		PS-4		PS-5	
Material	Type			#	#	#	#	#	%	#	%	#	%	#	%	#	%	#	%
Cherts	1011	-	-	2	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-
	1040	-	-	-	5	1	-	6	3	-	-	1	1	2	1	1	1	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	3	1	-	-	4	2	-	-	1	1	-	-	-	-	-	-
	1051	-	-	-	-	-	1	1	1	-	-	-	-	-	-	1	1	-	-
	1052	-	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
	1053	-	-	1	-	-	-	1	1	1	1	-	-	1	1	1	1	-	-
	1060	-	-	-	1	-	-	1	1	1	1	-	-	-	-	-	-	-	-
	1070	-	-	1	1	-	-	2	1	-	-	-	-	2	1	-	-	-	-
	1072	2	2	16	10	6	5	41	21	27	21	16	22	22	13	30	18	2	8
	1080	-	1	1	2	2	2	8	4	1	1	-	-	8	5	3	2	-	-
	1090	-	-	1	2	4	-	7	4	1	1	-	-	1	1	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	1	-	-	-	1	1	-	-	-	-	2	1	-	-	-	-
Subtotal		2	3	26	23	13	8	75	39	31	25	18	25	38	22	36	22	2	8
Silicified Woods	1112	1	2	5	2	10	3	23	12	40	32	19	26	33	19	25	15	5	21
	1113	-	-	-	-	2	2	4	2	5	4	3	4	4	2	11	7	2	8
	1120	1	-	-	1	4	3	9	5	7	6	4	5	14	8	10	6	2	8
	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1140	-	1	1	1	8	4	15	8	3	2	3	4	9	5	9	5	-	-
	1142	2	3	12	12	8	4	41	21	31	25	22	30	65	38	61	37	10	42
	1151	-	1	4	3	2	-	10	5	5	4	-	-	6	4	5	3	1	4
Subtotal		4	7	22	19	34	16	102	53	91	72	51	70	131	77	121	74	20	83
Osbidian	3510	-	-	1	-	2	-	3	2	2	2	1	1	-	-	-	-	-	-
	3520	1	-	-	-	-	-	1	1	-	-	1	1	-	-	1	1	-	-
Quartzite	4000																		
	Fine	-	-	-	2	-	-	2	1	-	-	1	1	1	1	-	-	-	-
	Medium	-	-	1	1	1	-	3	2	-	-	1	1	1	1	1	1	-	-
	Coarse	1	-	-	1	2	-	4	2	2	2	-	-	-	-	5	3	2	8
Brushy Basin																			
	2205	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-
Subtotal		1	-	1	4	4	-	10	5	2	2	2	3	2	1	6	4	2	8
Misc.	3240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenst.	4525	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		8	10	50	46	53	25	192	100	126	101	73	100	171	100	164	101	24	99
Estimated Surface Lithics		15	20	1000	4400	4200	100	10,000		5,000		2,900		10,000		7,500		30	

Appendix B, Table 8 Continued

		PS-11									PS-12										Small houses				
		House	'A'		'B'		'C'	Total		'A'		'B'		'C'		'D'	Total		PS-14		PS-15		PS-18
Material	Type	#	#	%	#	%	#	#	%	#	%	#	%	#	%	#	#	%	%	%	#	%	#
Cherts	1011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
	1040	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	1	1	-	-	-	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1072	7	33	43	24	45	2	66	46	15	23	6	35	1	5	3	25	22	6	40	24	31	-
	1080	-	5	6	2	4	-	7	5	3	5	-	-	2	10	-	5	4	-	-	4	5	-
	1090	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	1	1	-	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		7	38	49	26	49	2	73	50	19	29	6	35	4	20	3	32	28	6	40	29	37	-
Silicified Woods	1112	1	6	8	4	8	1	12	8	12	18	2	12	5	25	4	23	20	4	27	15	19	4
	1113	-	4	5	1	2	-	5	3	1	2	-	-	3	3	1	5	4	-	-	2	3	1
	1120	1	4	5	4	8	-	9	6	4	6	-	-	-	-	-	4	3	3	20	3	4	1
	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1140	-	5	6	4	8	-	9	6	-	-	1	6	-	-	-	1	1	1	7	-	-	-
	1142	3	20	26	12	23	-	35	24	27	41	7	41	6	30	5	45	39	1	7	25	32	6
	1151	-	-	-	2	4	-	2	1	3	5	1	6	-	-	-	4	3	-	-	-	-	-
Subtotal		5	39	51	27	51	1	72	50	47	71	11	65	14	70	10	82	71	9	60	45	58	12
Osbidian	3510	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
	3520	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	1	1	-	-	-	-	-
Quartzite	4000																						
	Fine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Coarse	-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	1	1	-	-	2	3	-
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
Subtotal		-	-	-	-	-	-	-	-	-	-	-	-	1	5	-	1	1	-	-	3	4	-
Misc.	3240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenst.	4525	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		12	77	100	53	100	3	145	100	66	100	17	100	20	100	13	116	101	15	100	78	100	12
Estimated Surface Lithics		25	1,500		500		5	2,000		2,250		340		160		50	2,800			30	800		150

Appendix B, Table 8 Continued

Material	Type	Small houses PS-20 #	PS-20 %	PS-21 #	PS-21 %	PS-22 #	PS-22 %	PS-24 #	PS-24 %	PS-25 #	PS-25 %	PS-26 #	PS-26 %	PS-27 'A' #	PS-27 'B' #	PS-27 'C' #	PS-27 'D' #	PS-27 Total #	PS-27 Total %	PS-28 'A' #	PS-28 'B' #	PS-28 'C' #	PS-28 'D' #	PS-28 Total #	PS-28 Total %
Cherts	1011	-	-	1	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	4
	1040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1051	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	-	-	-	-	-	-
	1060	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1072	17	20	5	14	10	17	2	4	2	10	20	34	1	-	-	3	4	11	9	3	3	-	15	54
	1080	4	5	-	-	4	7	2	4	1	5	4	7	-	-	-	-	-	-	1	-	-	-	1	4
	1090	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		21	24	7	19	15	26	5	10	3	15	24	41	1	-	-	4	5	14	11	3	3	-	17	61
Silicified Woods	1112	27	31	6	17	14	24	20	38	7	35	7	12	-	2	-	7	9	25	1	1	1	1	4	14
	1113	-	-	2	6	2	3	3	6	1	5	1	2	1	-	1	-	2	6	-	-	-	-	-	-
	1120	6	7	3	8	5	9	4	8	-	-	5	9	-	1	-	2	3	8	4	-	-	-	4	14
	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1140	-	-	1	3	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1142	30	35	14	39	16	28	17	33	8	40	16	28	1	3	-	10	14	39	2	1	-	-	3	11
	1151	2	2	1	3	1	2	2	4	-	-	2	3	-	-	-	2	2	6	-	-	-	-	-	-
Subtotal		65	76	27	75	41	71	46	88	16	80	31	53	2	6	1	21	30	83	7	2	1	1	11	39
Obsidian	3510	-	-	-	-	-	-	-	-	-	-	1	2	-	1	-	-	1	3	-	-	-	-	-	-
	3520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quartzite	4000																								
	Fine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Medium	-	-	1	3	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-
	Coarse	-	-	1	3	2	3	-	-	1	5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		-	-	2	6	2	3	-	-	1	5	2	3	-	-	-	-	-	-	-	-	-	-	-	-
Misc.	3240	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenst.	4525	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		86	100	36	100	58	100	52	100	20	100	58	99	3	7	1	25	36	100	18	5	4	1	28	100
Estimated Surface Lithics		1,700		350		600		1,000		100		2,420		-	-	-	-	70		40	10	10	-		60

Appendix B, Table 8 Continued

Material	Type	Small houses PS-29 #	%	PS-31 #	%	PS-32 #	%	PS-33 #	%	PS-34 #	%	PS-37 #	PS-38 #	%	PS-39 #	%	PS-40 #	%	PS-42 #	PS-43 #	PS-45 #	PS-46 #
Cherts	1011	2	1	-	-	-	-	1	3	-	-	-	2	5	1	3	-	-	-	-	1	3
	1040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-
	1051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
	1060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1072	42	30	5	24	19	48	3	8	11	27	4	6	14	5	15	13	39	4	-	1	2
	1080	-	-	3	14	1	3	4	10	-	-	-	1	2	4	12	-	-	1	-	-	-
	1090	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-
	1425	-	-	-	-	1	3	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-
Subtotal		44	31	8	38	21	53	9	23	11	27	4	12	27	10	30	13	39	5	-	2	5
Silicified Woods	1112	30	21	3	14	7	18	12	30	14	34	6	11	25	6	18	3	9	4	4	4	4
	1113	4	3	1	5	-	-	1	3	-	-	-	1	2	4	12	2	6	-	-	-	-
	1120	8	6	1	5	2	5	5	13	2	5	-	3	7	2	6	4	12	4	1	-	-
	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1140	8	6	1	5	-	-	2	5	-	-	2	2	5	5	15	-	-	1	4	4	-
	1142	41	29	7	33	10	25	7	18	13	32	2	8	18	5	15	10	30	1	3	2	-
	1151	3	2	-	-	-	-	-	-	1	2	-	2	5	-	-	-	-	-	2	1	-
Subtotal		94	67	13	62	19	48	27	68	30	73	10	27	61	22	67	19	58	10	14	11	4
Obsidian	3510	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	1	3
	3520	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quartzite	4000																					
	Fine	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-	1	3	-	-	-	-
	Medium	-	-	-	-	-	-	-	-	-	-	1	1	2	1	3	-	-	-	-	-	-
	Coarse	1	1	-	-	-	-	3	8	-	-	-	2	5	-	-	-	-	-	-	1	-
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-
Subtotal		1	1	-	-	-	-	4	10	-	-	1	4	9	1	3	1	3	-	-	1	-
Misc.	3240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenst.	4525	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		140	100	21	100	40	101	40	101	41	100	15	44	99	33	100	33	100	15	14	15	12
Estimated Surface Lithics		14,000		50		800		1,600		400		30	1,000		330		120		30	25	60	25

Appendix B, Table 8 Concluded

		Ancillary Units				Fieldhouse	Non-habitation		Scatters		Misc.	
		PS-13	PS-17	PS-19	PS-30	PS-41	PS-47	PS-6	PS-8	PS-36	PS-9	
Material	Type	#	#	#	#	#	#	#	#	#	#	%
Cherts	1011	-	1	-	-	1	-	-	-	1	7	6
	1040	-	-	-	-	-	-	-	-	-	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-
	1051	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	-	-	-	-	-
	1060	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	2	2
	1072	3	-	1	-	4	-	-	-	-	11	9
	1080	-	-	-	-	-	-	-	-	-	26	22
	1090	-	-	-	-	-	-	-	-	-	4	3
	1091	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	-	-	-	-	-	-	-	-	-
Subtotal		3	1	1	-	5	-	-	-	1	50	43
Silicified Woods	1112	2	-	1	1	3	1	1	-	-	10	9
	1113	-	1	-	-	1	-	-	-	-	13	11
	1120	1	-	-	-	3	-	-	-	-	13	11
	1130	-	-	-	-	-	-	-	-	-	-	-
	1140	-	-	-	-	-	1	-	-	-	12	10
	1142	5	-	1	-	1	-	1	2	-	10	9
	1151	-	-	-	-	-	-	-	-	-	1	1
Subtotal		8	1	2	1	8	2	2	2	-	59	50
Obsidian	3510	-	-	-	-	-	-	-	-	-	2	2
	3520	-	-	-	-	-	-	-	-	-	-	-
Quartzite	4000											
	Fine	-	-	-	-	-	-	-	-	-	3	3
	Medium	-	-	-	-	-	-	-	-	-	3	3
	Coarse	-	-	-	-	-	-	-	-	1	-	-
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-
Subtotal		-	-	-	-	-	-	-	-	1	6	5
Misc.	3240	-	-	-	-	-	-	-	-	-	-	-
Greenst.	4525	-	-	-	-	-	-	-	-	-	-	-
Total		11	2	3	1	14	2	2	2	2	117	100
Estimated Surface Lithics		25	2	3	1	25	2	5	5	2	130	

Appendix B, Table 9
Lithic material type frequencies by site for the Pierre's survey area

		Chacoan Structures											
		Pierre's Site						P-6					
		House A		House B		Total		Trash A		Trash B		Total	
Material	Type	#	%	#	%	#	%	#	%	#	%	#	%
Cherts	1011	7	15	27	40	34	30	15	23	5	13	20	19
	1140	-	-	-	-	-	-	-	-	-	-	-	-
	1042	-	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-	-
	1051	-	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	-	-	-	-	-	-
	1060	-	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	-	-	-
	1072	3	6	1	1	4	4	-	-	-	-	-	-
	1080	1	2	-	-	1	1	1	2	-	-	1	1
	1090	-	-	-	-	-	-	-	-	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		11	23	28	42	39	34	16	25	5	13	21	20
Silicified Woods	1112	10	21	8	12	18	16	8	12	8	21	16	16
	1113	8	17	8	12	16	14	4	6	1	3	5	5
	1120	1	2	-	-	1	1	4	6	-	-	4	4
	1130	-	-	-	-	-	-	1	2	-	-	1	1
	1140	9	19	14	21	23	20	3	5	2	5	5	5
	1142	-	-	2	3	2	2	1	2	1	3	2	2
	1151	4	9	2	3	6	5	27	42	18	47	45	44
Subtotal		32	68	34	51	66	58	48	74	30	79	78	76
Osbidian	3510	-	-	-	-	-	-	-	-	-	-	-	-
	3520	1	2	-	-	1	1	-	-	-	-	-	-
Quartzite	4000												
	Fine	-	-	-	-	-	-	-	-	-	-	-	-
	Medium	1	2	1	1	2	2	1	2	2	5	3	3
	Coarse	2	4	4	6	6	5	-	-	1	3	1	1
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		3	6	5	7	8	7	1	2	3	8	4	4
Total		47	99	67	100	114	100	65	101	38	100	103	100
Estimated Surface Lithics			100		200		300		130		50		180

		Small houses															Isolated rooms			Isolated firepit	Non-hab.
		P-1	P-3		P-4	P-5	P-8	P-9	P-10		P-12	P-13		P-15		P-16	P-17	P-18	P-20	P-17	P-14
Material	Type	#	#	%	#	#	#	#	#	%	#	#	%	#	%	#	#	#	#	#	#
Cherts	1011	1	1	5	-	-	3	-	27	36	-	14	42	14	22	-	2	-	1	-	-
	1140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1042	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
	1050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1051	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1052	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1072	-	-	-	-	-	-	-	2	3	-	-	-	1	2	-	-	-	-	-	-
	1080	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1090	-	-	-	-	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-	-
	1091	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1425	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		1	1	5	-	-	3	-	30	39	-	15	45	15	24	-	2	-	1	-	-
Silicified Woods	1112	1	4	20	-	4	3	4	6	8	-	3	9	2	3	-	-	-	3	3	1
	1113	5	4	20	-	3	-	6	9	12	3	3	9	20	32	1	-	-	-	1	3
	1120	1	2	10	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-
	1130	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
	1140	2	6	30	1	5	2	1	5	7	4	4	12	7	11	-	1	1	1	6	1
	1142	-	-	-	-	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-
	1151	3	2	10	2	4	1	4	22	29	1	4	12	17	27	2	-	-	-	-	1
Subtotal		12	18	90	3	16	7	16	43	57	10	14	42	46	73	4	1	1	4	10	6
Osbidian	3510	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3520	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Quartzite	4000																				
	Fine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Medium	-	-	-	-	-	-	-	1	1	-	1	3	-	-	-	-	-	-	-	-
	Coarse	-	1	5	-	-	2	3	2	3	-	3	9	2	3	-	-	-	-	-	-
Brushy Basin	2205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal		-	1	5	-	-	2	3	3	4	-	4	12	2	3	-	-	-	-	-	-
Total		13	20	100	3	16	12	19	76	100	11	33	99	63	100	4	3	1	5	10	6
Estimated Surface Lithics		25		40	5	40	20	40		200	20		100		125	10	5	1	10	15	10

APPENDIX C

Chacoan Structure Laboratory of Anthropology Site Numbers

Site Name	Laboratory of Anthropology Number	Other Site Number/Names
Allantown	-	Fort Defiance 12:19
Aztec West Ruin	LA 45	
Bee Burrow	LA 13163	
Bis sa'ani	LA 17286 LA 17287	29SJ2375
Casamero	LA 8779	
Chimney Rock	-	5AA83
Dalton Pass	-	
El Rito	LA 13831	
Escalante	-	5MT2149
Greenlee	LA 35418	
Grey Hill Springs	LA 18244	
Guadalupe	LA 2757	SDV-5, ENMU 848
Halfway House	LA 15191	ENMU 5112, ENMU 10732
Haystack	LA 6022	29Mc4
Hogback	LA 11594 LA 3522	
Houck	-	
Ida Jean		North McElmo 8
Kin Bineola	LA 18705	29SJ1580
Kin Klizhin	LA 4975	29SJ1413
Kin Ya'a	LA 8978	29 Mc 108
Lowry	LA 627	
Site 39	-	ENMU 5155

APPENDIX C

Chacoan Structure Laboratory of Anthropology Site Numbers - Continued

Site Name	Laboratory of Anthropology Number	Other Site Number/Names
Site 41	LA 5631	ENMU 5098
Muddy Water		
Hurley Ruin	LA 10959	
Site #1	LA 10716	
Site #33	LA 17257	
Peach Springs	LA 10770	
Pierre's		
House A	LA 16509	ENMU 6020
House B	LA 16508	
Site #6	LA 16515	
Pueblo Pintado	LA 574	29 Mc 166
Salmon	LA 8846	
Skunk Springs	LA 7000	
Standing Rock	LA 18232	
Sterling	-	ENMU 5031
Twin Angels	LA 5642	ENMU 5003
Upper Kin Klizhin	LA 34245	
Village of the Great Kivas	LA 631	
Wallace	-	
Yucca House		Aztec Spring

APPENDIX D: TABLES RELATED TO CHAPTER 6

Appendix D, Table 1 Outlier and Chaco Canyon Chacoan structure lithic material types

Material Type	Salmon[CH] #	Salmon[CH] %	Chimney Rock[d] #	Chimney Rock[d] %	Escalante[CH] #	Escalante[CH] %	Lowry[CH] #	Lowry[CH] %	Hogback[CH] #	Hogback[CH] %	Halfway House[CH] #	Halfway House[CH] %	Pierre's[CH] #	Pierre's[CH] %	Pierre's[C] #	Pierre's[C] %
Cherts and Chalcedonies																
High surface cherts (1050-1055)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morrison Form. cherts & chalcedonies (includes Brushy Basin)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-Brown chert (1072)	-	-	-	-	-	-	-	-	-	-	-	-	4	2	3	1
Washington Pass chert (1080-1081)	448	1	-	-	-	-	-	-	4	11	-	-	2	1	-	-
Pedernal chert (1090-1091)	-	-	-	-	-	-	-	-	4	11	-	-	-	-	1[e]	-
Misc. chert	-	-	-	-	-	-	-	-	6	16	-	-	54	25	64	22
Misc. chalcedony	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown/other misc. cherts & chalcedonies	17,808[a]	34	155	22	202	20	11	100	-	-	2	33	-	-	-	-
TOTAL CHERTS & CHALCEDONIES	18,254	35	156	22	202	20	11	100	14	38	2	33	60	28	68	23
TOTAL INTRUSIVE CHERTS & CHALCEDONIES	448	1	-	-	-	-	-	-	4	11	-	-	6	3	3	1
Silicified Woods																
Cherty silicified wood (1112, 1113)	-	-	-	-	-	-	-	-	9	24	2	33	55	25	92	31
Splintery silicified wood (1109-1110)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chalcedonic silicified wood (1140-1145)	-	-	-	-	-	-	-	-	2	5	-	-	32	15	50	17
Chinle (Zuni) wood (1160)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. silicified wood	-	-	-	-	-	-	-	-	6	16	1	17	57	26	69	23
Unknown misc. silicified wood (1100)	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
TOTAL SILICIFIED WOODS	-	-	-	-	2	-	-	-	17	46	3	50	144	66	211	72
TOTAL INTRUSIVE WOODS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sedimentary Materials																
Quartzitic sandstone	-	-	473	66	-	-	-	-	-	-	-	-	-	-	-	-
Brushy Basin quartzitic sandstone (2201, 2205)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. sedimentary	6,865[b]	13	8	1	71	7	-	-	2	5	-	-	-	-	-	-
TOTAL SEDIMENTARY	6,865	13	481	67	71	1	-	-	2	5	-	-	-	-	-	-
TOTAL SEDIMENTARY INTRUSIVES	614	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Igneous Material																
Obsidian 3510	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3530	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550 (Misc.)	326	1	-	-	96	10	-	-	-	-	-	-	-	-	-	-
Misc. Igneous	10;140	19	62	9	10	1	-	-	-	-	-	-	-	-	-	-
TOTAL IGNEOUS	10,446	20	62	9	106	11	-	-	-	-	-	-	-	-	1	-
TOTAL INTRUSIVE IGNEOUS	326	1	-	-	96	10	-	-	-	-	-	-	1	-	1	-
Metamorphic Materials																
Quartzite	-	-	15	2	623	62	-	-	4	11	1	17	12	6	15	5
Quartz	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-
Turquoise (5300)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. metamorphic	17,179	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL METAMORPHIC	17,179[c]	33	19	3	623	62	-	-	4	11	1	17	12	6	15	5
TOTAL METAMORPHIC INTRUSIVES	15		-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL LITHICS	52,744	101	717	101	1004	100	11	100	37	100	6	100	217	100	295	100
TOTAL LITHIC INTRUSIVES	1,403	3	-	-	96	10	-	-	4	11	-	-	7	3	4	1

Appendix D, Table 1 Continued

Material Type	Bis sa'ani[CH] #	Bis sa'ani[CH] %	Bis sa'ani[C] #	Bis sa'ani[C] %	Pueblo Pintado[CH] #	Pueblo Pintado[CH] %	Up. Kin Klizhin[CH] #	Up. Kin Klizhin[CH] %	Bee Burrow[CH] #	Bee Burrow[CH] %	Bee Burrow[C] #	Bee Burrow[C] %	Kin Ya'a[CH] #	Kin Ya'a[CH] %	Muddy Water[CH] #	Muddy Water[CH] %
<u>Cherts and Chalcedonies</u>																
High surface cherts (1050-1055)	2	6	16	4	11	3	10	23	-	-	47	27	12	7	13	15
Morrison Form. cherts & chalcedonies (includes Brushy Basin)	1	3	6	1	1	-	-	-	-	-	-	-	-	-	-	-
Yellow-Brown chert (1072)	-	-	7	2	4	1	2	5	-	-	17	10	17	10	28	33
Washington Pass chert (1080-1081)	-	-	2	-	7	-	-	-	1	10	10	6	1	1	10	12
Pedernal chert (1090-1091)	1[e]	3	12[e]	3	-	-	-	-	1[e]	10	-	-	-	-	-	-
Misc. chert	3	9	40	9	46	14	2	5	-	-	20	11	20	12	9	11
Misc. chalcedony	-	-	1	-	7	2	-	-	-	-	-	-	3	2	-	-
Unknown/other misc. cherts & chalcedonies	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
TOTAL CHERTS & CHALCEDONIES	7	21	84	19	77	24	14	33	2	20	94	54	53	33	60	71
TOTAL INTRUSIVE CHERTS & CHALCEDONIES	1	3	15	3	12	4	2	5	1	10	27	16	18	11	38	45
<u>Silicified Woods</u>																
Cherty silicified wood (1112, 1113)	9	27	113	25	25	8	8	19	2	20	57	33	28	17	-	-
Splintery silicified wood (1109-1110)	-	-	-	-	26	8	3	7	-	-	9	5	4	2	-	-
Chalcedonic silicified wood (1140-1145)	11	33	184	41	107	33	12	28	5	50	3	2	65	40	-	-
Chinle (Zuni) wood (1160)	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
Misc. silicified wood	2	6	9	2	2	1	2	5	-	-	3	2	2	1	-	-
Unknown misc. silicified wood (1100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	21
TOTAL SILICIFIED WOODS	22	67	306	69	160	49	25	59	7	70	72	42	100	61	18	21
TOTAL INTRUSIVE WOODS	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
<u>Sedimentary Materials</u>																
Quartzitic sandstone	-	-	-	-	47	14	-	-	-	-	-	-	1	1	-	-
Brushy Basin quartzitic sandstone (2201,2205)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. sedimentary	-	-	-	-	2	1	4	9	-	-	-	-	1	1	3	4
TOTAL SEDIMENTARY	-	-	1	-	49	15	4	9	-	-	-	-	2	1	3	4
TOTAL SEDIMENTARY INTRUSIVES	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Igneous Material</u>																
Obsidian 3510	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3520	1	3	13	3	-	-	-	-	1	10	4	2	-	-	-	-
Obsidian 3530	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550 (Misc.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Igneous	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1
TOTAL IGNEOUS	1	3	13	3	1	-	-	-	1	10	4	2	-	-	1	1
TOTAL INTRUSIVE IGNEOUS	1	3	13	3	1	-	-	-	1	10	4	2	-	-	1	1
<u>Metamorphic Materials</u>																
Quartzite	3	9	40	9	35	11	-	-	-	-	4	2	4	2	1	1
Quartz	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-	-
Turquoise (5300)	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Misc. metamorphic	-	-	-	-	1	-	-	-	-	-	-	-	-	-	2	2
TOTAL METAMORPHIC	3	9	40	9	37	11	-	-	-	-	4	2	8	5	3	4
TOTAL METAMORPHIC INTRUSIVES	-	-	-	-	1	-	-	-	-	-	-	-	4	2	-	-
TOTAL LITHICS	33	100	444	100	324	99	43	101	10	100	174	100	163	100	85	101
TOTAL LITHIC INTRUSIVES	2	6	28	6	14	4	2	5	2	20	31	18	23	14	39	46

Appendix D, Table 1 Continued

Material Type	Dalton Pass[CH]		Kin Klizhin[CH]		Kin Bineola[CH]		Standing Rock[CH]		Peach Springs[CH]		Peach Springs[C]		Grey Hill Springs[f]		Skunk Springs[CH]	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Cherts and Chalcedonies																
High surface cherts (1050-1055)	-	-	3	9	9	8	5	3	7	4	9	-	5	6	2	1
Morrison Form. cherts & chalcedonies (includes Brushy Basin)	-	-	-	-	-	-	2	1	6	3	5	-	-	-	13	7
Yellow-Brown chert (1072)	-	-	1	3	4	3	24	14	41	21	427	22	8	9	-	-
Washington Pass chert (1080-1081)	1	4	4	11	7	6	6	3	8	4	84	4	11	13	66	34
Pedernal chert (1090-1091)	1[e]	4	2[e]	6	-	-	-	-	7[e]	4	8[e]	-	-	-	-	-
Misc. chert	1	4	1	3	8	7	6	3	6	3	34	2	1	1	49	25
Misc. chalcedony	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-
Unknown/other misc. cherts & chalcedonies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL CHERTS & CHALCEDONIES	3	13	11	31	29	25	44	25	75	39	567	30	25	28	130	66
TOTAL INTRUSIVE CHERTS & CHALCEDONIES	1	4	5	14	11	9	32	18	55	29	516	27	19	22	79	40
Silicified Woods																
Cherty silicified wood (1112, 1113)	11	48	1	3	15	13	35	20	27	14	478	25	-	-	3	2
Splintery silicified wood (1109-1110)	-	-	6	17	3	3	23	13	-	-	-	-	35	40	42	21
Chalcedonic silicified wood (1140-1145)	6	26	9	26	46	39	37	21	56	29	629	33	9	10	16	8
Chinle (Zuni) wood (1160)	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-
Misc. silicified wood	2	9	4	11	14	12	16	9	19	10	179	9	-	-	1	1
Unknown misc. silicified wood (1100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2
TOTAL SILICIFIED WOODS	19	83	20	57	81	69	111	63	102	53	1286	67	44	50	65	33
TOTAL INTRUSIVE WOODS	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-
Sedimentary Materials																
Quartzitic sandstone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Brushy Basin quartzitic sandstone (2201, 2205)	-	-	-	-	-	-	-	-	1	1	2	-	-	-	-	-
Misc. sedimentary	-	-	1	3	-	-	12	7	-	-	-	-	-	-	-	-
TOTAL SEDIMENTARY	-	-	1	3	-	-	12	7	1	1	2	-	-	-	1	1
TOTAL SEDIMENTARY INTRUSIVES	-	-	-	-	-	-	-	-	1	1	2	-	-	-	-	-
Igneous Material																
Obsidian 3510	1	4	-	-	-	-	2	1	3	2	12	1	-	-	-	-
Obsidian 3520	-	-	-	-	2	2	-	-	1	1	5	-	-	-	-	-
Obsidian 3530	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550 (Misc.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Igneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL IGNEOUS	1	4	-	-	2	2	2	1	4	2	18	1	-	-	-	-
TOTAL INTRUSIVE IGNEOUS	1	4	-	-	2	2	2	1	4	2	18	1	-	-	-	-
Metamorphic Materials																
Quartzite	-	-	3	9	5	4	4	2	9	5	43	2	19	22	-	-
Quartz	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Turquoise (5300)	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
Misc. metamorphic	-	-	-	-	-	-	2	1	1	1	-	-	-	-	-	-
TOTAL METAMORPHIC	-	-	3	9	6	5	8	5	10	5	43	2	19	22	-	-
TOTAL METAMORPHIC INTRUSIVES	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-
TOTAL LITHICS	23	100	35	100	118	101	177	101	192	100	1916	100	88	100	196	100
TOTAL LITHIC INTRUSIVES	2	9	5	14	16	14	36	20	60	31	536	28	19	22	79	40

Appendix D, Table 1 Continued

Material Type	Casamero[CH] #	Casamero[CH] %	Haystack[CH] #	Haystack[CH] %	El Rito[CH] #	El Rito[CH] %	El Rito[Ci] #	El Rito[Ci] %	Guadalupe[CH] #	Guadalupe[CH] %	Houck[CH] #	Houck[CH] %	Penasco Blanco[CH] #	Penasco Blanco[CH] %	Pueblo Alto[CH] #	Pueblo Alto[CH] %
Cherts and Chalcedonies																
High surface cherts (1050-1055)	-	-	5	7	4	7	83	31	-	-	-	-	161	22	11	7
Morrison Form. cherts & chalcedor (includes Brushy Basin)	9[g]	7	1[g]	1	-	-	-	-	-	-	1	9	-	-	18	11
Yellow-Brown chert (1072)	16	12	10	13	38	70	75	28	-	-	-	-	3	-	1	1
Washington Pass chert (1080-1081)	-	-	-	-	2	4	2	1	-	-	-	-	31	4	37	23
Pedernal chert (1090-1091)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. chert	1	1	21	28	-	-	7	3	-	-	4	36	50	7	10	6
Misc. chalcedony	-	-	-	-	1	2	14	5	-	-	-	-	12	2	1	1
Unknown/other misc. cherts & chalcedonies	95	69	5	7	-	-	-	-	120	75	-	-	-	-	-	-
TOTAL CHERTS & CHALCEDONIES	121	88	42	56	45	83	181	67	120	75	5	45	257	35	78	49
TOTAL INTRUSIVE CHERTS & CHALCEDONIES	16	12	10	13	40	74	77	29	-	-	1	9	34	5	56	35
Silicified Woods																
Cherty silicified wood (1112, 1113)	3	2	8	11	-	-	-	-	-	-	2	18	177	24	13	8
Splintery silicified wood (1109-1110)	1	1	-	-	-	-	1	-	-	-	-	-	49	7	26	16
Chalcedonic silicified wood (1140-1145)	-	-	-	-	-	-	-	-	-	-	-	-	165	22	21	13
Chinle (Zuni) wood (1160)	-	-	-	-	2	4	1	-	-	-	-	-	-	-	1	1
Misc. silicified wood	-	-	-	-	-	-	3	1	-	-	3	27	23	3	2	1
Unknown misc. silicified wood (1100)	-	-	-	-	-	-	-	-	32	20	-	-	-	-	-	-
TOTAL SILICIFIED WOODS	4	3	8	11	2	4	5	2	32	20	5	45	414	56	63	40
TOTAL INTRUSIVE WOODS	-	-	-	-	2	4	1	-	-	-	-	-	-	-	1	1
Sedimentary Materials																
Quartzitic sandstone	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
Brushy Basin quartzitic sandstone (2201, 2205)	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Misc. sedimentary	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL SEDIMENTARY	3	2	-	-	-	-	-	-	-	-	-	-	4	1	1	1
TOTAL SEDIMENTARY INTRUSIVES	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Igneous Material																
Obsidian 3510	1	1	16[h]	21	7[h]	13	50	19	-	-	-	-	1	-	-	-
Obsidian 3520	-	-	-	-	-	-	6	2	-	-	-	-	2	-	1	1
Obsidian 3530	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-
Obsidian 3550	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Obsidian 3550 (Misc.)	1	1	-	-	-	-	24	9	-	-	-	-	-	-	-	-
Misc. Igneous	-	-	-	-	-	-	3	1	1	1	-	-	-	-	-	-
TOTAL IGNEOUS	4	3	16	21	7	13	83	31	3	2	-	-	3	-	1	1
TOTAL INTRUSIVE IGNEOUS	4	3	16	21	7	13	83	31	2	1	-	-	3	-	1	1
Metamorphic Materials																
Quartzite	5	4	9	12	-	-	1	-	4	3	1	9	61	8	15	9
Quartz	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turquoise (5300)	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Misc. metamorphic	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
TOTAL METAMORPHIC	6	4	9	12	-	-	1	-	4	3	1	9	64	9	15	9
TOTAL METAMORPHIC INTRUSIVES	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
TOTAL LITHICS	138	100	75	100	54	100	270	100	159	100	11	99	742	101	158	100
TOTAL LITHIC INTRUSIVES	20	14	26	35	49	91	161	60	2	1	1	9	42	6	58	37

Appendix D, Table 1 Concluded

Material Type	Pueblo Bonito[CH] #	%	Chetro Ketl[CH] #	%	Tsin Kletzin[CH] #	%	Una Vida[CH] #	%
Cherts and Chalcedonies								
High surface cherts (1050-1055)	35	9	12	5	11	10	9	6
Morrison Form. cherts & chalcedonies (includes Brushy Basin)	12	3	6	3	-	-	-	-
Yellow-Brown chert (1072)	10	3	2	1	7	6	1	1
Washington Pass chert (1080-1081)	175	44	125	55	13	12	9	6
Pedernal chert (1090-1091)	-	-	-	-	-	-	-	-
Misc. chert	8	2	3	1	12	11	9	6
Misc. chalcedony	2	-	-	-	-	-	1	1
Unknown/other misc. cherts & chalcedonies	-	-	-	-	-	-	3	2
TOTAL CHERTS & CHALCEDONIES	242	61	148	65	43	39	32	21
TOTAL INTRUSIVE CHERTS & CHALCEDONIES	197	49	133	58	20	18	10	7
Silicified Woods								
Cherty silicified wood (1112, 1113)	27	7	10	4	18	16	35	23
Splintery silicified wood (1109-1110)	25	6	30	13	10	9	3	2
Chalcedonic silicified wood (1140-1145)	37	9	13	6	9	8	71	47
Chinle (Zuni) wood (1160)	5	1	7	3	1	1	-	-
Misc. silicified wood	6	2	6	3	8	7	4	3
Unknown misc. silicified wood (1100)	-	-	-	-	-	-	1	1
TOTAL SILICIFIED WOODS	100	25	66	29	46	41	114	76
TOTAL INTRUSIVE WOODS	5	1	7	3	1	1	-	-
Sedimentary Materials								
Quartzitic sandstone	6	2	1	-	1	1	-	1
Brushy Basin quartzitic sandstone (2201-22-5)	1	-	-	-	-	-	1	1
Misc. sedimentary	-	-	-	-	2	2	-	-
TOTAL SEDIMENTARY	7	2	1	-	3	3	2	1
TOTAL SEDIMENTARY INTRUSIVES	1	-	-	-	-	-	1	1
Igneous Material								
Obsidian 3510	1	-	-	-	-	-	-	-
Obsidian 3520	22	6	2	1	1	1	1	1
Obsidian 3530	-	-	-	-	-	-	-	-
Obsidian 3550	1	-	-	-	-	-	-	-
Obsidian 3550 (Misc.)	1	-	-	-	-	-	-	-
Misc. Igneous	-	-	-	-	1	1	-	-
TOTAL IGNEOUS	25	6	2	1	2	2	1	1
TOTAL INTRUSIVE IGNEOUS	25	6	2	1	2	2	1	1
Metamorphic Materials								
Quartzite	13	3	8	4	17	15	-	-
Quartz	1	-	-	-	-	-	1	1
Turquoise (5300)	8	2	1	-	-	-	-	-
Misc. metamorphic	2	-	2	1	-	-	-	-
TOTAL METAMORPHIC	24	6	11	5	17	15	1	1
TOTAL METAMORPHIC INTRUSIVES	8	2	1	-	-	-	1	1
TOTAL LITHICS	398	100	228	100	111	100	150	100
TOTAL LITHIC INTRUSIVES	226	57	134	59	22	20	13	9

KEY

CH = Chacoan structure
C = Community sites (not including Chacoan structure)

Cherts and Chalcedonies

Morrison Formation cherts and chalcedonies include lithic types 1020, 1022, 1040, 1430.

Miscellaneous cherts include lithic types 1010, 1011, 1014, 1016, 1021, 1030, 1041, 1042, 1060, 1070. 1071, 1075, 1400, 1425, 1501, 1600, 1602, 1630, 1640, 1660, 1661, 1680.

Miscellaneous chalcedony includes lithic types 1200, 1201, 1210, 1214, 1221, 1230, 1231, 1300.

Silicified Woods

Miscellaneous silicified wood includes lithic types 1111, 1120, 1130, 1150, 1151.

Sedimentary Materials

Quartzitic sandstone includes lithic types 2200, 2202, 2204, 2221.

Miscellaneous sedimentary includes claystone (2551), siltstone, shale (2650), limestone (2701), sandstone and other miscellaneous sedimentary materials.

Igneous Materials

Miscellaneous igneous includes basalt (3400, 3410, 3050), granite (3100), rhyolite (3150), diorite (3420), and felsite porphry.

Metamorphic Materials

Quartzite includes 4000, 4001, 4005, and miscellaneous unidentified quartz.

Quartz includes lithic types 5000, 5002, 5010, and miscellaneous unidentified quartz.

Miscellaneous metamorphic includes greenstone (4525), selenite (5401), metasyenite (4375), azurite (5310), malachite (5320), and miscellaneous unidentified materials.

a - includes silicified woods
b - instrusive sedimentary rocks are lumped in miscellaneous category. Intrusives include limestones, Nacimiento orthoquartzite, and Brushy Basin claystone.
c - includes intrusive metamorphic rocks
d - sample from Site 5AA88, a great kiva and small house site in the Chimney Rock community.
e - Pedernal chert represented at this site may be from local surface gravel deposits.
f - Grey Hill Springs lithic sample is from two community small houses, LA18239 and LA18243.
g - 1040 possibly obtained from local Morrison Formation outcrops
h - although probably obtained directly by prehistoric inhabitants of these communities, there are no known source areas within the 10 km radius.
i - El Rito community sample includes Chacoan structure sample

Appendix D, Table 2

Ceramic wares at outlying Chacoan structures and Chaco Canyon Chacoan structures

Ware		Salmon		Site 39		Site 41		Chimney Rock		Escalante		Lowry		Hogback		Twin Angels	
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Cibola	Whiteware	2,183	1	38	1	58	1	8	1	–	–	354	14	–	–	70	10
	Grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	1,710	1	3	–	4	–	–	–	9	–	47	2	–	–	3	–
	Total	3,893	2	41	1	62	1	8	1	9	–	401	16	–	–	73	11
San Juan	Whiteware	39,350	19	450	11	590	11	270	28	1,921	20	687	28	25	28	93	14
	Grayware	24,162	12	–	–	46	1	654	69	446	5	–	–	9	10	–	–
	Redware	41	–	8	–	4	–	–	–	26	–	15	1	1	1	18	3
	Total	63,553	31	458	12	640	12	924	97	2,393	24	702	29	35	40	111	16
Tusayan	Whiteware	44	–	4	–	1	–	7	1	74	1	108	4	–	–	–	–
	Grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	110	–	1	–	–	–	1	–	229	2	37	2	–	–	–	–
	Total	154	–	5	–	1	–	8	1	303	3	145	6	–	–	–	–
Chuska	Whiteware	225	–	11	–	2	–	–	–	–	–	–	–	28	32	4	1
	Grayware	1,935	1	21	–	2	–	–	–	–	–	–	–	25	28	16	2
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	2,160	1	32	1	4	–	–	–	–	–	–	–	53	60	20	3
Mogollon	Whiteware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Brownware	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
	Redware	370	–	–	–	–	–	–	–	–	–	–	–	–	–	12	2
	Total	372	–	–	–	–	–	–	–	–	–	–	–	–	–	14	2
Other	Whiteware	1	–	–	–	–	–	–	–	–	–	–	–	–	–	6	1
	Brown/grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	1	–	–	–	–	–	–	–	–	–	–	–	–	–	6	1
Unident.	Whiteware	20,418	10	994	25	1,421	26	8	1	1,210	12	26	1	–	–	107	16
	Grayware	111,185	55	2,386	61	3,381	61	–	–	5,874	60	1,173	48	–	–	352	51
	Redware	580	–	11	–	9	–	2	–	22	–	4	–	–	–	3	–
	Misc.	17	–	–	–	–	–	–	–	11	–	–	–	–	–	–	–
	Total	132,200	65	3,391	86	4,811	87	10	1	7,117	72	1,203	49	–	–	462	67
Grand Total		202,333	99	3,927	100	5,518	100	950	100	9,822	99	2,451	100	88	100	686	100
Total Intrusives		6,580	3	78	2	67	1	16	2	312	3	546	22	–	–	40	6

Appendix D, Table 2 Continued

Ware		P. Pintado #	%	U K. Klizhin #	%	Bee Burrow #	%	Kin Ya'a #	%	Muddy Water #	%	Kin Klizhin #	%	Kin Bineola #	%	Grey Hill Sp. #	%
Cibola	Whiteware	200	21	39	42	53	25	85	16	207	41	57	38	57	21	83	35
	Grayware	491	51	26	28	1	–	348	64	248	49	59	39	116	42	68	28
	Redware	2	–	–	–	21	10	2	–	18	4	2	1	–	–	9	4
	Total	693	72	65	70	75	36	435	81	473	94	118	79	173	63	160	67
San Juan	Whiteware	6	1	–	–	3	1	1	–	29	6	1	1	–	–	3	1
	Grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
	Total	6	1	–	–	3	1	1	–	29	6	1	1	1	–	3	1
Tusayan	Whiteware	3	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–
	Grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	–	–	–	–	–	–	–	–	2	–	2	1	–	–	–	–
	Total	3	–	–	–	1	–	–	–	2	–	2	1	1	–	–	–
Chuska	Whiteware	10	1	1	1	1	–	–	–	–	–	2	1	4	1	5	2
	Grayware	54	6	3	3	–	–	2	–	–	–	13	9	56	20	70	29
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	64	7	4	4	1	–	2	–	–	–	15	10	60	22	75	31
Mogollon	Whiteware	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Brownware	–	–	–	–	–	–	–	–	–	–	–	–	2	1	–	–
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	4	–	–	–	–	–	–	–	–	–	–	–	2	1	–	–
Other	Whiteware	–	–	–	–	1	–	–	–	1	–	1	1	–	–	2	1
	Brown/grayware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Redware	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	–	–	–	–	1	–	–	–	1	–	1	1	–	–	2	1
Unident.	Whiteware	189	20	–	–	22	11	102	19	–	–	13	9	39	14	–	–
	Grayware	–	–	22	24	105	50	–	–	–	–	–	–	–	–	–	–
	Redware	–	–	2	2	–	–	–	–	–	–	–	–	–	–	–	–
	Misc.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	189	20	24	26	127	61	102	19	–	–	13	9	39	14	–	–
Grand Total		959	100	93	100	208	98	540	100	505	100	150	101	276	100	240	100
Total Intrusives		77	8	4	4	6	3	3	1	32	6	19	13	64	23	5	2

Appendix D, Table 2 Continued

Ware		Skunk Springs #	Skunk Springs %	Haystack #	Haystack %	Casamero #	Casamero %	El Rito #	El Rito %	Guadalupe #	Guadalupe %	Houck #	Houck %	Penasco Blanco #	Penasco Blanco %	New Alto #	New Alto %
Cibola	Whiteware	20	5	113	51	395	18	44	70	276	31	6	29	46	20	7	10
	Grayware	20	5	68	31	-	-	4	6	582	65	-	-	72	31	-	-
	Redware	6	1	7	3	10	-	4	6	-	-	2	10	-	-	2	3
	Total	46	11	188	85	405	18	52	83	858	96	8	39	118	51	9	13
San Juan	Whiteware	27	6	-	-	-	-	2	3	-	-	-	-	1	-	2	3
	Grayware	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Redware	7	2	5	2	-	-	-	-	-	-	-	-	2	1	-	-
	Total	35	8	5	2	-	-	2	3	-	-	-	-	3	1	2	3
Tusayan	Whiteware	2	-	1	-	-	-	-	-	-	-	-	-	3	1	-	-
	Grayware	-	-	-	-	-	-	-	-	-	-	2	10	-	-	-	-
	Redware	-	-	-	-	13	1	-	-	-	-	-	-	-	-	2	3
	Total	2	-	1	-	13	1	-	-	-	-	2	10	3	1	2	3
Chuska	Whiteware	136	31	-	-	-	-	-	-	-	-	-	-	11	5	-	-
	Grayware	214	49	-	-	-	-	1	2	-	-	-	-	53	23	-	-
	Redware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	350	80	-	-	-	-	1	2	-	-	-	-	64	28	-	-
Mogollon	Whiteware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Brownware	-	-	5	2	-	-	-	-	-	-	2	10	1	-	-	-
	Redware	-	-	1	-	2	-	-	-	-	-	3	14	-	-	-	-
	Total	-	-	6	3	2	-	-	-	-	-	5	24	1	-	-	-
Other	Whiteware	3	1	5	2	1	-	-	-	-	-	-	-	-	-	-	-
	Brown/grayware	-	-	-	-	-	-	-	-	6	1	-	-	-	-	-	-
	Redware	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-
	Total	3	1	8	4	1	-	-	-	6	1	-	-	-	-	-	-
Unident.	Whiteware	-	-	-	-	-	-	4	6	25	3	4	19	43	19	11	16
	Grayware	-	-	8	4	1,788	81	2	3	3	-	2	10	-	-	46	66
	Redware	2	-	4	2	-	-	2	3	-	-	-	-	-	-	-	-
	Misc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	2	-	12	5	1,788	81	8	13	28	3	6	29	43	19	57	81
Grand Total		438	100	220	99	2,209	100	63	101	898	100	21	101	232	-	70	100
Total Intrusives		86	20	20	9	16	1	3	5	6	1	7	33	71	31	4	6

Appendix D, Table 2 Continued

Ware		Pueblo Alto #	Pueblo Alto %	Kin Kletso #	Kin Kletso %	P. Bonito #	P. Bonito %	P. del Arroyo #	P. del Arroyo %	Chetro Ketl #	Chetro Ketl %	Tsin Kletsin #	Tsin Kletsin %	Una Vida #	Una Vida %	Wijiji #	Wijiji %
Cibola	Whiteware	76	30	5,240	86	143	23	418	29	178	30	63	19	61	23	3	25
	Grayware	73	29	-	-	190	30	294	21	171	29	194	60	-	-	-	-
	Redware	-	-	272	4.5	5	1	27	2	3	1	3	1	1	-	-	-
	Total	149	59	5,512	91	338	54	739	52	352	59	260	80	62	24	3	25
San Juan	Whiteware	1	-	75	1	4	1	57	4	2	-	-	-	6	2	2	17
	Grayware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Redware	-	-	-	-	1	-	-	-	-	-	-	-	4	2	-	-
	Total	1	-	75	1	5	1	57	4	2	-	-	-	10	4	2	17
Tusayan	Whiteware	-	-	-	-	6	1	19	1	9	2	6	2	-	-	-	-
	Grayware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Redware	-	-	219	4	-	-	-	-	-	-	-	-	1	-	-	-
	Total	-	-	219	4	6	1	19	1	9	2	6	2	1	-	-	-
Chuska	Whiteware	3	1	-	-	8	1	60	4	13	2	1	-	-	-	-	-
	Grayware	55	22	-	-	134	21	359	25	114	19	14	4	-	-	-	-
	Redware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	58	23	-	-	142	23	419	29	127	21	15	5	-	-	-	-
Mogollon	Whiteware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Brownware	2	1	29	-	9	1	27	2	10	2	1	-	-	-	-	-
	Redware	-	-	212	3.5	-	-	-	-	-	-	-	-	-	-	-	-
	Total	2	1	241	4	9	1	27	2	10	2	1	-	-	-	-	-
Other	Whiteware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Brown/grayware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Redware	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unident.	Whiteware	42	17	-	-	129	21	167	12	95	16	42	13	100	38	5	42
	Grayware	-	-	-	-	-	-	-	-	-	-	-	-	87	33	2	17
	Redware	-	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-
	Misc.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	42	17	14	-	129	21	167	12	95	16	42	13	187	72	7	58
Grand Total		252	100	6,061	100	629	101	1,428	100	595	100	324	100	260	100	12	100
Total Intrusives		61	24	535	9	162	26	522	37	148	25	22	7	11	4	2	17

1 - With the exception of Grey Hill Springs, where a combined ceramic sample from the Chacoan structure, associated features and six adjacent small house sites is presented, all samples are from Chacoan structures and associated refuse mounds.

Appendix D, Table 3
Temper types at outliers and Chaco Canyon Chacoan structures

	Salmon (CH) EP-III-LPIII		Site 41(C) EPIII		Pierres (CH)(C) EPIII		Bis sa'ani(CH) EPIII		Pueblo Pintado(CH,C) LPII-EPIII		Pueblo Pintado(C) PII-III		Kin Ya a (CH)(C) PII-III		Kin Ya a (CH) LPII-III	
	#	%	#	%	#	#	#	%	#	%	#	%	#	%	#	%
Black-on-white wares																
Mineral Paint																
Trachyte	-	-	-	-	2	4	1	7	-	-	2	3	-	-	-	-
Sand (2112)	-	-	-	-	-	-	-	-	-	-	10	17	-	-	4	9
Sand	-	-	-	-	53	93	14	93	-	-	46	78	-	-	38	84
Sherd	-	-	-	-	1	2	-	-	-	-	-	-	-	-	3	7
Sherd/Trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	-	-	-	-	1	2	-	-	-	-	1	2	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Sample Size	-	-	-	-	57	101	.15	100	-	-	59	100	-	-	45	100
Total Intrusives	-	-	-	-	3	5	1	7	-	-	3	5	-	-	-	-
Carbon Paint																
Trachyte	-	-	-	-	11	55	14	38	-	-	1	13	-	-	-	-
Sand (2112)	-	-	-	-	1	5	-	-	-	-	1	13	-	-	-	-
Sand	-	-	-	-	5	25	22	59	-	-	6	75	-	-	2	67
Sherd	-	-	5	28	-	-	-	-	-	-	-	-	-	-	-	-
Sherd/Trachyte	-	-	-	-	1	5	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	-	-	13	72	2	10	1	3	-	-	-	-	-	-	1	33
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Sample Size	-	-	18	100	20	100	37	100	-	-	8	101	-	-	3	100
Total Intrusives	-	-	-	-	13	65	15	41	-	-	1	13	-	-	1	33
Grayware																
Trachyte	1,935	7	-	-	13	18	12	50	20	10	2	9	4	1	-	-
Sand (2112)	-	-	-	-	8	11	-	-	-	-	-	-	-	-	5	17
Sand	618	2	-	-	47	66	12	50	-	-	19	83	-	-	24	80
Sherd	108	-	-	-	1	1	-	-	-	-	2	9	-	-	-	-
Sherd/Trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	24,162	90	-	-	2	3	-	-	-	-	-	-	-	-	-	-
Other	54*	-	-	-	-	-	-	-	183**	90	-	-	263**	99	1	3
Total Sample Size	26,877	99	-	-	71	99	24	100	203	100	23	101	267	100	30	100
Total Intrusive	1,935	7	-	-	15	21	12	50	20	10	2	9	4	1	-	-
Redware																
Trachyte	-	-	-	-	-	-	5	56	-	-	-	-	-	-	-	-
Sand	-	-	-	-	5	31	4	44	-	-	5	63	-	-	5	83
Sherd	-	-	-	-	10	63	-	-	-	-	-	-	-	-	-	-
Sherd/Trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	-	-	-	-	-	-	-	-	-	-	3	38	-	-	1	17
Other	-	-	-	-	1*	6	-	-	-	-	-	-	-	-	-	-
Total Sample Size	-	-	-	-	16	100	9	100	-	-	8	101	-	-	6	100
Total Intrusive	-	-	-	-	-	-	5	56	-	-	3	38	-	-	1	17
Total Temper Sample	26,877	100	18	100	164	100	85	100	203	100	98	100	267	100	84	100
Total Intrusives	1,935	7	-	-	31	19	33	39	20	10	9	9	4	1	2	2
Total Trachyte	1,935	7	-	-	26	16	32	38	20	10	5	5	4	1	-	-
Total Andesite-Diorite	24,162	90	13	72	5	3	1	1	-	-	4	4	-	-	2	2

Appendix D, Table 3 Continued

	Kin Klizhin (CH) EPIII		Kin Bineola (CH)(C) EPII-EPIII		Peach Springs (CH,C) EPII-LPIII		Casamero (CH) LPII-EPIII		Kin Kletso EPIII		Pueblo Bonito (CH) PII-III		Chetro Ketl (CH) EPIII		Una Vida (CH) EPII-EPIII	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Black-on-white wares																
Mineral Paint																
Trachyte	4	5	-	-	9	7	1	2	19	5	12	32	-	-	5	6
Sand (2112)	11	15	-	-	45	37	7	13	-	-	-	-	-	-	22	24
Sand	58	78	-	-	67	55	45	82	65	18	23	61	-	-	57	63
Sherd	-	-	-	-	-	-	2	4	227	62	-	-	-	-	-	-
Sherd/Trachyte	1	1	-	-	-	-	-	-	5	1	-	-	-	-	-	-
Andesite-Diorite	-	-	-	-	-	-	-	-	12	3	-	-	-	-	1	1
Other	-	-	-	-	-	-	-	-	37	10	3	8	-	-	5	6
Total Sample Size	74	99	-	-	121	99	55	101	365	99	38	100	-	-	90	100
Total Intrusives	4	5	-	-	9	7	1	2	31	8	12	32	-	-	6	7
Carbon Paint																
Trachyte	3	33	-	-	-	-	-	-	217	14	5	63	21	7	2	22
Sand (2112)	-	-	-	-	1	25	-	-	-	-	-	-	-	-	-	-
Sand	3	33	-	-	3	75	-	-	379	25	2	25	63	22	3	33
Sherd	2	22	-	-	-	-	-	-	752	49	-	-	122	43	-	-
Sherd/Trachyte	-	-	-	-	-	-	-	-	68	4	-	-	-	-	-	-
Andesite-Diorite	1	11	-	-	-	-	-	-	6	-	-	-	42	15	4	44
Other	-	-	-	-	-	-	-	-	124	8	1	13	36	13	-	-
Total Sample Size	9	99	-	-	4	100	-	-	1,546	100	8	100	284	100	9	100
Total Intrusives	4	44	-	-	-	-	-	-	223	14	5	63	63	22	6	67
Grayware																
Trachyte	8	21	77	30	18	28	-	-	118	47	19	38	-	-	20	26
Sand (2112)	4	10	-	-	13	20	5	21	-	-	-	-	-	-	10	13
Sand	26	67	-	-	33	52	19	79	98	39	29	58	-	-	48	62
Sherd	-	-	-	-	-	-	-	-	21	8	-	-	-	-	-	-
Sherd/Trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	1	3	-	-	-	-	-	-	-	-	2	4	-	-	-	-
Other	-	-	-	-	-	-	-	-	13	5	-	-	-	-	-	-
Total Sample Size	39	101	256	100	64	100	24	100	250	100	50	100	-	-	78	100
Total Intrusive	9	23	77	30	18	28	-	-	118	47	21	42	-	-	20	26
Redware																
Trachyte	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand	-	-	-	-	6	100	-	-	-	-	-	-	-	-	-	-
Sherd	1	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sherd/Trachyte	2	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Andesite-Diorite	2	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Sample Size	5	100	-	-	6	100	-	-	-	-	-	-	-	-	-	-
Total Intrusive	2	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Temper Sample	127	100	256	100	195	100	79	100	2,161	100	96	100	284	100	177	100
Total Intrusives	19	15	77	30	27	14	1	1	372	17	38	40	63	22	32	18
Total Trachyte	15	12	77	30	27	14	1	1	354	16	36	38	21	7	27	15
Total Andesite-Diorite	4	3	-	-	-	-	-	-	18	1	2	2	42	15	5	3

1 Frequencies are estimated, as derived from percentages given by Franklin (1979a). The sample includes 20% of all grayware sherds recovered through 1977.
2 Sites sampled are House B(n=33); P-6(n=23); P-1(n=23); P-10(n=40); P-13(n=20); and P-15(n=25).
CH Chacoan structure.
C One or more associated community sites.
* Denotes sand/sherd temper
** Denotes unidentified temper-type.

3 Sample consists of 365 Chaco B/W sherds (12% of all B/W sherds), 1,546 Chaco-McElmo (29% of all B/W, 51% of all McElmo), and 520 culinary (random sample) sherds (3% of estimated 8,037 culinary sherds).
4 Sample of 284 McElmo B/W sherds.

Note: Period of occupation designations (ie., LP II, EP III) indicates estimated date of sample.

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