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CHRONOLOGICAL ANALYSIS OF TSEGI PHASE SITES
IN NORTHEASTERN ARIZONA.**

**University of Arizona, Ph.D., 1967
Anthropology**

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CHRONOLOGICAL ANALYSIS OF TSEGI PHASE SITES
IN NORTHEASTERN ARIZONA

by
Jeffrey Stewart Dean

A Dissertation Submitted to the Faculty of the
DEPARTMENT OF ANTHROPOLOGY
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

1 9 6 7

THE UNIVERSITY OF ARIZONA

GRADUATE COLLEGE

I hereby recommend that this dissertation prepared under my
direction by Jeffrey Stewart Dean
entitled Chronological Analysis of Tsegi Phase Sites in
Northeastern Arizona
be accepted as fulfilling the dissertation requirement of the
degree of Doctor of Philosophy

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Jeffrey Stewart Dean

PREFACE

The research reported in this paper was conducted under the auspices of the Laboratory of Tree-Ring Research, The University of Arizona in Tucson. Grants to the Laboratory by the National Park Service supported the fieldwork in 1962 and 1963. Funds provided by the Arizona State Museum permitted additional fieldwork in 1964. The fieldwork was performed on lands belonging to Navajo National Monument, a part of the United States National Parks system, and on the Navajo Indian Reservation. Overall direction of the research fell to Bryant Bannister of the Laboratory, while I was responsible for the fieldwork and the laboratory analyses.

This report would not exist were it not for the contributions of many individuals to all phases of the undertaking---the fieldwork, the laboratory analysis, and the writing. I am deeply indebted to all these people, and it is with distinct pleasure that I gratefully acknowledge their assistance. My remarks here are inadequate to convey the measure of my obligation to these many individuals.

Bryant Bannister of the Laboratory of Tree-Ring Research perceived the need for and the potential of intensive dendrochronological analyses of individual archaeological sites and recognized the promise of Betatakin for this type of study. The research at Betatakin and Kiet Siel was structured largely in terms of his conception of the problem. In addition, he laid the groundwork for the study, negotiated with the National Park Service for funds, and

provided overall direction for the research projects. On numerous occasions Dr. Bannister took time from his busy schedule to come to the assistance of the Betatakin and Kiet Siel dating projects. Without his contributions, the value of this research would have been sharply reduced.

Erik K. Reed, as Regional Chief of the Division of Interpretation of the Southwest Region of the National Park Service, and the late R. Gordon Vivian, Supervisory Archeologist of the Southwest Archeological Center at Globe, Arizona, received the idea of a Betatakin dating project with enthusiasm, and their encouragement helped make the project a reality. The Southwest Region of the National Park Service, through the efforts of Dr. Reed, provided the Laboratory of Tree-Ring Research with funds to support the field and laboratory work at both Betatakin and Kiet Siel and with permission to collect samples at both ruins. The active support and enthusiastic cooperation of the Southwest Regional Office is in large measure responsible for the success of the field collecting programs.

My work in the field was made possible and pleasant by the active cooperation of a number of individuals. Edward B. Danson, Director of the Museum of Northern Arizona at Flagstaff, generously allowed me to work under permits issued the Museum by the Navajo Tribe and by the Department of the Interior. The personnel of the Museum were quick to render assistance whenever the need arose, and I am deeply indebted to them for their courtesy. Special thanks are due Milton A. Wetherill, Assistant Curator of Mammology, who shared with me his unparalleled knowledge of the Tsegi country, of its

many archaeological sites, and of the research undertaken there since 1930.

The most pleasant memories of my Tsegi Canyon fieldwork involve the personnel of Navajo National Monument who far exceeded the bounds of hospitality to provide an itinerant dendrochronologist with a home away from home. Arthur H. and Mary White, Buddy D. and Sina Martin, Keith M. and Joyce Anderson, and Larry and Judy Powers extended to me true "western" hospitality at its finest. To Robert J. Holden and Robert Laughter I owe many evenings of stimulating and enlightening discussion ranging from Tsegi Canyon archaeology to existentialist philosophy. I also wish to thank Mr. Holden for sharing with me a memorable horseback ride down Dogoszhi Biko into the teeth of a torrential cloudburst. At one time or another Ake Bigman, Bob Black, Keith Boone, and Terry Gray Mountain---members of the Monument labor crew---assisted in the field work.

Arthur H. White, Superintendent of Navajo National Monument during my three field seasons of work on Tsegi Phase sites, merits special credit for the innumerable courtesies he extended me. He provided comfortable accommodations both at Monument headquarters and at Kiet Siet that not only facilitated my work, but made living conditions pleasant in the extreme. He permitted me the full use of the facilities of the Monument and in every way made me feel at home. Many times he went out of his way to fulfill requests that must have seemed rather unusual. Throughout my association with the Monument, Mr. White exemplified the Park Service tradition of gracious hospitality and cheerful readiness to help.

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Tree-Ring Research---Harold C. Fritts, C. Wesley Ferguson, William J. Robinson, and Marvin A. Stokes---who gave generously of their time to answer innumerable general and specific questions. Association with these individuals has greatly enhanced my personal comprehension of the promise and problems of dendrochronology.

The organization and writing of this report reflect the assistance of many individuals. My dissertation committee, composed of Emil W. Haury, Raymond H. Thompson, and Bryant Bannister, read hundreds of pages of copy and offered many cogent suggestions for improving the manuscript. Their devotion to this burdensome task in large measure enabled me to complete the writing several months sooner than anticipated. The constant efforts of the committee to curb my verbosity are all that prevented this paper from being even longer than it is. Alexander J. Lindsay, Jr., Curator of Anthropology at the Museum of Northern Arizona, generously shared with me his unequalled knowledge of Kayenta Branch archaeology and read and commented upon parts of the manuscript. His efforts to keep me from venturing too far beyond the available data are greatly appreciated. Keith M. Anderson, formerly Park Archaeologist at Navajo National Monument, provided me with much data on the ceramic complements of Betatakin and Kiet Siel and with the benefit of his knowledge of Tsegi Phase material culture and technology. Needless to say, none of these individuals is answerable for the many shortcomings of this report, for which I take full responsibility.

Marvin A. Stokes of the Laboratory of Tree-Ring Research contributed many hours of his valuable time to helping me prepare the

photographs that illustrate the text. Cheryl A. White, Forrest Meader, and John W. Hannah, also of the Laboratory, helped prepare the line drawings. Mr. Hannah drafted the final versions of the drawings that appear in the report.

Joyce Drennen and Donald Emslie, Sr. should be mentioned here also, for as typist and printer they worked together on the dissertation in which the mechanics alone provided a challenge, to say the least. My thanks to both of them for their time spent answering my multitude of questions, and for their quality workmanship in the finished product.

Finally, I wish to express, however inadequately, my gratitude to my wife Pat. She not only helped prepare the manuscript, but also participated in the fieldwork at Kiet Siel, where not the least of her accomplishments was the regular production of home-baked bread on a Coleman stove during driving sand storms. In addition, she managed the field camp and handled the details of supplying a camp that could be reached only by horse or on foot. Her patience and understanding while I was writing the manuscript can never be repaid. Her editorial and liaison work during the last stages of organizing and writing the dissertation is responsible for the completion of the manuscript by the established deadline.

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ABSTRACT

Dendrochronology provides two basic types of information useful for archaeological interpretation: chronological-archaeological and nonchronological. The former derives from the assignment of absolute dates to prehistoric remains through the use of the techniques of dendrochronological analysis. Nonchronological information of two types, cultural-historical and environmental, may be derived from archaeological tree-ring collections. Cultural-historical information involves the recognition of unique historic events and the identification of certain cultural practices, such as the stockpiling or reuse of timbers. Recoverable environmental data include the prehistoric distributions of various species of tree and paleoclimatic reconstructions derived from dendroclimatic analyses.

Most archaeological use of dendrochronological data has emphasized the chronological-archaeological aspect. This orientation produced a large number of absolutely dated sites that have been compared with one another to isolate contemporaneous regional variations and to study the processes and rates of culture change. However, the nonchronological aspects of the data have been neglected, and the full potential of dendrochronology for archaeological interpretation has rarely been achieved. This paper presents the results of several experiments designed to explore and illuminate the contributions made by dendrochronological analyses to archaeological interpretation.

Two "cliff dwellings" in the Tsegi Canyon of northeastern Arizona were selected for this experiment, primarily because their large size and excellent preservation guaranteed the existence of many in situ timbers. Classificatorally, Betatakin and Kiet Siel are contemporaneous and are assigned to the Tsegi Phase, dated between 1200 and 1300. Attempts were made to sample every suitable timber in these sites. When combined with earlier collections, total samples of 292 specimens from Betatakin and 540 specimens from Kiet Siel are available for laboratory analysis. These collections are augmented by comprehensive notes on the provenience and condition of each timber and by detailed architectural data. Intensive analyses of the tree-ring dates, the species assemblages, the nature of the terminal rings, and the prehistoric utilization of timbers provide a body of data fundamental to a number of inferences. These inferences concern the chronology and internal development of each site; the processes by which the villages were founded, peopled, and abandoned; the social organization of the villages; a number of cultural practices ranging from the structural use of dead wood to the stockpiling of timbers for future use; and changes in the environments of the sites. The isolation of several significant differences between these sites is relevant to the consideration of the dynamics of intra-phase cultural variability.

Eighty-seven dates and less detailed archaeological information from 11 other Tsegi Phase sites supplement the data from Betatakin and Kiet Siel and provide a basis for a consideration of the phase as a whole. The beginning date of the phase is revised

upward from 1200 to 1250, while the terminal date of 1300 is not changed. In the 50 years between 1250 and 1300, about 700 people moved into Tsegi Canyon, established a number of villages, and departed. These people generally moved in extended family households, although a large village group occasionally traveled as a unit. The problems of integrating the mobile population into large villages were met in a way that produced a village organization like that of the modern Hopis. Households were integrated into the villages through membership in nonlocalized lineages and clans. Ceremonial units whose membership crosscut that of the kinship units united the lineages and clans into functioning village-wide organizations. No evidence for formal inter-village organization exists, although the Tsegi Canyon villages probably constituted a loosely defined "community" based on close but informal interpersonal relationships. After abandoning the Tsegi about 1300, the Tsegi Phase people contributed heavily to the population of the Hopi Mesas.

CHAPTER 1. INTRODUCTION

The Tsegi Canyon system of northeastern Arizona has long been known as the locus of a major florescence of Anasazi culture. Its rich store of prehistoric remains has drawn the attention of archaeologists for over 70 years, beginning with the explorations of the Wetherill brothers in the 1890's. They were followed by a host of archaeologists, among whom are numbered many of the pioneers of that science in the Southwest and, indeed, in the United States. Men such as Byron Cummings, J. Walter Fewkes, Alfred V. Kidder, Samuel J. Guernsey, and Neil M. Judd penetrated deep into this primitive and rugged country in response to the lure of the prehistoric riches to be found here.

The most spectacular of these remains are the large "cliff dwellings" such as Betatakin, Kiet Siel, Batwoman House, and Twin Caves Pueblo. Betatakin, Kiet Siel, and Inscription House---the last located 30 miles to the west in the Navajo Canyon system---are the major sites preserved for the American public by Navajo National Monument. Each year several thousand people visit Betatakin, and a few hundred venture into the depths of the canyons to reach the more isolated ruins of Kiet Siel and Inscription House.

Despite the fact that almost all of these sites were thoroughly excavated many years ago, there is yet potential for much fruitful work. This report presents the results of three seasons' dendro-chronological and archaeological research in Tsegi Canyon on sites representative of the Tsegi Phase. Tsegi Canyon, and specifically

Betatakin and Kiet Siel, were chosen for study because of their suitability for the testing of a number of ideas pertaining to the archaeological interpretation of tree-ring data. This subject is discussed in detail in Chapter 2.

The field work was carried out in the summers of 1962-64. Financial support for this work was provided by the National Park Service, Southwest Region in 1962 and 1963, and by the Arizona State Museum in 1964. The first two summers were devoted primarily to the collection of tree-ring specimens from a number of Tsegi Canyon sites, principally Betatakin and Kiet Siel. The third season was spent in mapping and collecting archaeological data from several of the larger Tsegi Phase cliff sites. In addition, much valuable information has been contributed to this study by the Synthesis of Southwestern Dendrochronology Project of the Laboratory of Tree-Ring Research. This project, sponsored by the National Science Foundation, has accomplished a complete re-analysis of all tree-ring material collected from the Tsegi prior to 1962.

The problems around which this report is oriented are many-faceted. Generally, they concern the ways in which tree-ring dates from archaeological contexts may be interpreted. They stem from my conviction that the full interpretive value of tree-ring dating has not yet been attained. Specifically, these problems can be divided into two categories: (1) archaeological-chronological, and (2) non-chronological. The former includes the dating of archaeological units such as rooms, villages, phases, and pottery types by tree-ring analysis. The second refers to purely archaeological problems, such

as settlement pattern, and to cultural and environmental inferences which may be made from dendrochronological data. The theoretical and practical concomitants of these considerations are examined in Chapter 2.

Several terms which appear throughout this report must be defined. The usages of these terms here may differ slightly from those common in Southwestern archaeology. Such divergences must be indicated so as to avoid possible misunderstanding or misinterpretation. Most of the differences in usage are a result of applying restrictive limitations on terms which ordinarily have somewhat broader connotations in the literature. These are procedural definitions, set up to make the discussion of various topics more lucid and clearly understood. It is hoped that this will eliminate a great deal of verbal hair-splitting and descriptive elaboration which would otherwise be necessary to clarify the precise meaning of a term each time it is used.

The Kayenta Branch. In this paper the Kayenta Branch is taken to mean a geographically bounded variant of the Anasazi cultural tradition, which can be differentiated from other geographically limited variants of the same tradition on the basis of the nature of the material remains recovered by archaeology. In general, these branches are distinguished chiefly on the basis of differences in ceramic traditions and assemblages; however, there are other fairly consistent divergences which accompany the ceramic differences. The branch is a classificatory device based on cultural content and geographic unity,

and thus corresponds to what were originally termed subcultures by Kidder (1924: 48).

Thus it is possible to refer to the Kayenta area, the Kayenta culture, or the Kayenta people when discussing the archaeological remains which belong to this classificatory category.

Remains typical of the Kayenta Branch are found over a wide area of the plateau country of the northern Southwest. Lindsay and Ambler (1963: 86) define the limits of the Kayenta area as follows: "that part of southern Utah and northern Arizona which extends from the Grand Canyon on the west to the Chinle Wash and Monument Valley on the east, and lying between the Henry Mountains on the north and the southern flank of Black Mesa on the south." George J. Gumerman in a paper delivered at the 1966 Pecos Conference in Flagstaff, Arizona, extended the geographical limits of the Kayenta Branch south into the Little Colorado River Valley to include the Winslow Branch defined by Colton (1939: 66-9). This vast area of more than 10,000 square miles represents the maximum extent of Kayenta materials through time and not at any particular point in time. Kayenta people may never have occupied the entire area at any one time, and certainly by the late 1200's---the period with which we are concerned here---their geographical range was much more restricted. In addition, isolated enclaves of Kayenta population probably occurred beyond these limits; for example, at the Coombs site in southern Utah (Lister and Lister 1961: 5-10) and at Point of Pines in central Arizona (Haury 1958).

Tsegi Phase. Colton (1939: 51-9) subdivided the Kayenta cultural continuum into six foci, which are referred to in this report

as phases in conformity with present practice in Southwestern archaeology. The Tsegi Phase was the terminal unit in this sequence and was named after Tsegi Canyon, where there are numerous sites belonging to the phase.

Colton (1939: 58, Fig. 11) limits the geographical extent of the Tsegi Phase to include Tsegi Canyon and the area immediately adjacent. His map (Fig. 11) indicates that it extends as far east as Kayenta, as far west as Shonto, and as far north and south as Tsegi Canyon itself. A large number of contemporaneous Kayenta Branch sites near Navajo Mountain are thus excluded from Colton's Tsegi Phase. A number of these Navajo Mountain sites have recently been found to be nearly identical in ceramic assemblage and range of tree-ring dates with Tsegi Phase sites in the Tsegi itself. Therefore, it may be argued that the geographical limits of the Tsegi Phase should be extended to cover the full range of 13th century Kayenta culture. However, for purely procedural reasons and for the sake of clarity of expression, I am going to adhere to Colton's original definition of the spatial range. I feel partly justified in doing this because Lindsay, Ambler, Stein, and Hobler (1966), the excavators of these sites, do not assign them to any phase, but use the Pecos Classification categories for all their materials. This provides a convenient and clear method of differentiating between the Navajo Mountain and Tsegi Canyon sites without resorting to a great deal of excess verbiage. It would be awkward and repetitive to continually refer to "the Tsegi Phase occupation of Tsegi Canyon," or "Tsegi Phase sites in Tsegi Canyon," or "the Tsegi Tsegi Phase." Therefore, throughout

this paper the term Tsegi Phase will refer to sites in the Tsegi itself and its immediate vicinity. For comparative purposes, the Navajo Mountain sites will be referred to by the term late Pueblo III or Pueblo III late, the terminology of Lindsay, Ambler, Stein, and Hobler (1966: 12). It must be stressed that this is strictly an arbitrary distinction on my part. The two periods---Tsegi Phase and late Pueblo III---are contemporaneous and nearly identical in archaeological characteristics. Nevertheless, there are minor but distinguishable differences which may eventually turn out to be significant. Thus, the separation of these two manifestations also serves to guarantee a greater degree of comparability among sites referred to as Tsegi Phase.

Tsegi Canyon. According to the general procedures of naming geographic features in the United States, the correct name for Tsegi Canyon is Laguna Canyon, as this is the name on file with the U.S. Board of Geographic Names. The history of this difference in nomenclature is hard to trace. According to John Wetherill (Guernsey 1931: 3), "Carson" (Kit?) gave the canyon the name Laguna because of the lakes then present. This name was also used by Gregory (1916, 1917), probably based on the United States Geological Survey map of 1882. Because of this priority, Laguna has become the official designation for the canyon. The name Tsegi comes from the Navajo language and was probably first applied to the canyon by the Wetherills or by Cummings. John Wetherill states a preference for the name Tsegi because all the lakes have disappeared (Guernsey 1931: 3).

I propose to use the name Tsegi for two reasons. First, the term, with its numerous associated ideas, is embedded in the

archaeological literature, and to refer to Laguna Canyon would evoke no recognition from the reader. Second, the canyon has a number of major branches and tributaries, many of which also possess officially accepted names. Thus, the term Laguna applies only to that part of the canyons through which Laguna Creek itself flows. Even this name is restricted to only the lower half of the main canyon, for the upper half is known officially as Long Canyon. Therefore, the terms Tsegi or Tsegi Canyon here refer to that entire system of canyons which is cut into the Shonto Plateau and Skeleton Mesa and which is drained by Laguna Creek and all its tributaries above Marsh Pass (Fig. 1). This definition of the term Tsegi is consistent with the common archaeological usage which denotes a general area rather than to a limited stretch of the canyon system.

Other topographic names used throughout this report are, with a few exceptions, taken from the latest United States Geological Survey topographic maps, where these are available. A few of these names deserve some comment. The term Laguna Creek is now applied to the full length of the stream which begins at the head of Long Canyon in the Tsegi system and empties into Chinle Wash south of Mexican Water, Arizona. In the earlier archaeological literature this stream is often referred to as Tyende or Kayenta (Kaenta, Kaente) Creek, both these terms being English attempts at rendering a single Navajo word. The lower part of this stream below Marsh Pass is sometimes erroneously referred to as Tyende Creek even today (Steen 1966: 5, Fig. 3). The name Tyende is now assigned to the next major stream south of Laguna Creek which rises on the east slopes of Black Mesa and flows

northeastward into Chinle Wash. The major stream which drains the south slopes of Tyende Mesa is today known as Parrish Creek. In the early literature it was frequently referred to as Kaycuddie Wash (Beals, Brainerd, and Smith 1945: 72). In this report I have retained the familiar spelling of Dogoszhi Biko in favor of Dowozhiebito Canyon, which is shown on the U.S. Army Map Series, Marble Canyon, and the USGS Boot Mesa 15' quadrangle. The former spelling appears frequently in the literature and more closely approximates the correct Navajo pronunciation of the word. Topographic features such as Bubbling Springs Canyon which do not have official designations are given names used by the local inhabitants of the area.

Something should now be said about the organization of this report. Chapter 2 contains a discussion of the theoretical and practical aspects of the problems to be attacked in this report. It includes definitions of the objectives of the analysis, the different ways of approaching the problem through the conjunctive use of archaeological and dendrochronological data, and an analysis of the techniques and assumptions which underlie the archaeological interpretation of tree-ring dates. Chapter 3 includes a description of the physical environment of the Tsegi Canyon system as it relates to the prehistoric Kayenta Anasazi population and to the tree-ring data. Chapter 4 includes a discussion of the archaeological and dendrochronological background to the present study and an outline of previous work in the Tsegi which has laid the foundation for the more recent work.

Chapter 5 contains a discussion of the archaeology of the Tsegi Phase with greatest emphasis on settlement pattern and

architecture; lesser emphasis on pottery; and least emphasis on other criteria, such as nonceramic material culture, burial patterns, and physical type. These priorities in emphasis are determined by the nature of the data available at this time. Settlement pattern and architecture, of course, are most directly related to the tree-ring dates, for the dates usually come from beams which are integral structural members of various architectural features. Tree-ring dates are only indirectly associated with the cultural items generally found in the structures which are dated. For this reason and because no detailed studies of Tsegi Phase material culture have yet been published, this aspect of the archaeology receives slight attention. Ceramic analysis plays a much smaller role in this report than it deserves. Despite the fact that the total ceramic content of the Tsegi Phase is fairly well known, it is almost impossible to get an accurate analysis of the ceramic assemblage of any one of the sites to be considered because they have all been excavated. This excavation was accomplished before it became customary to save large numbers of sherds; consequently, only small, recently made surface collections exist, all biased by the disturbance of the original excavations and by the depredations of decades of subsequent visitor traffic.

Chapter 6 covers the techniques employed in the collection and analysis of the data as well as the formats by which the various data are presented in subsequent chapters. Chapters 7 and 8 contain detailed chronological analyses of Betatakin and Kiet Siel respectively. These two sites are responsible for the vast majority of the tree-ring specimens collected in 1962-63. Furthermore, because of excellent

preservation, both sites provide much of the archaeological data embodied in Chapter 5. Chapter 9 includes chronological analyses of twelve additional Tsegi Phase sites. Since these sites are either much smaller than Betatakin and Kiet Siel or have only a few tree-ring dates, they require a less detailed type of analysis than do the two larger sites. Kiet Siel and Betatakin provide the interpretive framework within which the less well represented sites are analyzed.

Chapter 10 contains a brief summary of the analyses and draws together the conclusions derived therefrom, including an organized synthesis of the dated history of the Tsegi Phase occupation of the canyon.

CHAPTER 2. THE PROBLEM: THEORY AND PRACTICE

The work of which this report is a result was conceived as an experiment designed to investigate the application of tree-ring dating to the refined interpretation of archaeological phenomena. The study began with a thorough analysis of material from Betatakin. The results were better than had been initially hoped and amply fulfilled the objectives of the experiment. The Betatakin study not only provided answers to questions that had been asked in devising the experiment, it also answered questions that had not been anticipated. Thus, it greatly increased our knowledge of the range of interpretive problems which could be attacked through dendrochronological analyses. With this sharpened sense of problem, a study with objectives formulated on the basis of the Betatakin project was made of Kiet Siel. Again the rewards were greater than anticipated, in that new interpretive problems were indicated and answered by the Kiet Siel data. Thus, several of the problems toward which this report is oriented are *a posteriori* in nature, in that they were suggested by the data rather than anticipated in the research design. The experiment, set up to explore the interpretive possibilities of tree-ring dating, was an unqualified success.

THE PROBLEMS

The interpretive problems upon which dendrochronological data can be brought to bear may be divided into two broad categories: archaeological-chronological problems, and nonchronological problems.

The first archaeological-chronological problem to be considered is, of course, the dating of a single archaeological site. It has been general practice in Southwestern archaeology to collect tree-ring specimens from a site, date them, and analyze the dates with reference to the site as a whole. This approach has produced a long list of Southwestern dated sites. With a few exceptions, little attention has been given to chronological variation within a single site, except in terms of gross differences, such as the existence of two or more widely separated clusters from a site as indicative, for example, of abandonment and reoccupation (Gladwin 1945: 128-9). Usually this has been due less to lack of desire than lack of opportunity. Many sites were collected for the chronological value of the material rather than specifically for archaeological interpretation, and the provenience control on individual specimens often does not go beyond a record of the particular site involved. A notable exception to this generalization and a valuable indicator of the potential of refined analyses of tree-ring dates is Haury's work at the Canyon Creek Ruin, where he was able to demonstrate the construction sequence of a number of rooms (Haury 1934: 55-8).

Analyses such as Haury's are possible with tight provenience controls on each tree-ring specimen. Given such controls and certain favorable site circumstances, much more than a dated site is possible.

Small architectural units such as rooms can be dated. A room-by-room analysis may yield the sequence and the interval of time in which rooms were added to the site. Combining the dates for individual rooms within a single room block may result in a series of dated house groups within the site as a whole. This type of analysis also yields valuable information on the rate of growth of the village. Thus, one objective of this study is to establish intra-site chronological relationships as part of the larger problem of dating an archaeological site.

A second archaeological-chronological problem considered is the temporal relationships among closely related and supposedly contemporaneous sites. This amounts to an analysis of intra-phase chronological relationships. It involves not only the gross consideration of the sites as dated units, but also a comparison of the internal fluctuation of construction activity from site to site, as shown by the tree-ring dates. Bannister (1965: 200-1) has presented a similar analysis for a group of contemporaneous sites in Chaco Canyon, New Mexico.

The final archaeological-chronological problem considered is the definition of the temporal limits of the Tsegi Phase. The large number of well-dated sites belonging to this phase provides the basis for this analysis. Furthermore, the precise provenience controls available for each specimen lead, in most cases, to the elimination of those dates not truly associated with the phase, thus enhancing the reliability of the phase dating. Therefore, one result of this study is the precise delimitation of the temporal span of this distinctive well-defined taxonomic unit. This has important implications for the

general concept of phase and for the study of cultural dynamics on an inter- and intra-phase level.

Nonchronological problems to which dendrochronological analyses may be applied fall into two subcategories: cultural-historical and environmental.

Problems of a cultural or historical nature are many and varied. Some of these have been considered previously, while a few are new to this report. Not all these problems are capable of examination or solution at any one site; much is dependent on the nature of the data from a particular site, which often is a product of the unique history of that site. Therefore, a broad range of possibilities is indicated below; the actual realization of these possibilities is discussed under the appropriate sites.

Solutions to certain problems of population can be abstracted from the tree-ring data. For example, the dated sequence of intra-site architectural groups would provide information on the rate of growth of the site and thus, indirectly, on population changes. The time of maximum village population may be inferred in certain instances. Supplementary information on the nature of certain social units may be derived from the analysis of the architectural units by whose accretion the villages grew.

Evidence for a number of cultural practices is present in the tree-ring data. The methods of extracting this evidence are discussed under the individual sites, where concrete examples are available. It will suffice here to indicate the kinds of cultural practice which are susceptible to examination through the data. Several of these

practices have been discussed by previous writers and served to help structure the design of the research. Others are new and resulted directly from the analysis of the Tsegi data.

Four different cultural practices may be inferred from the careful analysis of the clustering of dates, especially if there are a number of cutting dates combined with knowledge of the exact provenience and condition of the dated beam (Bannister 1962: 512-13). One such practice is the stockpiling of timbers for future construction work. Bannister (1965: 151) demonstrated this practice at Chetro Ketl in Chaco Canyon, New Mexico. The use of freshly cut timber to repair older structures may be detected (Bannister 1962: 509). Conversely, the reuse of wood from structures of an older period can also be recognized. Douglass (1929: 754) cites the example of a beam at Oraibi which was used and reused over a period of four centuries. The use of dead wood for constructional purposes is a problem related to that of the reuse of timbers in that the empirical evidence for these practices is the same; however, they represent quite different cultural practices. Some sort of supplemental evidence is necessary to differentiate reused beams from deadwood timbers, and such evidence is not always present. O'Bryan (1949) discusses the use of dead trees on an early (Basketmaker II) time level, but except for Douglass' (1935: 47-8) consideration of the problem at Wupatki, it has been virtually ignored in reference to later materials.

Types of evidence other than the clustering of dates must be used to isolate other cultural practices. Nichols and Smith (1965) present evidence from Mesa Verde for the repeated limbing of living

trees, which may indicate the intentional care and "harvesting" of certain trees. Analysis of insect tunnels in beams from Long House and Mug House on Wetherill Mesa enabled Graham (1965: 172-4) to suggest that the inhabitants of these villages may have left freshly cut trees lying out so that phloem-eating beetle larvae could loosen the bark for easier removal. The presence or absence of bark on beams indicates either the presence or lack of a cultural preference for peeled beams. Scott (1966: 35-6) was able to demonstrate the prehistoric artificial shaping of beams at Casas Grandes in northern Mexico. Insight into the differential use of various species of wood may be abstracted from the correlations among the several species and the various use-categories to which they may be assigned.

Much may be learned about the activities involved in tree felling and wood working. A number of lines of evidence can be combined to indicate whether the felling of trees for constructional purposes was a communal or individual task; whether or not it was patterned seasonally; if so, at what time of year it was usually done; and what sort of methods were used in the task. Careful analyses of the marks made by tools on prehistoric timbers and wooden artifacts would yield valuable information on the tools and techniques of wood working.

A number of unique historical incidents may be inferred from the tree-ring data. However, this kind of situation cannot be anticipated in setting up a research design. Therefore, the reconstruction of historical events is almost entirely *ex post facto*. Douglass' (1935: 45-7) hypothesis of the deforestation of Chaco Canyon is an

example of such a unique historical event recognized through the study of tree-ring data.

Problems of prehistoric environment may be approached by two routes using tree-ring data. The first of these involves the comparison of the prehistoric assemblage of tree species as represented at an archaeological site with the range of tree species presently growing in the area. This approach provides insight into the changes undergone by the local environment in the years between the two points of comparison. This approach is also valuable in assessing the effects of man's activities on his environment, as illustrated by Douglass' consideration of the deforestation of Chaco Canyon.

The second approach to environmental problems lies in the analysis of the relationships between variations in ring width and fluctuations in the trees' external environment, primarily climate. This extremely complex series of problems has been a primary concern of dendrochronology since its inception. Indeed, postulated relationship between tree growth and climate led Douglass to begin his studies of tree rings and, ultimately, to found the science of dendrochronology (Douglass 1919: 9).

Much of the dendrochronological literature takes as its basic theme the relationship between climate, particularly precipitation, and tree-ring width variation (Douglass 1919, 1928, 1936; Glock 1937; Schulman 1956). Today this particular aspect of dendrochronology is one of the most interesting and potentially enlightening aspects of the science. The ability to reconstruct past climatic conditions

would be of inestimable value to archaeologists, as well as to students of climate, geography, and geology.

Archaeologists have been sensitive to the climatological possibilities of dendrochronology ever since Douglass (1935: 48-9) postulated a series of prehistoric droughts on the basis of long range tree-ring chronologies. Some of these "droughts" have been used as pegs upon which to hang various theories intended to explain certain trends and events perceptible in the archaeological evidence. The classic example of this is the "Great Drought" of 1276 to 1299. Douglass (1929, 1935: 39, 48-9) was the first to point out the possible culture-historical importance of this period, and archaeologists were quick to utilize the drought to at least partially explain the great population movements which took place at the beginning of the 13th century (Haury 1935: 107; Hargrave 1935a: 53). The Great Drought and the Great Drought theory of abandonment have had a number of vociferous opponents, most notably Gladwin (1947, 1957: 298-9) and Jett (1964). Quantities of printer's ink and paper have been devoted to the Great Drought debate, with very little ever being settled, primarily because the opposing stands are based on the same data---data which have not been appreciably augmented since Douglass' original mention of the drought. Bannister points out the danger in using relative measures of climatic fluctuations "to explain away highly intricate archaeological situations and cultural behavior" (Bannister 1963: 174).

Many extremely intricate variables intervene between archaeological data and variations in tree growth. Before one can even attempt to use the latter as an aid in interpreting the former, these

variables must be recognized, analyzed, and taken into account. Primarily, these variables are concerned with the biological nature of tree growth and its relationship to various climatic parameters. Only recently have refined physiological and statistical techniques been employed in an effort to solve these particular problems (Matalas 1962; Fritts 1963). All this has been made possible by the use of electronic computers which can sift through mountains of data and make the innumerable calculations necessary in these types of analysis. Fritts, Smith, and Stokes (1965) discuss many of these problems, so a lengthy treatment is not necessary here.

Douglass (1919: 65-73) first demonstrated a mathematical correlation between precipitation and tree growth in lower forest border trees in the Southwest. The most significant correlations were achieved between ring widths and winter precipitation (Douglass 1928: 98). His studies produced a model which attributed variations in tree growth to the supply of soil moisture during the growing season, which was thought to depend on the amount of precipitation and evapotranspiration before and during the growing season. This model was accepted by Southwestern dendrochronologists and archaeologists. A wide ring was assumed to indicate a wet winter and a narrow ring a dry winter. The widespread acceptance of this model has contributed to the Great Drought debate in Southwestern archaeology. Both Gladwin (1947) and Jett (1964: 282) argue that dry or wet winters would have little effect on Indian crops and, therefore, that tree-ring recorded "droughts" are of little value for the interpretation of archaeological data in the Southwest.

Recent work by the Laboratory of Tree-Ring Research on Mesa Verde (Fritts, Smith, and Stokes 1965) and at a physiological experiment station on Mount Bigelow in the Santa Catalina Mountains near Tucson (Fritts 1965a) has illuminated many facets of this extremely complex problem. These studies have led Fritts (1965a: 876) to postulate a new model for the relationships between tree growth and the environment (Fritts 1965a). This model emphasizes the importance of stored food supplies rather than soil moisture in controlling tree growth. Thus, climatic factors which affect the production of food by the tree indirectly affect growth. This model supersedes the old residual soil moisture model which has not withstood refined analysis. The new model involves a complex system of interacting climatic and physiological processes (Fritts, Smith, and Stokes 1965, Fig. 9). While a myriad of climatic factors enter into this network of relationships, precipitation and temperature exert the strongest influences on food production and tree growth.

Although this model appears extremely difficult to interpret and less useful in archaeological interpretation, it holds much more promise than did the simpler, but less accurate, soil moisture model. The greater interpretive reliability coupled with refined statistical analyses permits much more accurate and detailed reconstructions of prehistoric climates than has heretofore been possible.

An indication of the possibilities inherent in paleoclimatic reconstruction is found in Fritts (1965b) analysis of the patterns of climatic change in western North America from A.D. 1501 to 1940. The results are best seen in the series of synoptic maps of regional

variations in climate (Fritts 1965b: 433-41). These maps show areas of high and low precipitation throughout western North America for overlapped ten-year intervals throughout the 440-year period considered. The maps graphically illustrate the changing patterns through time of relatively drier and wetter conditions over this area. When this type of analysis is applied to the various regional chronologies now being built in the Southwest, it will be possible to construct a similar series of maps for this more restricted area. These maps will show the localized occurrence of wet or dry conditions throughout the region and the changes which take place through the span of human occupation. It may be possible to begin this analysis as early as A.D. 400 and to continue it up to the present. When the regional climatic patterns and their changes are correlated with the archaeological record and the known movements of prehistoric peoples throughout the period covered, a much better understanding of the effect of climate on the culture-history of man in the Southwest will be possible. The Laboratory of Tree-Ring Research is at present engaged in a program of building a series of regional archaeological chronologies for the northern Southwest which will serve as the basis for paleoclimatic reconstructions. The day may not be too far off when knowledge of regional climatic variations throughout the Southwest for a period of 1500 years will be available to aid the archaeologist in understanding and interpreting the data that he recovers from the ground.

Despite the great strides made toward a better understanding of the relationship between climate and tree growth, and, therefore,

a greater ability to reconstruct paleoclimatic conditions, the attempt to integrate this information with the archaeological record is fraught with a number of hazards. Chief among these are the problems of how human communities respond to environmental changes---not only gross long-range changes, but also minor short-term fluctuations. A vast number of variables enter into any attempt to solve these problems: the cultural attainments, nature of the social organization, and subsistence technology of the people involved; the kind and degree of the environmental changes involved; and the physical environment which is being changed in some way.

The cultural problems alone are extremely intricate and have received a considerable amount of attention in the anthropological literature. Steward (1955) has developed a theory which attempts to explain the nature of the relationship between a culture and the environment within which its human bearers live. This rigidly empirical theory involves the concept of a dynamic balance between a culture and the environment which may be upset by change in either aspect. Such changes initiate a condition of disequilibrium which is ultimately alleviated after a period of adjustment which produces a new and different balance. This theory is especially useful in archaeological interpretation, because the kinds of data it requires can be recovered from archaeological situations. Such dynamic or systemic approaches to the archaeological aspects of culture, culture change, and culture-environment relationships are undoubtedly the most suitable for any attempt to relate the prehistoric climatic parameters derived from studies of tree growth to the cultural and

historical changes and events which can be extracted from the archaeological record.

Another basic problem arises at this juncture. What is the nature of the influence of the climatic factors recorded in tree growth on the actions of the people who endured such changes? A series of interrelated phenomena control or affect this relationship. Do ring widths record environmental phenomena which directly affect human communities by influencing certain aspects of their culture, such as subsistence patterns? For example, does a drought directly cause the people to alter their agricultural techniques as an intentional response to the dry conditions? Does the drought cause crop failures because a society's agricultural technology is not advanced enough to be able to offset the lack of atmospheric moisture? Or do ring widths record factors which, through their influence on other environmental phenomena, affect human communities indirectly? For example, do droughts cause excessive erosion or shifts in plant and animal communities which might affect the subsistence capabilities of a group of people? These are questions which must be answered before meaningful cultural-historical correlations of the archaeological record with tree growth can be made.

Despite the extremely complex nature of these problems, the Tsegi data are sufficient enough to at least make an attempt to solve some of them. This attempt should be viewed as an experiment designed more to test the possibilities than to arrive at a grandiose final solution. Neither the data nor our knowledge of the dynamics of the culture-environment relationship are sufficient to permit it.

Nevertheless, within the bounds of the limitations cited above, the Tsegi data do permit a number of inferences to be made, some of which may be advanced as hypotheses for future testing. This involves the conjunctive use of all data bearing on the past environmental conditions in Tsegi Canyon and the Colorado Plateaus province, whether tree-ring, geological, archaeological, or historical. Therefore, one of the problems considered in this report is the effects environment and environmental changes may have had on the culture-history of the Tsegi Phase people.

NECESSARY CONDITIONS FOR THE ANALYSIS

The objectives of this study impose a number of stringent conditions on the data that are to be used to attain them. The nature of ring series best for chronology building and most susceptible to climatic analyses and the factors which produce them, have been discussed by Schulman (1956), Fritts, Smith, Cardis, and Budelsky (1965), Fritts, Smith, Budelsky, and Cardis (1965), and Fritts (1965a). Therefore, there is no need to consider this matter here.

My main concern here is to point out the types of data that are needed for the refined chronological and nonchronological interpretations of the tree-ring material in its archaeological context. Several rather limiting conditions must be met before this type of study can be undertaken.

First, and most important, the exact provenience of each specimen must be known. This requirement is crucial to any detailed analyses of either the dates themselves or of other factors, such as

species distribution or use-categories. Its importance cannot be over-emphasized. It is not sufficient merely to know that a date comes from a particular site or even from a particular room within a site. For purposes of these analyses, it must be known whether the specimen comes from a roof, from a firepit, or from a wall; and if from a roof, whether it is from a primary or secondary beam. Only in this way can the fullest interpretive utilization of tree-ring data be attained.

Second, there must be a large number of dates available from as many intra-site structural units as possible, in order to provide complete coverage of the site. In practice, this means a 100% sample to ensure that every possible date may be derived, and that the possibility of missing something by omission is minimal. Statistical sampling procedures are not adequate for the solution of these problems, because they simply could not provide the necessary detail.

Third, there must be a high percentage of cutting dates. Non-cutting dates, while valuable time-period indicators, are, by definition, useless for the types of analysis contemplated.

Fourth, in addition to precise provenience control, detailed notes must be taken on the individual beam or post from which the specimen comes. These notes should record the presence of beetle galleries, bark, smoke staining, weathering, stone-ax marks, or any other conditions which may be present on the beam, as well as its diameter at the butt. Such information is often necessary to determine which dates are cutting dates, and is invaluable in interpreting the dates which are derived. For example, if it can be shown that a single beam that gives an earlier date than any others in a particular room is

heavily weathered, while the others are not, the inference that it is a reused timber is strengthened immeasurably. Many additional examples of the value of this type of information are found below in the analysis of the dates.

Fifth, detailed information on the structural unit in which a timber is found must be recorded. This information is a valuable guide in interpreting the dates. Wall abutment patterns often give clues as to the order of construction of two or more rooms, and thus aid in the interpretation of the dates from the rooms. Often the features of a structure preserve evidence of repair or modifications that cannot be perceived in the distribution of tree-ring dates. Conversely, the inference of repair work from the dates is often confirmed by purely architectural evidence.

Finally, it is necessary to record the range of tree species growing in the area at present in order to compare them to the assemblages of tree species found in the prehistoric sites to get an indication of the environmental changes which have taken place since the construction of the sites.

All these conditions are met by the Tsegi data, particularly those from Betatakin and Kiet Siel. Indeed, these sites were selected for intensive study precisely because these limiting conditions were met. The problems of provenience control are simplified by the excellent preservation of both sites, which results from their locations in dry caves. Many roof beams are still in place and can easily be distinguished from those used in jacal walls or as firewood. Such is often not the case in open sites where burned roofing material

frequently cannot be segregated from firewood. The high degree of preservation also permits the taking of detailed notes on the beams and on the structural details of architectural units. The need for a high percentage of cutting dates is also satisfied by the good preservation; the beams have been subjected to little or no weathering. Furthermore, the fact that the specimens are of good sound wood increases the incidence of cutting dates. While a 100% sample of any site is rarely attained, the Betatakin and Kiet Siel collections closely approach that ideal, a factor which further enhances the interpretive potential.

THE INTERPRETATION OF TREE-RING DATES

Bannister (1962) presents a lucid and comprehensive analysis of a number of factors which influence the interpretation of archaeological tree-ring dates. He defines and describes four types of error which may be made and analyzes the interpretive situations which give rise to each of them. The four types of error are defined by the combinations of two aspects of the interpretive situation, each of which is divided into two mutually exclusive subcategories. The first of these aspects is the association between the dated tree-ring specimen and the archaeological feature to which the date is applied. Two types of association are recognized. Direct association occurs when the date is applied to a feature of which the specimen is an integral part; for example, the association between the date from a ceiling beam and the room in which the beam is found. Indirect

association occurs when the date is applied to a feature of which the specimen is not an integral part; for example, the attempt to date the artifactual contents of a room by the use of tree-ring dates derived from the ceiling beams of that room. The second aspect involves the chronological relationship between the date and the feature to be dated; that is, whether the date is correct or incorrect, and, if incorrect, whether it is too early or too late.

The four types of error that result from the combinations of direct or indirect association and early or late dating are (Bannister 1962: 508):

Type 1. The association between the dated tree-ring specimen and the archaeological manifestation being dated is direct, but the specimen itself came from a tree that died or was cut prior to its use in the situation in question.

Type 2. The association between the dated tree-ring specimen and the archaeological manifestation being dated is not direct, the specimen having been used prior to the feature being dated.

Type 3. The association between the dated tree-ring specimen and the archaeological manifestation being dated is direct, but the specimen itself represents a later incorporation into an already existing feature.

Type 4. The association between the dated tree-ring specimen and the archaeological manifestation being dated is not direct, the specimen having been used later than the feature being dated.

Bannister (1962: 510) offers two methods of resolving these types of error. "Errors of Type 1 and Type 3 varieties are particularly amenable to correction through the use of tree-ring date clusters, providing that there are enough dates available with which to work"

(Bannister 1962: 510). In other words, individual dates which are earlier or later than the majority of dates from any feature indicate errors of these types. The clustering of archaeological traits is suggested as a method for solving errors involving indirect association, thus, errors of Types 2 and 4. This involves the use of archaeological context to infer whether the dates actually apply to the archaeological materials with which they are indirectly associated.

Bannister's four types of error are conclusions about objective data derived from that data. While the nature of the association can be directly observed, the dating factor can be determined only by the analysis of the data. The four types of situation cannot be recognized except on the basis of data which are also used to interpret them. Thus, his analysis cannot be applied a priori to describe concrete interpretational situations which are isolated in the field data. They can be applied only after the interpretation has been completed. In order to resolve this seeming impasse, I propose to reverse Bannister's approach and examine the ways in which these conclusions are produced from the data at hand. It hardly need be stated that the interpretation of tree-ring dates is an exercise in inference. The conclusions about the data, described as the four types of possible error, result from inferences made on the basis of those data in conjunction with other pertinent facts. Thompson's (1958) analysis of the inferential process is used as a framework for my discussion of the interpretation of tree-ring dates.

Thompson outlines three guiding principles for the making of inferences and describes how they apply to the data with which

archaeologists work. His analysis is followed here to show that it applies also to tree-ring data.

The first principle is that of context, which "defines the area of knowledge to which an inquiry pertains.... It is from the context that the greater part of the data necessary for the making and testing of inference is derived" (Thompson 1958: 2). Thompson points out that because the data consist of observations of the results of human behavior, the context of any archaeological inquiry is cultural. He then develops the thesis that Osgood's (1951: 208) definition of culture provides a conceptual framework for the making of cultural inferences from archaeological data. Finally, Osgood's concept of techniculture---the behavior associated with the manufacture and use of material objects, combined with the perceivable attributes of the material objects---is viewed as the best avenue of approach to the making of cultural inferences from the limited segment of the total culture available to the archaeologist (Thompson 1958: 2-3). This same approach can profitably be taken in the interpretation of tree-ring data from archaeological contexts.

The application of Thompson's analysis to the context within which tree-ring data are interpreted is complicated by the fact that more than one context is involved. One of these contexts is cultural, just as it is for any archaeological inquiry. The wood or charcoal which is recovered from a site is there as a result of human activity. A roof beam is just as much an object of techniculture as is the stone ax that was used to shape it, or the behavioral patterns that went into its cutting, transportation, shaping, and ultimate use.

Therefore, the interpretation of tree-ring dates takes place within a cultural context.

In my opinion, this factor cannot be overemphasized. The date from an archaeological specimen, as a result of its association with the artifact, is a part of techniculture which can be observed by the archaeologist. Therefore, a tree-ring date is an integral part of the archaeological data from a site and cannot validly be separated from these data. This is the fallacy involved in Gladwin's oft-repeated contention that when tree-ring dates conflict with the archaeological evidence, preference should be given to the latter over the former, which at best is a mere adjunct to archaeological interpretation (Gladwin 1943: 59, 65, 68; 1944: 25; 1945: 90-1, 118-30; 1946: viii, 5-6). I take the position that the tree-ring dates---if they are correct, as the vast majority are---cannot conflict with the archaeology, because they are part of the archaeology. At any rate, Gladwin is not referring to a conflict between tree-ring dates and the objective archaeological data, but to a conflict between the tree-ring dates and an interpretation of the archaeology. No one is justified in ignoring tree-ring dates because they do not conform to his interpretations, any more than he is justified in ignoring the presence of a particular pottery type for the same reason. It is up to the archaeologist to interpret dates which he considers aberrant by using the same inferential processes he would for any other data from his site. In most cases the full range of data available will contain the information necessary to explain the date or dates which appear to be out of line.

A second context within which tree-ring dates are interpreted is absolute time. The dates, in the abstract, may be completely divorced from the wood from which they come and interpreted within a chronological frame of reference. The dates from a site can be compared with each other, with the absolute time scale provided by the Christian calendar, and with dates from other sites. Even in this type of analysis a cultural factor is present, in that the groups of dates compared are defined on the basis of some sort of cultural package: a site, a region, a phase. Nevertheless, it is convenient to isolate a chronological context for purposes of the analysis of the inferential interpretation of tree-ring dates. It may be useful to think in terms of different conceptual levels defined on the basis of cultural criteria within which the chronological context can be isolated. Thus, a number of dates from a site can be interpreted quite apart from any consideration of their cultural context within the site. This type of analysis has produced the large number of "Southwestern dated ruins" listed in the literature (Douglass 1935: 50-4; Stallings 1937; Smiley 1951). The use of the clustering of dates, so important in resolving many dating problems, is an excellent example of inference within the context of chronology.

Another context involved in the interpretation of tree-ring dates is biological. This, of course, derives from the fact that the trees that supplied the raw material for the prehistoric builder, and from which the dates are derived, were once living organisms. Most of the biological background data for the interpretation of

tree-ring dates comes from the analysis of the structure and physiology of trees.

Knowledge of the internal structure of trees is the foundation of dendrochronology. The recognition of cell and ring structures is essential to the identification of the ring patterns which provide the dates. Structural knowledge also provides the basis for the identification of true cutting dates. A cutting date is defined as the year in which a tree dies, whether of natural causes, by catastrophe such as fire or flood, or by the hand of man. The importance of being able to recognize cutting dates for archaeological interpretation is obvious (Bannister 1962: 511). Most of the external conditions which indicate a cutting date---the presence of bark, phloem-beetle galleries, the so-called L condition (see Chapter 6 for an explanation of these features)---are recognized through knowledge of the structure of trees.

The physiology of a tree is responsible for its structure, but it is of little concern in the interpretation of archaeological dates. It is of vast importance, however, in the attempt to establish the existence of relationships between variations in ring width and climatic fluctuations. The only approach to such problems is through the study of the life processes of the trees. In the analysis of the tree-ring data from a number of Tsegi Phase sites, whether or not the final ring on a specimen is complete or incomplete assumes considerable importance. The inferential significance of this factor derives entirely from its biological context, and yet it is of value in making purely cultural inferences.

The interpretation of archaeological tree-ring dates thus takes place within at least three contexts: cultural, chronological, and biological. As in any archaeological analysis, the first of these is the most important. However, the use of all three contexts in conjunction is the best approach to the problems, for only in this way can the maximum contribution of dendrochronology to archaeological interpretation be realized. This report is in part an attempt to demonstrate the utility of such an approach.

The second guiding principle is that of indication. "Indication is that quality of the evidence which describes its inferential possibilities. It is the indicative quality of data which makes inference possible. An indication suggests a conclusion. The leap to this conclusion (and the test of its probability) is an inference" (Thompson 1958: 3). Thus, the material data and the associational constellations in which they are found provide the foundation for the inference. Osgood's concept of techniculture is a recognition of the principle of indication, in that it recognizes that material objects in themselves provide the data from which inferences may be made about the behavior that went into their manufacture and use (Thompson 1958: 3). Again, this viewpoint is valid for the interpretation of tree-ring dates within the cultural context. Within the chronological and biological contexts the concept of techniculture does not apply; however, the principle of indication is just as fundamental to making inferences within these two contexts.

Finally, there is the principle of testing, about which Thompson (1958: 3) says:

An indication suggests the possibility that the materials of an indeterminate situation are capable of being expressed in a more determinate way. The transition to the conclusion that such a new situation does exist is an inference. Testing establishes the degree to which this more determinate relation is probable. An inferred conclusion has probability instead of certainty because of the indeterminate environment of its subject matter. As indication is an expression of the indicative character of the data, testing brings out their probative quality. Thus, the materials which serve to test an indicated conclusion are probative data.

An important consideration in regard to testing is that the data which indicate the conclusion are also probative data which may be used to test the inference. That this is equally true in the interpretation of tree-ring dates can be seen by examining Bannister's (1962) types of error and the techniques which are used to resolve them.

With the principles of context, indication, and testing as a foundation, Thompson (1958: 4-8) discusses the inferential process itself. The first step involves the recognition of the indicative quality of the data and the formulation of an indicated conclusion which is based on that quality. The process does not end here. As soon as an indicated conclusion is formulated, it must be tested and the inferential process enters its probative phase.

This phase consists of specific statements of the evidence which enters into the substantiation of the inference.... Some of them are explicit formulations of the indicative data; others are statements of entirely new material.... In practice, the probative data represent a transition from the explicit declaration of the indicative background to the introduction of the new information, such that the documentation of the indicative reasoning leads to additional probative evidence. (Thompson 1958: 5)

Within the context of culture, much of the probative phase of the inferential process is concerned with the use of analogies between the archaeological situation and comparable ethnographic

data. These analogies are of two kinds: the general comparative analogy, involving the repeated occurrence of a pattern in a large number of cultures at a similar level of development; and the specific historical analogy, dependent on a direct continuity between the archaeologically and ethnographically defined cultures (Thompson 1958: 5-6). These same relationships hold true in the interpretation of tree-ring dates within the cultural context, and at least partially within the chronological and biological contexts. A different type of analogy enters into the biological context. It might be called a physiological analogy. It is based on an assumed identity in life process (and therefore structure) between trees which were used by prehistoric peoples and modern living trees of the same species.

The interpretation of archaeological tree-ring data is an exercise in inference, and therefore conforms to the principles of the inferential process. Furthermore, since the context of the interpretation is in large measure cultural, Thompson's analysis of the inferential process in the interpretation of archaeological materials is completely applicable to the interpretation of tree-ring data within that context. The addition of the chronological and biological contexts to this endeavor merely enhances the range of interpretive possibilities that lie within the data. Data from all three contexts may be applicable to any particular inference without regard to context within which the inference is being made.

A vast number of inferences have been made in the interpretation of the data presented in this report. In every instance, I have endeavored to apply Thompson's analysis as a test of the

reliability of the inferential process by which the conclusions were reached. The testing of the conclusions themselves can, of course, be accomplished only through the use of the indicative and probative data involved in each case.

At this point, I propose to present a few examples of the application of Thompson's analysis to the interpretation of tree-ring data. These examples are presented in the format used by Thompson (1958: 51-64) in illustrating the inferential process, with reference to an archaeological collection of Yucatecan Maya pottery. Although the inferences made in the interpretive section of this report could have been presented in this same form, it is impractical to do so. Therefore, these few examples exemplify the process by which all conclusions were reached, and thus to show that the same processes are involved in interpreting tree-ring data as in interpreting strictly archaeological materials. There are four examples, one for each of Bannister's types of error. Each presents an actual case taken either from the Tsegi data or from the Tree-Ring Laboratory records. They are intended merely as examples, and therefore do not cover the full range of possible situations within a single type of error. It is hoped, in this way, to demonstrate how Bannister's types of error are recognized and defined on the basis of concrete data rather than as theoretical constructs.

EXAMPLE I

Type 1. Association direct, dating early.

Indicative data: Betatakin Room 6, a second-story chamber above Room 5, has cutting dates of 1246, 1257, 1257, 1258, 1261, 1267, 1269, 1273, and 1276 from nine beams in the ceiling.

Indicated conclusion: Room 6 was built in 1276 or later, using beams salvaged from older structures which give dates earlier than the actual construction of the room.

Probative data: It is extremely unlikely that it took thirty years (1246-1276) to build Room 6.

There is no architectural evidence for remodeling or repair of the roof or walls of Room 6; the room was built in one operation and not subsequently altered.

The date of 1276 comes from an auxiliary beam which supports all the other beams in the roof, many of which gave dates earlier than 1276.

Many of the beams in Room 6 were cut for a much larger room, and project well beyond the east wall of the chamber.

Room 6 could not have been built before Room 5.

The walls of Room 6 are continuous with those of Room 5. Both rooms were built at the same time.

All the dates from the ceiling of Room 5, which forms the floor of Room 6, fall at 1276 and are cutting dates.

There is no evidence for the remodeling or repair of Room 5 subsequent to its construction.

Trees which have died of natural causes and lain in the open for some time exhibit a characteristic weathering.

The beams from Room 6 with early dates do not show this type of weathering.

The marks made by stone axes on the logs appear to have been made while the wood was green.

The modern Hopi commonly use wood salvaged from abandoned parts of the village for new construction.

Probable inference: Room 6 was built in 1276, reusing beams salvaged from older, abandoned structures; therefore, the dating of the reused beams is earlier than the date of the chamber with which they are directly associated.

EXAMPLE II

Type 2. Association indirect, dating early.

Indicative data: Firepits in Room 13, Courts 25 and 63, and Kiva 78 at Kiet Siel contain fragments of charcoal dating at 945, 1226, 1244, and 979.

Indicated conclusion: During the Tsegi Phase occupation after 1250, fires were built using wood from trees which died at an earlier time.

Probative data: With the exception of the date at 1261, all the specimens date prior to the time of the Tsegi Phase occupation as determined by a number of dates from structural timbers in direct association.

Dead wood burns better than freshly cut green wood.

Seasoned dead wood is ordinarily used for fires.

Kiet Siel Cave was occupied for centuries prior to the Tsegi Phase.

This early occupation resulted in the presence of timbers in the cave at the time the Tsegi Phase occupation began.

Such old timbers would be eminently suited for firewood.

Modern Pueblo Indians are known to use old structural timbers for firewood.

Possible inferences: The Tsegi Phase inhabitants of Kiet Siel used dead wood for fires.

The Tsegi Phase people of Kiet Siel used old structural timbers for firewood, as well as reusing them in architectural contexts.

Many dates from firepit charcoal are earlier than the date of the site with which they are indirectly associated.

EXAMPLE III

Type 3. Association direct, dating late.

Indicative data: Room 65 at Kiet Siet has cutting dates at 1273, 1275, 1275, 1276, and 1279 from five beams in the ceiling.

Indicated conclusion: Room 65 was roofed in 1275, and the roof remodeled in 1279 or later.

Probative data: It is unlikely that it took four years to roof Room 65.

There is considerable non-dendrochronological evidence for remodeling of the room.

The high sill of the original storeroom-type doorway was knocked out to produce a doorway of the living room type.

A broken area in the floor in front of the doorway shows that a firepit-entrybox complex was removed.

The walls of the room are heavily coated with soot from the burning of fires in the firepit.

The primary beams are heavily smoke-blackened.

The secondary beams, closing material, and matting are not blackened.

The building sequence as shown by architectural evidence is as follows: (1) the room was built as a granary; (2) it was converted into a living room by enlarging the doorway, adding a firepit and entrybox; and replacing the original roof with a new one; (3) the walls and ceiling were heavily smoke-blackened; (4) the firepit and entrybox were torn out and the roof was removed except for the primary beams; and (5) a new roof was built on the old primary beams.

The dates of 1275 come from two of the smoke-blackened primary beams.

The dates of 1273, 1276, and 1279 come from three of the unblackened secondary beams.

Room 65 could not have been built after Room 61 which was probably built in 1267.

The modern Pueblo Indians frequently remodel and convert rooms from one purpose to another.

Probable inference: Room 65 was built in 1267 along with Room 61. Room 65 was later extensively remodeled. A new roof was put on the room in 1275. In 1279 or later major roof repairs were undertaken. Thus, the dates from the roof are later than the room with which they are directly associated.

EXAMPLE IV

Type 4. Association indirect, dating late.

Indicative data: Pithouse 1 at NA-8942 located near Houck, Arizona, has the following dates: 755, 792, 792, 795, 803, and 1056, of which only that at 803 is a cutting date.

Indicated conclusion: Pithouse 1 was built about 803, and the specimen which gave the 1056 date is intrusive.

Probative data: There is good clustering of the non-cutting dates in the period just prior to the one cutting date of 803.

The date of 1056 is incongruous with this clustering.

The dates of 755 and 795 are directly associated with architectural features of the pithouse.

The dates of 792, 792, and 803 come from specimens recovered from fill directly above the floor of the structure.

The date of 1056 comes from a rotten timber lying vertically in the fill of the pithouse.

The 1056 specimen could be traced down only as far as 27 cm. above the floor.

Ceramically, the pithouse belongs in the White Mound Phase.

The White Mound Phase has been reliably dated elsewhere at about 725 to 825.

Modern Pueblo Indians commonly use abandoned structures for the dumping of trash of all kinds.

Probable inference: Pithouse 1 was built about A.D. 803 and was used as a dump subsequent to its abandonment sometime after 803. The material thrown into this dump included a beam which was deposited there sometime after 1056. The 1056 beam gives a date later than the date of the structure with which it is indirectly associated.

These four examples are intended to show the inferential processes involved in the interpretation of four different constellations of tree-ring data. They bring out two important facts. First, the interpretation of tree-ring dates proceeds from the same foundation and employs the same processes as does the interpretation of any archaeological data. Second, they show the wide range of materials derived from the cultural, chronological, and biological contexts which may be used as probative data in testing the conclusions indicated by the original data. The cultural and environmental interpretations mentioned previously also involve the same inferential processes which operate within the same three contexts. No specific examples of these types of inference are presented. The exact steps involved in their formulation should be evident in the discussion of each in the analysis section of this report.

ASSUMPTIONS

Since the objective of this study is the very refined interpretation of tree-ring dates, the assumptions underlying the analysis of the dates should be made explicit.

Assumption 1. The date is assumed to be correct. This assumption rests on the degree of correlation between the individual specimen and the master tree-ring chronology against which it was dated. Ultimately, it is grounded in the very foundation of dendrochronology as a scientific dating tool. If the principles and techniques of dendrochronology are sound---and they have survived countless tests---then the dates from individual specimens must be

correct, unless there is some sort of human error on the part of the dendrochronologist who derived the dates. To minimize this source of error, the dating of a site is always independently checked by a second person. If the two investigators cannot agree, the disputed date is not released.

Assumption 2. It is assumed that in the vast majority of cases the death of a tree was caused by human activity; namely, the felling of the tree in order to put it to some sort of use. Haury (1931: 12-13; 1935: 103-4) presents the rationale behind this assumption. O'Bryan (1949) has argued that in certain instances this assumption may be erroneous. However, his reservations about the assumption concern a much earlier time level than that of the Tsegi Phase and, consequently, do not apply to the present situation.

Assumption 3. It is assumed, unless there is objective evidence to the contrary, that the beams found in the sites were cut expressly for use as constructional material.

Assumption 4. This is a corrolary of Assumptions 2 and 3. Unless there is evidence to the contrary, it is assumed that dates from structural wood apply to the structure in which the wood was used.

Assumption 5. It is assumed that in the majority of cases in which the above assumptions do not apply, there will be some sort of non-dendrochronological evidence to that effect. For example, reused beams or repair timbers may be recognized by their appearance. There may be, of course, a few instances where this assumption does not hold, and therefore the interpretation may be erroneous.

In addition to the general assumptions listed above, a few specific ones have been made regarding the Tsegi data, especially those from Betatakin and Kiet Siel.

Assumption 6. It is assumed that the dated specimens from a site constitute a representative sample of that site. The Betatakin and Kiet Siel samples approach 100% for timbers greater than two inches in diameter.

Assumption 7. It is assumed, because of the location of the villages in dry caves or shelters and because of the short occupation of the sites, that repair timbers were not generally needed. If an occasional repair beam was used, however, the field collector should be able to detect its presence in a roof, under the conditions of Assumption 5. Therefore, in the absence of evidence to the contrary, the latest date from a roof should indicate the date at which the roof was built.

CHAPTER 3. THE ENVIRONMENTAL SETTING

Northeastern Arizona lies within the Colorado Plateaus physiographic province. This province is made up of a number of relatively flat, high-standing plateaus and mesas which are stacked up on one another to produce vertical relief. This topographic regimen is produced by the generally flat-lying strata of sedimentary rocks which underlie the country. The elevation of the different plateaus varies greatly, but is usually above 5000 feet and reaches a maximum of over 8000 feet on the Mesa Verde, Black Mesa, and Skeleton Mesa. A few isolated mountain ranges of igneous origin break the monotony of flat-lying sediments and form high, rounded or conical mountain masses; examples of these are the volcanic San Francisco Peaks (elevation, 12,611 feet), and Navajo Mountain (10,388 feet) and Carrizo Mountain (9142 feet), both of laccolithic structure. The predominant relief of the country, however, is not upward, but downward. The streams of the region have cut down through the sediments to form countless deep, vertical-walled canyons, culminating in the Grand Canyon of the Colorado River, which reaches nearly a mile in depth.

The topography of northeastern Arizona is dominated by the many high plateaus and mesas which fall away in all directions from the great uplift of Navajo Mountain. This area is bounded on the north by the canyon of the San Juan River, on the east by Monument Valley and Chinle Valley, on the south by Marsh Pass and the Klethla Valley, and on the west by the canyon of the Colorado River. The two

large rivers---the Colorado and the San Juan---are the master streams of the area, and all water from the high country drains into them. On the north a series of deep, rather steeply graded canyons flow almost due north into the San Juan. The western and southern slopes of Navajo Mountain are drained by the extensive Navajo Canyon system, which flows northwest into the Colorado River. Monument Valley and the north and east faces of Skeleton Mesa are drained by a series of short, deep canyons and streams which flow either to the San Juan or into Chinle Wash. The southern flanks of these uplands are drained in two directions: east and west. The southern parts of the Shonto Plateau are drained by a number of long, comparatively shallow canyons which empty into the Klethla Valley and thence into the internal drainage basin of Red Lake farther west. The eastern face of the Shonto Plateau and most of Skeleton Mesa are drained by a large, deep, south-flowing canyon whose waters eventually reach Chinle Wash 42 miles to the east; this is the canyon of Laguna Creek, known most familiarly as Tsegi Canyon.

TSEGI CANYON

The Tsegi (Figs. 1, 2, and 3) is not a single canyon but a great dendritic system of canyons incised into the bulk of Skeleton Mesa to a maximum depth of over 1200 feet. The upper six miles of the main canyon---called Long Canyon on most maps---trends in a generally southwestern direction. About nine miles below its head the main canyon makes a broad, almost right-angle turn so that in its lower course---the part referred to herein as the main Tsegi---it runs in a

Fig. 2. Tsegi Canyon looking downstream from Tsegi Point. Betatakin Wash enters Laguna Creek from the right. Important topographic features include the Kayenta bench, the falling dune indicated by the arrow at the right, and the eroded alluvial fill of the canyon floor. The arrow at left indicates a Navajo cornfield.

Fig. 3. Tsegi Canyon looking upstream from Tsegi Point. The level surface of the Shonto Plateau forms the horizon; the high point at left is Dzil Nez (Tall Mountain). A typical arched rock shelter may be seen in the Navajo sandstone at the upper left. The arrow indicates the position of Scaffold House at the base of the sandstone cliff.

southeasterly direction to its mouth at Marsh Pass. Long Canyon is a narrow, high-walled gorge with only a few short tributary branches and coves. Below Long Canyon several major tributaries open into the main canyon from both sides. Six miles from the head three large, unnamed canyons join the main Tsegi: two from the west, one from the east. Next south, Bubbling Springs Canyon, one of the major tributaries of the Tsegi, enters from the west. Below this point the west bank of the Tsegi is lined with a number of small, rather insignificant canyons of which none, save Betatakin Canyon, are named. Opposite the mouth of Betatakin Canyon the chasm of Kiet Siel Canyon opens from the east. In general, it parallels the main Tsegi and, except for the vagaries of naming, should be considered a tributary of Dogoszhi Biko. Dogoszhi Biko, which enters Kiet Siel Canyon about a mile east of the latter's confluence with the Tsegi, is the major tributary canyon of the Tsegi system. This canyon heads at the very edge of Skeleton Mesa, and headward erosion is in the process of breaching this scarp. South of Dogoszhi Biko three major tributaries enter from the left bank; the first of these is unnamed, and is followed by Cobra Head and Wildcat canyons, the latter actually opening directly into Marsh Pass itself.

The Tsegi Canyon system is drained by the many tributaries of Laguna Creek, which derives its name from the lakes that existed along its course in the 19th century. Laguna Creek, Kiet Siel Creek, and Bubbling Springs Wash are perennial, spring-fed streams; all the other tributaries are intermittent, ceasing flow during the summer, except immediately after thundershowers. At Marsh Pass Laguna Creek emerges from Tsegi Canyon, makes a right-angle turn, flows eastward

through the pass, and debouches into the broad, arid Chinle Valley where it continues on past Kayenta to empty into Chinle Wash, which in turn flows into the San Juan River.

GEOLOGY

A great series of Mesozoic rock formations is laid bare to the walls of the Tsegi Canyons (Gregory 1916, 1917; Hack 1945; Cooley 1958; Harshbarger, Repenning, and Irwin 1957). The characteristics of these formations not only determine the configuration of the canyon itself, but have had an important influence on the distribution of human populations, both prehistoric and modern. The erosion of Laguna Creek through alternating resistant and softer formations has produced the stepped canyon walls which define the U-shaped profile of a box canyon (Figs. 2 and 3). The differential porosity and permeability of the formations determines to a great extent the hydrology of the canyon system, a feature of great importance in the history of human occupation.

The earliest stratigraphic unit known to be exposed in the walls of Tsegi Canyon is the Late Triassic Rock Point member of the Wingate sandstone (Harshbarger, Repenning, and Irwin 1957: 8-10, Pl. 2). It consists of flat bedded, silty sandstones which outcrop as irregular slopes and ledges only in the lower reaches of the Tsegi below the mouth of Betatakin Canyon.

Overlying the Rock Point member is the Lukachukai member of the Wingate sandstone, also of Upper Triassic Age (Cooley 1958, Table 1; Harshbarger, Repenning, and Irwin 1957: 10-12, Pl. 2). The

Lukachukai member, which in the Tsegi reaches a maximum thickness of about 250 feet, is an aeolian deposit characterized by very large-scale crossbedding. Figure 1 illustrates the distribution of this member throughout the Tsegi. The Lukachukai member forms vertical-walled, columned cliffs and shallow, arch-shaped caves in which the prehistoric inhabitants of the canyons occasionally made their homes.

The Lukachukai member of the Wingate sandstone is overlain by the Triassic (?) Moenave formation, which is composed of two members, the Dinosaur Canyon sandstone and the later Springdale sandstone (Harshbarger, Repenning, and Irwin 1957: 12-17). In the Tsegi, the entire Moenave formation does not exceed 100 feet in depth. The chief topographic expression of the Moenave formation is a low cliff which caps the Wingate sandstone and underlies the Kayenta formation.

Above the Moenave formation lies the Jurassic Kayenta formation, which reaches a maximum thickness of about 150 feet. The Kayenta formation is of fluvial origin and consists of lenticularly bedded quartz sandstone with lenses of mudstone (Harshbarger, Repenning, and Irwin 1957: 17-19, Figs. 2 and 20). It is less resistant to erosion than the Lukachuaki member of the Wingate sandstone or the Moenave formation, and characteristically forms a fairly narrow stepped bench rising back from the edge of the low Moenave cliff to the foot of the cliffs formed by the overlying Navajo sandstone. This bench is of extreme importance in the local topography of some parts of the Tsegi. The Kayenta formation occasionally forms small overhangs and low-roofed caves in which are sometimes found isolated Tsegi Phase storage chambers.

Stepped back from the edge of the Kayenta bench, loom the towering cliffs of the Jurassic Navajo sandstone which rise to a maximum height of more than 700 feet. Like the Lukachukai member of the Wingate formation, the Navajo sandstone is of aeolian origin and exhibits very large-scale crossbedding (Cooley 1958, Table 1). The Navajo sandstone is exposed throughout the Tsegi system, forming the rim rock of the canyons. In Long Canyon and in the upper reaches of Bubbling Springs and Kiet Siet canyons this is the only formation exposed, the great sandstone cliffs springing vertically from the canyon floor to enclose narrow, tortuous gorges of the saw-cut types (Cooley 1958: 27). On either side of the canyon stripped areas of Navajo sandstone form the surfaces of Skeleton Mesa to the east and the Shonto Plateau to the west. Both these highland areas bear an irregular mantle of windblown sand and some developed soil, the Shonto Plateau being the more favorably endowed in this respect. The Navajo sandstone erodes to form vertical and rounded cliffs often characterized by the development of conspicuous, sculptured buttresses and recesses. Because of the crossbedding, the Navajo characteristically erodes to form large, usually shallow, arch-shaped caves. In caves such as these were built the large Tsegi Phase "cliff dwellings." Figure 15 b illustrates a cave of this type in which Betatakin is situated.

Surficial deposits may be divided into three types: aeolian deposits, talus, and alluvial deposits.

Aeolian deposits are largely confined to a number of huge stabilized sand dunes which fall from the rim of the canyon to the

floor far below. These falling dunes are restricted to the southwest side of the canyon and, generally, to the lower reaches below Bubbling Springs Canyon. The bases of these dunes are overlain by the complete series of alluvial deposits, and Hack (1945: 153-4) attributes them to the altithermal period of the post-Pleistocene temperature curve. These dunes are chiefly important as routes of travel from the rim down into the canyon, since they often form steep, but passable ramps over the vertical cliffs. One such dune may be seen in the right foreground of Figure 2.

Talus deposits are common throughout the canyons. The relative structural weakness of the Kayenta formation has led to the development of tremendous talus accumulations at the foot of the Navajo sandstone. Often such talus covers and completely obscures the Kayenta formation itself. In areas where the Kayenta formation is not exposed, such as in Long Canyon and upper Kiet Siel Canyon, the talus accumulations from the Navajo sandstone are smaller and more localized. A second major zone of talus formation lies at the foot of the Wingate sandstone; depending on their relative ages, these deposits lie on or are buried by the alluvium in the canyon bottom. The talus slopes seem not to have been too important in the Tsegi Phase occupation, but were a common habitation site in pre-Pueblo II times (Hack 1945: 152). Typical talus deposits can be seen in Figures 2 and 3.

The canyon bottoms are filled with deep deposits of Recent alluvium. These deposits are now deeply eroded by Laguna Creek, which has cut an arroyo from 40 to 80 feet deep and 100 feet wide throughout the canyon system (Figs. 2, 3, and 4). At present, downward erosion

Fig. 4. The Laguna Creek arroyo in Tsegi Canyon. At this point, just above the mouth of Bubbling Springs Canyon, the stream has cut to bedrock. The water lies about 50 feet below the surface of the alluvial terrace.

has virtually ceased, because the stream now flows on bedrock. Lateral cutting continues at an irregular rate. The degree of erosion and the nature of the sediments exposed by it can be seen in Figure 4.

Hack (1942, 1945) identifies two major periods of Recent deposition and two of erosion. The alluvium attributed to the first depositional cycle is designated the Tsegi formation, and that correlated with the younger cycle is called the Naha formation. It now seems that Hack's Tsegi formation includes two stratigraphic units separated by a period of either regional or local erosion and stream channeling (Cooley 1962: 50). The Tsegi formation was deposited sometime between 2000 B.C. and about A.D. 1150. The Naha deposition occurred after 1300 and was terminated by the present erosion cycle which began in the late 19th century. The two periods of deposition were separated by an interval of degradation, which may have begun as early as A.D. 1100. The first phase of this erosion was characterized by general stripping, while arroyo cutting predominated during the second phase (Cooley 1962: 50). The Tsegi-Naha erosion culminated sometime around A.D. 1300 in a developed system of arroyos that encompassed the entire Tsegi Canyon system. Although the Tsegi-Naha channeling was probably as extensive as that which presently occupies the canyon, it may have been much less severe in terms of the depth and width of the arroyos (Cooley 1962: 50).

Hack was able to trace the Naha and Tsegi formations from a point on Laguna Creek three miles northeast of Marsh Pass to a point six miles up the Tsegi, near the mouth of Betatakin Canyon. The Tsegi terrace and an undissected portion of the lower Naha formation show

quite clearly in the neck of the oxbow bend between Laguna and Betatakin creeks in the left center of Figure 2. It is not known how much farther up the canyon the Naha formation may be traced, but the bulk of the sediments belong to the Tsegi formation, undoubtedly correlative with Cooley's (1962: 50) Unit 4. This is demonstrated by the presence on the terrace and within the sediments themselves of archaeological remains whose dates limit the range of possibilities to exclude the comparatively late (post-1300) Naha formation and the earlier Unit 5 (pre-A.D. 500) of Cooley (1962: 50, Fig. 18.1).

Needless to say, the deposition and erosion of these sediments were of great importance in the history of the human occupation of the canyon. Unit 4 (the Tsegi formation) abounds in cultural material deposited in or buried by the accumulating sediments. Just how important these events are is taken up later under the discussion of the Tsegi Phase.

HYDROGRAPHY

Somewhat surprisingly, water is very plentiful in the Tsegi Canyon system. As has been mentioned, Laguna, Kiet Siel, and Bubbling Springs creeks are all perennial streams. In addition, permanent streams are found in the upper end of Dogoszhi Biko and throughout its major tributary, Nagashi Biko. Below the confluence of Nagashi Biko with Dogoszhi Biko, the waters of the stream are absorbed by the sands of the arroyo floor or are evaporated. During and after the violent summer thunderstorms characteristic of the region, all the

arroyos run deep with torrents of water, the level of which often rises six to eight feet in a few minutes.

There are two principle sources of water for the streams in the Tsegi. One of these is runoff from the highlands on either side. Since there is little soil development in these areas, this runoff is characteristically violent, taking the form of great cascades of water falling from the cliffs into the canyons, especially during the heavy summer thunderstorms. However spectacular this source might be, annual precipitation is neither sufficient nor regular enough to account for the permanency of the streams. Instead, their major source of water is the innumerable springs and seeps which are found throughout the canyons.

Two major sources supply the springs in the Tsegi. The first of these is the Navajo sandstone, which is an excellent aquifer of high permeability and porosity. The tremendous areas of Navajo sandstone exposed on the Shonto Plateau and Skeleton Mesa provide a great intake area for this water system. The underlying Kayenta formation, being horizontally bedded, is much less permeable, and the contact between the Navajo and Kayenta is a major zone of seepage throughout the Navajo country (Gregory 1916: 138). It is along this zone that water action has been most active in producing large caves in the Navajo sandstone. Such a cave is visible at the upper left in Figure 3. It is no accident that these shelters were chosen as homesites by the prehistoric peoples of the Tsegi.

The second major source of water in the Tsegi is the Recent alluvium. This reservoir is recharged by precipitation and by seepage

from the Navajo and Wingate sandstones and the large falling dunes. The cutting of Laguna Creek to the bedrock of the canyon floor taps this reservoir to the maximum extent. Countless springs well up from the floor of the stream or issue from the base of the arroyo wall at the contact of the alluvium with bedrock. This is unquestionably the major source of water in the canyon (Hack 1945: 152). Before the cutting of the present arroyo the volume of flow was less than at present, and several small lakes existed in the lower reaches of the canyon (Gregory 1916: 48). The present erosion cycle, which began in 1884, has destroyed all the lakes but has produced a substantial increase in the regularity of flow of Laguna Creek by tapping the ground water in the alluvium (Gregory 1916: 100).

FLORA AND FAUNA

The flora of the Tsegi Canyons is tremendously varied in response to the wide variety of localized environmental niches present throughout the canyons. No botanical studies of the canyon have been published. Consequently, the following statements are based solely on somewhat cursory personal observations made during three seasons' work in the canyon and are intended only to give a subjective picture of general conditions. The general character of the vegetation is evident in many of the photographs that accompany this report.

The alluvial terraces are covered by a sparse growth of grasses and occasional clumps of sagebrush (Artemesia sp.). Far upstream, near the heads of the major canyons and their branches, arroyo cutting is almost non-existent, and generally wetter conditions prevail. Here

grass is abundant, and mosses, ferns, and the like flourish in the stream bed. Locally, springs cut off from the main flow of the streams have produced miniature swamps with an attendant luxuriousness of vegetation, including ferns, rushes, and high grasses.

A number of species of tree are found in the canyon, each occupying its own special environmental niche. Deciduous trees present include Gambel oak (Quercus gambelii Nutt.), boxelder (Acer negundo), and quaking aspen (Populus tremuloides Michx.). Thick stands of Gambel oak cover the talus slopes of almost all coves, rincons, and heads of canyons which possess one or more springs. In addition, they commonly fringe the lower margins of talus slopes throughout the canyon; they rarely grow on the alluvial flats away from the talus. Boxelders are usually found beneath the edges of overhanging scarps where they receive the full benefit of the cascades of water that fall from the cliffs during storms; for this reason they are often associated with archaeological cave sites. A few lone boxelders grow at widely separated points on the alluvium where local conditions permit. Quaking aspens grow only near the heads of a few short side canyons where rather unique topographic and hydrographic circumstances have combined to produce a stable water supply (Fig. 15 a).

Coniferous trees are common throughout the canyons. Species present include pinyon (Pinus edulis Englm.), juniper (Juniperus species), ponderosa pine (Pinus ponderosa Laws.), Douglas-fir (Pseudotsuga menziesii [Mirbel] Franco), and white fir (Abies concolor [Gord. and Glend] Hoopes). Pinyon and juniper, mixed with desert shrubs and grasses, dot many of the talus slopes and the exposed

slopes of the Rock Point member of the Wingate sandstone and the Kayenta formation. Isolated ponderosa pines grow on the alluvium and talus in areas where the canyon is wide enough to provide long hours of sunshine during the day. Douglas-fir trees are abundant but are restricted to a very narrow range of sites. They are found on the south and east sides of the canyons; that is, on north and west facing slopes where they are shielded by the towering cliffs from the heat of the summer sun. Long, linear stands of Douglas-firs grow high on top of the talus against the cliffs, or in denser stands in the more protected coves. Fingers of Douglas-firs extend downslope only in ravines where there is a certain amount of shade and where, presumably, moisture is more abundant. Others find precarious foothold on the narrow ledges and crevices in the Navajo sandstone cliffs to within a few feet of the cliff top, but never any higher. White firs are limited to even more protected sites---deep coves or crevices in the cliffs. They generally appear to be associated with springs or seeps, whereas Douglas-firs, given enough shade, do not seem to need this additional supply of water.

The fauna of the canyons is limited to smaller forms. Lizards, jackrabbits, bats, mice, and numerous birds are present; snakes seem to be rare. Large game animals are absent and probably never were common. The only predator sighted was a single gaunt coyote. In the small localized swampy areas created by springs in the alluvium, amphibious life abounds. Frogs are abundant, and each one of these areas harbors several salamanders. Aquatic insect larvae also find refuge in these swamps.

CLIMATE

Climatically, the Tsegi lies within Sellers' (1964: 4-5, Fig. 2) northeast sector of the state of Arizona. Generally speaking, this sector is characterized by extreme aridity, being exceeded in this respect only by the hot, low-lying deserts of the southwestern sector of the state. In fact, winter precipitation in the southwest exceeds that of the northeast. Most of the annual precipitation falls in the summer and early fall months, usually in the form of thundershowers at sunset or in the early evening. As is characteristic of the Southwest, May and June are the driest months of the year. In contrast to the rest of Arizona, there is little increase in precipitation during the winter. Thirty to fifty per cent of the meager winter precipitation falls as snow, but this usually amounts to less than 50 inches (Sellers 1964: 24). The annual temperature range throughout the northeast is great, with hot summers and frequently very cold winters (Sellers 1964: 34).

The weather in the Tsegi region conforms quite well to this general picture. However, the presence of two nearby weather stations permits a more specific analysis of the local climate. One of these is located at Navajo National Monument Headquarters on the rim near the head of Betatakin Canyon, at an elevation of 7286 feet above sea level. Temperature and precipitation records for this station have appeared in Climatological Data, Arizona (U.S. Department of Commerce) since 1939 under the name "Betatakin." The data for the first 14 years are somewhat spotty, with no figures for several months of each year. Since 1952 the records are more

consistent, with temperature data missing for only one month each in 1957 and 1958. The other weather station is located at Kayenta, Arizona, at an elevation of 5600 feet. Except for a six-month period in 1942, this station has been reporting continuously since 1916 (Green and Sellers 1964: 233-6).

The environment of each of the stations is quite different. The Betatakin station, 1286 feet above that at Kayenta, is located on the Shonto Plateau. This part of the plateau is covered by a pinyon-juniper forest interrupted by small, sagebrush-covered swales and valleys. Kayenta lies in the broad alluvial valley of Laguna Creek in the rain shadow of the upland areas of Skeleton and Black Mesas to the west and south. The vegetation, reflecting the drier conditions and lower elevation, consists mainly of a sparse cover of grass and sagebrush.

Neither of these stations reflects the precise climate of the Tsegi itself. Nevertheless, both are pertinent to an attempt to estimate various climatic factors for the canyon. The canyon bottoms lie from 700 to 1000 feet below the Betatakin weather station and from 1000 to 700 feet above the Kayenta station. Local topographic considerations prohibit an attempt to estimate the climatic parameters of the canyon merely by averaging those for Kayenta and Betatakin. However, a general comparison of the two stations is illuminating.

TEMPERATURE

The average annual temperature at Betatakin is 50.0° Fahrenheit, while that at Kayenta is 53.0°. January is the coldest month at

both stations, with an average temperature of 30.0° at Betatakin and 29.3° at Kayenta. July is the warmest month at Betatakin (average temperature, 72.3°) and at Kayenta (76.5°). Yearly maximum temperatures at Betatakin, usually occurring between June 22 and July 26, range from 94° to 101° and average 96.1° . Annual minimum temperatures at the same station, occurring during January and February, range from -10.0° to 8.0° and average 1.0° . The frost-free season at Betatakin ranges from 107 to 213 days and averages 155 days, while Kayenta's frost-free period averages 160 days.

Several factors make it difficult to estimate the various temperature parameters for Tsegi Canyon itself on the basis of the data from the two weather stations. The average temperature is probably higher than that for the Betatakin station. Summer maximum temperatures may exceed those of Kayenta because of the heating effects of reflection from and heat retention by the canyon walls. Because of cold air drainage down the canyon at night, diurnal temperature variation is great. There probably is no significant difference between the growing seasons of the mesa top and canyon bottoms. The higher summer temperatures in the canyon may reduce the time required for crops to mature and ripen to less than that which prevails on the cooler uplands.

PRECIPITATION

Precipitation at Betatakin is extremely variable. The total yearly rainfall over a period of 17 years ranged from a low of 6.84 inches in 1956 to a high of 18.79 inches in 1965. The average yearly

rainfall for these 17 years is 11.39 inches. Precipitation greater than the average occurred in only 5 of the 17 years and, as in Arizona generally (Sellers 1964: 24), the excess was caused by unusually wet winters. The Kayenta station, lying in the rain shadow of the high mesa country to the south and west, receives an average of only 8.36 inches of rain a year. Both Betatakin and Kayenta exhibit the same seasonal pattern of precipitation. The driest period of the year occurs in the months of May and June. Late summer and early fall is the season of greatest precipitation, with high monthly averages in July and August at Kayenta and from July through October at Betatakin. Following the rainy season, monthly precipitation remains fairly low throughout the winter until the spring dry period sends it even lower.

The rainfall pattern for Tsegi Canyon probably fits that of Betatakin more closely than that of Kayenta, because the highland mass which causes greater precipitation at Betatakin would produce the same result for the canyon. Extreme variability and spottiness characterize rainfall in the canyons; Kiet Siel may not receive a drop of moisture from a violent storm which strikes Betatakin only six miles away. The average yearly precipitation in the canyons probably is quite close to the 11.39 inches recorded at the Betatakin station, and the monthly variation in rainfall undoubtedly parallels that at Betatakin.

HUMIDITY AND EVAPORATION

No data on humidity and evaporation are available for northeastern Arizona. However, humidity tends to be low and evaporation high because of the high temperatures and the almost continual movement

of dry air across the country. During the heat of the day the rate of flow of many springs and streams is exceeded by the evaporation rate, and these waters dry up until nightfall.

WIND

A dry wind of moderate force blows almost constantly in the spring, and to a lesser degree in the fall. In the summer violent gusty winds accompany the rainstorms or are produced on the periphery of storms which traverse nearby regions but do not actually strike the local area.

AGRICULTURAL POTENTIAL OF THE TSEGI ENVIRONMENT

The physical environment was an important factor in the history of human occupation of Tsegi Canyon and a major determinant of the nature of the cultures of the people who lived here through the centuries. Neither the cultural nor the environmental factors were stable during the human occupation of the canyon. Thus, each must be assessed in terms of the other at identical points in time. Only then can the interaction of these variables be fully understood.

The Tsegi Phase occupants of the canyons were farmers who possessed a definite assemblage of crops and agricultural techniques, knowledge, beliefs, and rituals. It is necessary to examine the Tsegi environment with reference to the agricultural system of these farmers. The Tsegi Phase people grew maize, beans, squashes, gourds, and cotton, all of which have been recovered from one or more sites. There is little evidence for other crops, but some undoubtedly existed. Simple digging stick techniques of planting were used.

Extensive agricultural terraces at Red House near Navajo Mountain, a large artificially dammed reservoir and check dams at Long House near Marsh Pass, and the elaborate irrigation works at the Creeping Dune Site (Sharrock, Dibble, and Anderson 1961) and at the Beaver Creek agricultural community (Lindsay 1961) indicate the range of water conservation and utilization techniques known to the Kayenta Anasazi. Undoubtedly the Tsegi Phase people were familiar with all these techniques, as well as dry and flood-water farming. The problem, then, is to assess the extent to which people with such a system of agricultural practices and knowledge could have successfully exploited the environment of the Tsegi and nearby areas.

CLIMATIC FACTORS

The notion that the climate of the present is appreciably different from that of the prehistoric past can be rejected on the basis of several lines of evidence, including dendrochronology, pollen studies (Schoenwetter 1962: 192), and the analysis of prehistoric plant communities. This is particularly true of periods as recent as that with which this analysis is concerned. Therefore, the climate during the Tsegi Phase occupation of the area must have been quite similar to that of the present.

Hack (1942: 8) has calculated that on the plateau "crops are most successfully grown in regions... where the mean annual precipitation is about 12 inches and the length of the growing season about 130 days." The Tsegi area, with its yearly rainfall of 11.39 inches and average growing season of 155 days or more, fulfills these

conditions, and falls into Hack's (1942: 23) main zone of flood-water farming. However, he also points out that 11 or 12 inches of rain a year are not sufficient to grow corn without special methods, such as flood-water farming, irrigation, or some means of conserving soil moisture (Hack 1942: 20). The great variation from year to year in total precipitation and its generally spotty distribution also limit the degree of reliance the farmer can put on rainfall. Dry farming, except in years of especially high rainfall, would seem to be a risky business in the Tsegi. The Tsegi Phase people must have drawn upon their knowledge of various other techniques, such as irrigation or water conservation, to offset the paucity of precipitation.

The 155-day growing season in the Tsegi is well above Hack's estimate of 130 days and even greater than his effective minimum of 120 days (Hack 1942: 8, 23). Furthermore, heat retention and radiation from the canyon walls may actually shorten the ripening period of corn, and further enhance the desirability of the canyon. The variation in the length of the growing season is also of importance. Only once in the 23 years of record was the frost-free season less than the minimum 120 days. In only four years was it less than 130 days. Thus, the growing season in the Tsegi is usually ample for the planting and ripening of corn. Only rarely do frosts occur early or late enough to cause serious damage to crops. Consequently, it may be inferred that the length of the growing season normally was not crucial to Tsegi Phase farming and that water was the most critical factor in the agricultural picture.

PRESENT CONDITIONS

Given the climatic factors outlined above, present environmental conditions in the canyon are not conducive to intensive agriculture on the Hopi level of technology. The relatively broad, flat alluvial terraces afford plenty of good land for planting, as do the sand dunes. However, the cutting of the arroyo to bedrock has lowered the water table away from the surface, and the water in the streams lies 50 to 80 feet below the level of the terraces (Fig. 4). Without a high level of agricultural technology, water, in quantities sufficient to ensure successful crops, cannot be applied to the acres of suitable farmland. In the absence of sufficiently reliable precipitation, this situation effectively prohibits the large-scale utilization of these areas. Presently in the canyon there is plenty of water and an abundance of land, but it is impossible to get the two together in quantities sufficient for large-scale farming.

The present-day Navajo utilization of this area presents a good example of the possibilities of the Tsegi environment for exploitation by a fairly low level of technology. The Navajos use the canyons chiefly for grazing herds of sheep, cattle, and horses. However, they also practice agriculture here, employing techniques which in general cannot be distinguished from those of the modern Hopi. The present land-water relationships in the canyon severely limit the location and nature of their fields. A few small orchards are irrigated from permanent springs in the manner described by Hack (1942: 34-7) for the Hopi. The staple crops are corn and squashes which are grown in two types of location. A few crops are planted in

small akchin fields on the arroyo floor near the mouths of small side channels, where they benefit from the flood waters of summer rainstorms. Larger fields are located on the alluvial terraces, usually near the mouths of large side canyons. A few of these fields are prepared with a horse-drawn plow before planting; others, by hand. These crops depend on residual soil moisture for germination and on summer rainfall for maturation. The only type of artificial watering noted involved the use of buckets hand carried from the arroyo bottom at times when rainfall was deficient or delayed. The Navajos do not begin corn planting until about the first of June. Thus, the threat of damage by late spring frost is almost nonexistent. Harvest begins in mid-September (Hill 1938: 41) and here, too, chances of frost damage are slight. The success or failure of a year's planting depends almost entirely on the quantity and timing of the summer rains. Little agricultural use is made of the nearby mesa tops, since precipitation is not reliable and there is practically no surface water on which to rely in case the rains fail. This area is restricted to the grazing of sheep and horses.

On a strictly agricultural subsistence base, the Tsegi of today is not capable of supporting the large populations that once dwelt in its depths. The Navajos harvest enough to supply no more than ten families. How, then, did the people of the many large Tsegi Phase villages support themselves in such an environment? The answer lies in the fact that the environment of today bears little resemblance to that of the period before A.D. 1300.

PREHISTORIC CONDITIONS

The long period of aggradation that produced the Tsegi formation was in progress until at least A.D. 1100 (Cooley 1962: 48, Fig. 18.1) and probably until about 1150. The arroyo cutting phase of the Tsegi-Naha erosion interval did not occur until late in Pueblo III times (Hack 1942: 62; 1945: 155), although generalized stripping of the surface may have begun as early as 1150 and prevailed throughout most of the 1200's (Cooley 1962: 50). The importance of this situation for the present consideration is that it is likely that the Tsegi Phase people did not have to contend with a system of deeply entrenched arroyos in their efforts to grow crops in the canyons. The broad, flat alluvial surface extended without break across the canyon. The water table was high, perhaps high enough to support a permanent stream that meandered back and forth across the entire width of the canyon floor (Hack 1945: 156; Cooley 1962: 48, Fig. 18.1). Large fields could have been planted throughout the canyon, with reliance for water being placed on the high water table or on irrigation from the flowing stream. If the stripping phase of the Tsegi-Naha erosion interval had begun by this time, flood-water farming would have been possible over broad areas, even if the water table had been lowered and a living stream was no longer active. Thus, conditions in the Tsegi were much more favorable for intensive agricultural exploitation than they are at present. The 13th century environment was quite capable of supporting the large number of people who inhabited the many Tsegi Phase villages, whereas that of today is not capable of such support.

The mesa tops present quite a different story. Extensive stripped surfaces of baldrock, thin soil mantle, and lack of surface water undoubtedly prevailed in the 13th century as they do today. The environment of this area has probably remained fairly constant, the only major difference being the rather recent extermination of almost all game animals. Thus, the inadequate rainfall and the absence of surface water combined to mitigate against any intensive agricultural exploitation of these highland areas. The lack of Tsegi Phase exploitation is borne out by the paucity of habitation sites in these areas. The few sites that do exist are small and were only briefly occupied. These mesa-top areas may have been cultivated as supplemental sources of food by the peoples living in the canyon. Crops would have failed in years of deficient rainfall or untimely freezes, but such losses would not have been disastrous if the harvest in the canyon had been adequate. The additional food acquired from the mesa fields in good years would undoubtedly have been a welcome, but not absolutely essential, dividend. Quite probably the Anasazi exploitation of this upland zone resembled that reported by Hobler (1964: 12-13, 17) for Navajo farmers on Paiute Mesa. There the amount of land under cultivation fluctuates with the nature of the weather in any particular year. In wet years cultivation is extended into marginal locations; in bad years planting is restricted to well watered areas, such as the bottom of the wash that drains much of the surface of Paiute Mesa.

In conclusion, the 13th century Kayenta colonist of Tsegi Canyon found a suitable environment in which to exercise his

agricultural knowledge and skill. Large areas of flat land greeted him; ample water was available in the form of either a flowing stream or a high water table. To this land he could apply techniques of dry farming, flood-water farming, terracing and check damming, or canal irrigation. The combination of suitable environment and adequate technology resulted in the establishment of a comparatively large population resident in several villages located throughout the canyon system.

CHAPTER 4. BACKGROUND TO THE STUDY

The archaeological wealth of the Tsegi Canyon--Marsh Pass Region has long been well known to the archaeologist and to the dendrochronologist. Each sandy ridge yields its quota of broken pottery; the shattered walls of small surface sites of all periods dot the countryside; a few large ruined villages occupy rocky eminences overlooking the quiet, sandy valleys; and deep in the shadowy recesses of narrow canyons and broad caves nestle famous "cliff dwellings" such as Kiet Siel, Betatakin, and Batwoman House and their lesser known, but no less interesting, smaller counterparts such as Lolomaki and Nagashi Bikin. Countless archaeological and dendrochronological expeditions have penetrated into this rugged country in quest of the prehistoric remains that it harbors in such abundance. As a consequence, the archaeology of this area is well known in general, but not in detail. Equally extensive work in nearby areas has served to define the Kayenta Branch of the Anasazi Tradition and to place the Tsegi--Marsh Pass material into the broader context of this conceptual category. Neither the history nor the content of Tsegi Canyon archaeology and dendrochronology can be divorced from those of the Kayenta Branch as a whole.

ARCHAEOLOGY

The first recorded observation of prehistoric remains in this region were made in 1859 by Captain J. G. Walker of the United States

3rd Infantry operating out of Fort Defiance, New Mexico Territory (Bailey 1964b). Captain Walker commanded two reconnaissance expeditions sent out to gather information on the whereabouts, hiding places, and mood of the Navajos, in preparation for a possible punitive war against them. His second expedition, in September 1859, was the Army's first penetration of the hitherto unknown area west of the Chinle and north of the Moqui Trail from Fort Defiance to the Hopi villages. Walker's command crossed Black Mesa, descended into Long House Valley, passed through Marsh Pass, and returned to Fort Defiance by way of Canyon de Chelly. Camp the night of September 12, 1859, was made at the large surface ruin now called Long House (Fig. 1). Walker's report on the expedition stresses the ruin's similarity to other sites he had observed in the region (Bailey 1964b: 84).

The Marsh Pass region practically disappears from written history for the next 35 years. Despite statements to the contrary (Hargrave 1935a: 8), there is no evidence that Kit Carson's activities in rounding up Navajos for transfer to Fort Sumner in 1863 and 1864 ever brought him this far west. Carson restricted his efforts along this line to Canyon de Chelly (Sabin 1914; Estergreen 1962; Bailey 1964a). A few immigrant trains may have passed through Marsh Pass after 1880 (Gillmor and Wetherill 1953: 14-15; Crampton 1962: 1), but they left no record of observation of prehistoric remains. Prospectors, in their never-ending quest for gold, roamed the countryside in the last three decades of the 19th century (Crampton 1960: 73-6) and undoubtedly discovered a wealth of archaeological material. Since most

of their activity is shrouded in anonymity, no record was ever made of such archaeological "discoveries."

As in so many other areas in the plateau Southwest, the archaeological resources of the Marsh Pass region were first made known through the explorations of the Wetherill brothers of Mancos, Colorado. Beginning in the 1890's, Richard, Alfred, John, Clayton, and Win Wetherill, and Charlie Mason ranged deep into virtually unknown country. John Wetherill claims to have visited the Tsegi as early as 1893 (Guernsey 1931: 3). In 1895 and 1897 Richard Wetherill led two expeditions into the area, both of which concentrated on Kiet Siel (McNitt 1957: 78-84, 153-63). In 1906 John Wetherill and Clyde Colville established a trading post at Oljato, the first permanent Anglo habitation south of the San Juan River and north of Ganado or Tuba City. In 1910 they moved to Kayenta and founded the trading post which for 30 years served as a jumping-off point and supply station for numerous archaeological explorations throughout the entire region.

During the first decade of the 20th century, Byron Cummings of the University of Utah had been engaged in exploring southern Utah for archaeological sites. In the summer of 1908, after digging at Alkali Ridge, he moved south, crossed the San Juan, and initiated a 25-year period of extensive exploration and excavation in the Kayenta district. From 1908 until 1930, with few interruptions, Cummings made trip after trip for the University of Utah and, after 1915, for the University of Arizona into the canyons and mesas of this rugged land. Although his focus of interest was on the more spectacular late sites, he recognized as early as 1909 that older material underlay the later

remains (Judd 1950: 23-4). He dug in many early sites, notably the large Basketmaker III village at Juniper Cove.

Cummings' pioneering activities paved the way for other archaeological investigations into this still wide-open region. J. Walter Fewkes visited the area in 1909 or 1910 or both (Fewkes 1911). His report, along with recommendations by W. B. Douglass, Examiner of Surveys, United States Land Office, resulted in the 1912 proclamation of President Taft that established Navajo National Monument.

From 1914 to 1917 and from 1920 to 1923 parties from the Peabody Museum at Harvard University, under the direction of Alfred V. Kidder and Samuel J. Guernsey, operated out of Kayenta with Clayton Wetherill as guide (Kidder and Guernsey 1919; Guernsey and Kidder 1921; Guernsey 1931). Their work in later ruins---the small cliff dwellings in Monument Valley, the South Comb, and near Marsh Pass; and the large ruin of Poncho House on the Chinle---complemented Cummings' work. Their chief contribution, however, lay in their work on older material. They discovered Basketmaker II remains that enabled them to propound the classic definition of this early cultural stage. Material unearthed in Tsegi Canyon provided the basis for the definition of the content of the Basketmaker III period.

The decade after 1923 was a period of relative inactivity in the Kayenta area. Cummings continued his explorations and limited excavations throughout the Kayenta region (Turner 1962: 4). The Bernheimer Expeditions of 1921 (Morris 1922) and 1926 passed through the Tsegi but concentrated on the Navajo Mountain area. About the

same time, the Los Angeles County Museum, the University Museum of the University of Pennsylvania, and the Public Museum of the City of Milwaukee (West 1927) were briefly active near Navajo Mountain and in Navajo Canyon. Noel Morss undertook surveys of the middle Chinle Valley in 1925 (Morss 1927) and of White Mesa in 1927 (Morss 1931) for the Peabody Museum at Harvard University. Gila Pueblo surveyed in the Navajo Mountain--Marsh Pass region and sunk a stratigraphic test into the trash mound at Turkey Cave in the Tsegi (Hargrave 1935a: 17). Most of this work was focused away from the Tsegi itself, but is of primary importance in providing comparative material from Kayenta Branch sites across a wide area.

One of the most ambitious scientific projects of the century was begun in this area in 1933. This was the Rainbow Bridge--Monument Valley Expedition, whose purpose was a complete scientific study of the region lying between the Colorado River and the Chinle Valley (Hall 1933). The research included archaeology, ethnology, botany, zoology, entomology, geology, paleontology, topographic mapping, and aerial photography. The results were to be integrated into a single analysis intended to provide a basis for assessing the potential of the region as a national park and to lay a foundation for the future administration of the area.

Archaeological parties of the Rainbow Bridge--Monument Valley Expedition were in the field from 1933 through 1938. This was the most ambitious and massive archaeological effort in the Southwest up to that time. On occasion, as many as five parties were in the field at once, and the total number of people engaged in archaeological work.

ranged from 30 to 70 (Beals, Brainerd, and Smith 1945: 7). Survey parties ranged far afield: through the canyons of the San Juan and Colorado Rivers, into the Monument Valley and Navajo Mountain areas, and upon Black Mesa and the Kaiparowitz Plateau. Excavation, however, was concentrated near Kayenta and Marsh Pass, with Tsegi Canyon a primary focus of attention.

In 1933 a survey party directed by Lyndon L. Hargrave of the Museum of Northern Arizona passed up the Tsegi from Marsh Pass, traversed the length of Dogoszhi Biko, gained the top of Skeleton Mesa, and proceeded on to Navajo Mountain, recording many sites along the way (Hargrave 1935a). Hargrave again took the field in 1934 and concentrated on a small tributary of Dogoszhi Biko called Waterlily Canyon. In this area Hargrave's party investigated Twin Caves Pueblo; a Pueblo II surface masonry site; a group of brush shelters; a number of Basketmaker II burials; and Horned Owl or Woodchuck Cave, a Basketmaker II burial site (Hargrave 1935b; Lockett and Hargrave 1953). In addition, they excavated Lenaki, a small but important late Pueblo II cliff dwelling near the head of Dogoszhi Biko (Hargrave 1935b).

The Expedition was reorganized in 1935 (Beals, Brainerd, and Smith 1945: 5-7). Direction of the project was assumed by Charles D. Winning, who established a large base camp at Marsh Pass. An intensive survey of Tsegi Canyon was launched, which that year covered an area three miles on either side of the survey camp at Peach Springs. In addition, excavations were undertaken in RB-564 near Marsh Pass and RB-568, a burial ground on Parrish Creek (Kaycuddie Wash). In 1936 the survey of Tsegi Canyon was continued downstream to the mouth of

Cobra Head Canyon. Excavations were continued in RB-568 and begun at RB-551 on Black Mesa. In 1937 the survey of the Tsegi from Cobra Head to a point two miles above Marsh Pass was completed. Excavations continued at RB-568 and RB-551, and RB-1006 in Cobra Head Canyon was dug. In 1938, RB-1006 and RB-1008 were excavated, and more work was accomplished on RB-568.

One of the major contributions of the Rainbow Bridge--Monument Valley Expedition was the detailed mapping of parts of the Tsegi system. This map was published by Beals, Brainerd, and Smith (1945, Map 1) and remains the only good detailed map of this large area.

Other contributions of the Expedition were the excavation of early sites and later burial grounds and the detailed analysis of Kayenta Branch ceramics. No work was done in Tsegi Phase sites, but the older material helps fill a void in our knowledge of the period just prior to the Tsegi Phase.

In 1933 and 1934, a CWA project directed by Irwin Hayden worked in and around the Tsegi. During the winter of 1933-34 this group excavated and stabilized Kiet Siel.

After the demise of the Rainbow Bridge--Monument Valley Expedition, a deep archaeological silence fell over the canyon as Southwesternists turned their attention to different problems. First, World War II, and then, with the renewed post-war activity, Mogollon sites far to the south occupied the attention of archaeologists. The Pueblo Ecology Study briefly touched ground here in 1949, but did not linger (Taylor 1958: 3). No major archaeological excavations were to be undertaken in the Tsegi until 25 years later.

In the meantime other areas occupied by Kayenta Anasazi began to receive more attention, principally through the impetus of salvage archaeology. Work on the Four Corners Pipeline across northern Arizona first disclosed the presence in the Klethla Valley of Pueblo III pit-houses contemporaneous with large surface masonry pueblos (Bliss 1960). Later highway salvage in the same area confirmed and helped further define this hitherto unknown residence pattern (Lindsay and Ambler 1963: 88-9). A survey of Monument Valley undertaken at the request of the Navajo Tribe will, when published, greatly augment our knowledge of the Kayenta occupation of that desolate but awesomely beautiful area.

By far the greatest post-war contribution to Kayenta Branch archaeology has been the Upper Colorado River Basin Salvage Programs of the Museum of Northern Arizona and of the University of Utah in the area flooded by the waters of Glen Canyon Dam. The tremendous amount of work accomplished in the canyons and uplands flanking the rivers illuminates many aspects of Kayenta Anasazi prehistory, including the geographic boundaries of Kayenta influence, trade routes, settlement patterns, and ceramics (Lindsay and Ambler 1963: 88; Jennings 1966). Unlike much earlier work, the Glen Canyon Salvage projects have produced a number of excellent publications (Adams 1960; Adams and Adams 1959; Adams, Lindsay, and Turner 1961; Lindsay 1961; Ambler, Lindsay, and Stein 1964; Fowler, Gunnerson, Jennings, Lister, Suhm, and Weller 1959; Lipe 1960; Lister 1959; Lister, Ambler, and Lister 1960; Lister and Lister 1961; Sharrock, Dibble, and Anderson 1961). These publications provide a large and still growing literature on the Kayenta Anasazi which is pertinent and extremely important to

any consideration of the Tsegi Phase. This body of data provides much of the framework within which Tsegi Canyon archaeology must be interpreted.

It was not until the 1960's that archaeological excavation was resumed in the Tsegi itself, after a hiatus of 25 years. In 1963 David A. Breternitz of the University of Colorado sunk two stratigraphic test pits, 8 and 11 feet deep, into the great trash mound in Turkey Cave (Breternitz 1964). In 1964 and 1965 Keith M. Anderson, Archaeologist at Navajo National Monument, undertook stratigraphic excavations in the shallow trash at Betatakin and the deeper refuse of Kiet Siel. Anderson has also studied several collections made previously in the Tsegi, including those of Cummings housed at the University of Utah, and the Monument's own collection of material from Kiet Siel assembled by the CWA project of 1933-34. Hopefully, the recent rebirth of interest in Tsegi Canyon archaeology can be sustained and developed into a disciplined attack on the many problems that remain unsolved. Taylor's (1958: 3, 14-15) pessimism notwithstanding, much significant material yet remains in this storied area that has already received more than 100 years of archaeological attention.

Regrettably, most of the work done in the Tsegi remains unpublished. McNitt (1957) is the best source of information about Richard Wetherill's work in the 1890's. John Wetherill has described the events leading up to and following the discoveries of Kiet Siel (Wetherill 1935, 1955a) and Betatakin (Wetherill 1955b). Scattered articles by Cummings (1910, 1915, 1953) include some miscellaneous data on Tsegi Canyon sites and some of his conclusions from these

data, but no excavation reports on any of these sites have appeared. Preliminary drafts of a report on Betatakin are on file at the Arizona Pioneers' Historical Society in Tucson, and some of his field notes are housed at the Pioneers' Historical Society and the Arizona State Museum.

J. W. Fewkes (1911) produced a short account of his visit to "Navajo National Monument," which includes sketchy descriptions of many Tsegi Phase sites and more detailed treatment of Betatakin and Kiet Siel. For a number of reasons this report is of limited value (Hargrave 1935a: 16). Judd's (1930) work on Betatakin is the only site report on a Tsegi Phase ruin. Considering that it is based on work done eight years after the site was excavated, Judd produced an admirable piece of work which still stands as the definitive report on a Tsegi Phase site. Perhaps the most thoroughly published work in the Marsh Pass--Tsegi area is that of the Peabody Museum, Harvard University, between 1914 and 1923 (Kidder and Guernsey 1919; Guernsey and Kidder 1921; Guernsey 1931). These works provide a large share of the data on which much of our knowledge of the Kayenta Branch is based.

The ambitious Rainbow Bridge--Monument Valley Expedition performed poorly when it came to publication of the research. The 1933 survey report of Hargrave (1935a) is the best description of the major Tsegi Phase sites in Dogoszhi Biko. The work of the 1934 season has been partially published in two brief articles by Hargrave (1934; 1935b) and a report on the excavation of Woodchuck Cave (Lockett and Hargrave 1953). The magnum opus of the Rainbow Bridge--Monument Valley Expedition is the work by Beals, Brainerd, and Smith

(1945). This is the first study of Tsegi Canyon archaeology to use modern techniques of ceramic analysis as the basis for spatial, temporal, and cultural interpretations.

This brief list nearly exhausts the supply of published works on Tsegi Canyon archaeology. It is a sad commentary on the history of archaeology in the Tsegi that an area long considered a major focus of the Kayenta development has not produced a single, complete report on any of the many important sites which have been excavated. To provide a framework for studies in this area, one must turn to the recent work of the Upper Colorado River Basin Salvage Program in the Navajo Mountain--Glen Canyon area far to the northwest.

The collections made by the numerous expeditions into the Tsegi are scattered and in many cases lost. Much of the material gathered by the Wetherills is at the American Museum of Natural History in New York, although some of it has been lost. Cummings' collections are widely scattered. Most of the material collected prior to 1915 is at the University of Utah, while that collected after 1915 is at the Arizona State Museum, the University of Arizona. Some of Cummings' material may be at the United States National Museum (Judd 1930: 65), which also has Judd's 1917 collection from Betatakin and Fewkes' material from "Navajo National Monument" (Fewkes 1911: 26). The collections of Kidder and Guernsey are at the Peabody Museum of American Archaeology and Ethnology, Harvard University. The vast collections of the Rainbow Bridge--Monument Valley Expedition are so badly scattered and mixed that they are practically worthless (Adams 1960: 9).

The extensive Wetherill and Cummings collections, insofar as they can be recovered, afford numerous opportunities for future research. Instead of taking to the field, the student will have to venture into the depths of museum storage rooms and re-excavate this material from long-sealed packing crates and dusty shelves. Studies of these collections, when integrated with our present knowledge of the sites from which they came, would add greatly to our knowledge of Kayenta Anasazi technology and culture. Anderson's restudy of the Cummings and Kiet Siel collections is an important step in this direction.

Despite the inadequacy of published data on Tsegi Phase archaeology, some information about these sites has filtered into the oral tradition of Southwestern archaeology, and the impression that a great deal is known about them is widespread. This general fund of unpublished information has formed part of the basis for several syntheses of the archaeology of the area. The syntheses are based primarily on geographic location, settlement pattern, architectural characteristics, and pottery.

The first of these syntheses was that of Kidder (1924). This work established the basic framework for Tsegi Canyon archaeology, and subsequent syntheses modified and expanded, but did not substantially alter, Kidder's analysis. In his classificatory scheme, sites now assigned to the Tsegi Phase were placed in the Pueblo Period of the Kayenta Culture, which, in turn, was considered to be a separable cultural entity within the San Juan culture area (Kidder 1924: 68-72). No estimate of the time range of this period was offered. The Pecos

Classification of 1927 was a refinement and elaboration of Kidder's original scheme and was intended to apply throughout the Southwest (Kidder 1927). Tsegi Phase sites fall neatly into the Pueblo III Period of this classification. Dates were not assigned to any of the periods.

In 1934 Harold S. Gladwin of Gila Pueblo introduced a new classificatory scheme based on analogy with the phylogenetic taxonomic system used in the biological sciences (Gladwin and Gladwin 1934). His scheme included the concepts of Root, Stem, Branch, and Phase which were intended to reflect the spatial, temporal, and "genetic" relationships among various assemblages of archaeological material. Gladwin's classification included a "Sagi" Phase of the Kayenta Branch of the San Juan Stem of the Basketmaker Root. To Gladwin, then, goes the honor of first defining a "Sagi" Phase which included the same sites as the unit that is now called the Tsegi Phase. To his Sagi Phase he assigned dates of about 1250 to 1300, based largely on tree-ring dates from Betatakin and Kiet Siel (Gladwin and Gladwin 1934: 27, Fig. 7). Some aspects of Gladwin's scheme have not survived the test of time, and only the concepts of Branch and Phase are widely used at present.

The most recent and most widely accepted synthesis is that of Colton (1939). His scheme shares several features with that of Gladwin, and some of Colton's divisions have been likewise ignored; however, the more specific categories of the system have been retained. One of these categories is the Tsegi Focus, hereafter referred to as the Tsegi Phase in compliance with contemporary terminology. Colton

is responsible for the definition of the Tsegi Phase as it is recognized today---a subject to be taken up in the next chapter.

DENDROCHRONOLOGY

The first collection of tree-ring specimens from a Tsegi Phase site was made in 1920 when Byron Cummings extracted cores from three beams at Kiet Siel. Subsequently, Tsegi Phase sites played an important role in A. E. Douglass' development of a tree-ring chronology for the northern Southwest. Intensive dendrochronological work in Tsegi Canyon was initiated in August of 1927 when Douglass collected a number of samples from Betatakin, Kiet Siel, and Turkey Cave. Several of the specimens from Betatakin and Kiet Siel were immediately crossdated with a floating chronology based on material from Wupatki, the Citadel, Mummy Cave, and sites on the Mesa Verde (Douglass 1929: 750; 1935: 21-2). A few months later, in February 1928, the so-called Citadel Chronology was linked with another prehistoric sequence derived from Pueblo Bonito and the Aztec ruin. This yielded a prehistoric floating chronology of more than 580 years. Pueblo Bonito was the earliest site in the sequence, Kiet Siel and Betatakin the latest. All that remained was to tie the relative chronology to the dated chronology that extended back to A.D. 1260. The earliest sites in this dated sequence were Kawaikuh and Kokopnyama on Antelope Mesa. Sites with a ceramic complex transitional between the assemblages of the latest "floating" sites and the earliest dated sites were suggested as likely spots to search for material that might bridge the gap between the two chronologies. In 1929 the Third Beam

Expedition was mounted to investigate four such sites---Kin Tiel, Kokopnyama, the Showlow ruin, and the Pinedale ruin (Haury and Hargrave 1931). Excavations at the Showlow ruin produced the famed specimen HH-39 which conclusively joined the two chronologies and made possible the most accurate prehistoric chronology in the world (Douglass 1929, 1935; Haury 1962). As a result of this dramatic achievement, Douglass and his colleagues were able to assign absolute dates to many major Southwestern sites, including Betatakin and Kiet Siel.

The Rainbow Bridge--Monument Valley Expedition made important additions to the tree-ring collections from the Kayenta area. Specimens were collected from both surveyed and excavated sites. None of the excavated sites---RB-551, RB-568, or RB-1006---were of the Tsegi Phase. The bulk of the Expedition's Tsegi Phase material was gathered by Hargrave in 1933 and 1934. During this period he collected from Kiet Siel, Lolomaki, Twin Caves Pueblo, Swallow's Nest, NA-2606, NA-2509, NA-2543, and Calamity Cave. All have at least Tsegi Phase components, although not all yielded dates.

Even after the virtual cessation of archaeological research there, the Tsegi continued to draw the attention of dendrochronologists. About 1936 an unknown party collected a few specimens from Betatakin and Kiet Siel for the Museum of Northern Arizona. In 1941 Deric O'Bryan of Gila Pueblo collected cores from Betatakin, Kiet Siel, and Scaffold House. Edmund Schulman, in the course of his indefatigable chronology-building activities, did not neglect the Tsegi. In 1947 he visited Navajo National Monument and obtained increment cores from several trees growing in a cove directly across the canyon from

Betatakin. Combining the chronologies of the modern trees with those of archaeological samples from Betatakin, Kiet Siet, and Lenaki, Schulman derived a standardized chronology for the area which extended from A.D. 698 through A.D. 1946 (Schulman 1948). This chronology is admirably suited for dating work throughout the Tsegi, for it is based on specimens which represent different localities and several different species, including Douglas-fir, juniper, and white fir.

Tree-ring dates from the Tsegi have been published in a number of places. One result of this multiple publication is much duplication which has caused some confusion and misinterpretation. Douglass published Tsegi Canyon dates twice (1935, 1938) and McGregor, four times (1934, 1936a, 1936b, 1938). More recently, Smiley (1951) republished and summarized all the dates from the Southwest, including, of course, those from the Tsegi. Gladwin (1957: 277) lists Gila Pueblo dates from the canyon. Breternitz (1963) includes Tsegi Canyon dates in his chronological analysis of Southwestern ceramic styles. Despite extensive publication, the dates are few in number and difficult to interpret because of poor provenience controls.

It can be seen from the foregoing that, although some dendrochronological work has been done in the Tsegi, much more remains to be done. The purpose of this report is to present the results of three summers' dendrochronological field work in this area which was intended to augment and clarify previous work and to provide a firmer foundation for temporal and cultural interpretations. This work had as its beginning what might be called the Betatakin Dating Project of 1962.

The Betatakin Project originated in a series of informal discussions involving several people. The theoretical considerations that underlay the project were developed during several conversations I had with Bryant Bannister of the Laboratory of Tree-Ring Research. These discussions centered on the ways in which tree-ring dates had previously been used in the Southwest and other ways in which they might possibly be used in the future. It seemed evident that, because of many uncontrollable factors, the full promise of tree-ring dating as an ultra-refined chronological tool had rarely been realized. Nevertheless, it seemed possible, at least in theory, to come closer to realizing this potential than had been done in the past. Our feeling was that refined, closely controlled analyses would have both temporal and cultural significance. As a result, our discussions developed along lines similar to some of those outlined in the discussion of problem in Chapter 2.

With this theoretical background in mind, the next problem was to come up with a site at which the theory could be tested. In the summer of 1960, Bannister visited Navajo National Monument and came away impressed with the promise Betatakin offered for the type of analyses that we had envisioned. Later that same year Bannister discussed the situation with Erik K. Reed and R. Gordon Vivian of the National Park Service, both of whom were favorably disposed toward an intensive chronological analysis of Betatakin. These discussions also brought out a number of factors which made Betatakin a promising candidate for this type of study. For one thing, the size of the ruin guaranteed a great number of specimens. Its size also suggested that

it was built over a period of years and might thus provide a broad range of dates rather than a single cluster. Another factor in its favor was its relative accessibility, which meant that elaborate and costly provisions for reaching the site were not necessary.

A telling point in the decision to attempt such a study at Betatakin was the inadequacy of the previous dating of the site. The most obvious limitation of the Betatakin dating was the small number of dates from a site so large and of such archaeological importance. Although for 25 years the dating had been accepted at face value, 13 dates could not be considered sufficient for adequate interpretation of the site. While it was possible that these few dates accurately covered the building period of the site, it was equally possible that they did not. The fact that most of the dates came from timbers lying loose about the cave and in the talus did not increase the probability of the dates being truly representative. Thus, ample opportunity remained to expand and complete the dating of Betatakin begun by Douglass in 1927.

A possible tree-ring dating project was devised for Betatakin which had a two-fold goal: first, to complete the dating of the site by collecting specimens from all beams still in the ruin; and second, to test the hypothesis that carefully controlled tree-ring evidence, when combined with other types of archaeological evidence, could aid greatly in the archaeologists' comprehension and interpretation of the culture of the site's inhabitants in the manner outlined in Chapter 2.

Once the concept of the proposed study had been worked out in detail, it was presented to the Southwest Region, National Park Service, for consideration. The Southwest Region very generously provided financial support without which the project would not have been possible. Thus, a theoretical exercise became an actuality.

It was with a great deal of anticipation, then, that I took the field in the summer of 1962. Two months were spent at Betatakin, where every beam greater than two inches in diameter was sampled. The rest of the field season was spent surveying the canyons to locate other sites suitable for collection. Additional tree-ring material was collected from Scaffold House and Kiet Siel. Results of analysis of the Betatakin collection the following winter proved to be so good that it was decided to mount a second collecting expedition to the Tsegi. This decision led to the Kiet Siel Dating Project.

Kiet Siel possessed the same virtues for intensive dating analysis as did Betatakin. In fact, it appeared to be even more promising; preservation was more complete and the site was larger, a fact which presented the prospect of an even larger collection and more dates upon which to base the analysis. Once again the Southwest Region, National Park Service, provided financial support for the field and laboratory work.

Two and one-half months were spent in sampling Kiet Siel and other sites in Kiet Siel Canyon, such as Turkey Cave, Turkey House, NA-8435, and NA-8624. A brief survey trip was made up Dogoszhi Biko, where specimens were collected from Nagashi Bikin and Batwoman House. A second collecting trip was made to Scaffold House. Long House, a

large pueblo in Long House Valley, was also sampled. Analysis of the collections during the following winter produced a large number of dates, especially from Kiet Siel.

In the summer of 1964 a third trip was made to the Tsegi. John W. Hannah of the Laboratory of Tree-Ring Research and I comprised the field party. Our objective was not so much the collection of tree-ring samples as it was the documentation of the sites from which collections had already been made. Many of these sites had not been accurately mapped, and only a few were represented in museums by adequate sherd collections. Ground plans were made of Nagashi Bikin, Batwoman House, Lolomaki, NA-7251, Swallow's Nest, Scaffold House, NA-8435, NA-8624, and Long House. This work was accomplished under a grant from the Arizona State Museum, the University of Arizona, Tucson.

The previous 100 years of archaeological work and 40 years of dendrochronological research in Tsegi Canyon provide the background to the present study. This work has made the Tsegi Phase one of the best defined and best dated phases in the Southwest. The full implications of this statement are brought out in the following section of this report.

CHAPTER 5. THE ARCHAEOLOGY OF THE TSEGI PHASE

An extended discussion of the archaeological content of the Tsegi Phase is necessary for a number of compelling reasons. First, the lack of published reports has left a large gap in our knowledge of the phase. Judd's (1930) volume on Betatakin is the only such report, and it is far from complete. It is necessary, then, to at least partially fill in some of the details of this phase, if only for the archaeological record. Second, tree-ring dates are of only limited value unless they can be related to specific features of the archaeology. This cannot be done in the present state of Tsegi Canyon archaeology, for simply not enough data on any of the sites has been published to make it possible. Third, recent developments in Kayenta Branch archaeology and new trends in the science of archaeology demand a reappraisal of our knowledge of Tsegi Canyon prehistory.

Despite the fundamental need for more data on the Tsegi Phase, this is not the place for an exhaustive analysis of every facet of the phase. Therefore, only those selected aspects of the phase which relate most closely to the problem orientations of this study are emphasized. Settlement pattern and architecture can be most directly related to tree-ring dates and receive considerable attention. Ceramics, because of their value in dating and as phase determinants, are considered at some length. Other criteria, such as non-ceramic material culture, technology, and burial patterns, are considered only insofar as they are germane to the purposes of this paper.

DEFINITION OF THE PHASE

Gladwin and Gladwin (1934) can be credited with coining the term "Sagi Phase" as applied to the late Pueblo III occupation of the Kayenta area. However, it remained for Harold S. Colton to precisely define the archaeological criteria by which this particular taxonomic unit is recognized (Colton 1939: 58-9). His Tsegi Focus was the final such unit in a series of six foci which comprised the Kayenta Branch of the Anasazi Root (Colton 1939: 51-9). These units compartmentalized the sequence of development from Basketmaker II through Pueblo III within the Kayenta Anasazi area. It is not my intention to discuss any of the earlier phases of this sequence, except to remark that recent work indicates that some modifications must be made in Colton's system, especially with regard to the temporal limits of each phase.

Colton (1939: 58, Fig. 11) restricts the geographical range of the Tsegi Phase to Tsegi Canyon and surrounding areas. For reasons discussed in Chapter 1 I adhere to these limits, even though some argument could be made for including contemporaneous Kayenta Branch sites as far away as Navajo Mountain. In this paper the spatial distribution of the Tsegi Phase is considered to include the canyon itself, the mesa tops on either side of the canyon, Marsh Pass, Long House Valley, and the valley of Laguna Creek as far east as Kayenta. Personal observation has shown that sites which conform to the definition of this phase do actually occur in these areas.

Colton is inconsistent in the dates that he assigns to the phase. In one instance (Colton 1939: 58) he gives a range of 1250 to 1300. The beginning date of 1250, however, produces a gap of

50 years in his sequence, for the preceding Klethla Phase is given a terminal date of 1200 (Colton 1939: 58). In another place (Colton 1939: 14, Table II), he gives dates of 1200 to 1300, thus closing the gap. The work reported here clarifies this situation by more precisely defining the temporal limits of the Tsegi Phase.

Colton (1939: 59) lists the following traits as determinants of the Tsegi Phase:

Indigenous pottery: Kiet Siet Gray, Tsegi Orange, Tsegi Red-on-orange, Tsegi Polychrome, Dogoszhi Polychrome, Kayenta Polychrome, Kayenta Black-on-white, Tusayan Black-on-white.

Architecture: Large cliff pueblos; circular and rectangular kivas.

Non-ceramic material culture: grooved metate, two-hand mano, full grooved ax, digging stick, bow and arrow, loom.

Cultivated plants: cotton, corn, beans, pumpkin.

Domesticated animals: dog, turkey.

Disposal of dead: inhumation, flexed.

Physical type: brachycephalic, deformed.

This list of traits is not so impressive as it may appear. No studies of non-ceramic artifacts, foodstuffs, disposal of the dead, or physical type have been made for any Tsegi Phase site. In any event, these traits are of minor importance in defining the phase; settlement pattern, architecture, and ceramic assemblage are the only features which differentiate the Tsegi Phase from the preceding Klethla Phase (Colton 1939: 58).

Colton's definition of the Tsegi Phase is basically sound and stands the test of further work well. The necessary modification in

this construct are apparent in the following discussion of the archaeological content of the phase.

ARCHAEOLOGICAL CONTENT OF THE PHASE

SETTLEMENT PATTERN

The Tsegi Phase settlement pattern is more complex than might be expected from the results of previous work in the Kayenta area--- work which was concentrated on the well preserved cliff dwellings. It is quite true that all the large villages in the Tsegi are found in caves or on ledges at the foot of overhanging cliffs. The pattern of cave utilization is an old one in the Kayenta Branch. It began at least as early as the Basketmaker II period, as exemplified by sites such as White Dog Cave (Guernsey and Kidder 1921) and Woodchuck Cave (Lockett and Hargrave 1953). The use of caves as alternatives to settlement in the open continued throughout the subsequent history of the area. Some caves, such as Turkey Cave (Guernsey 1931: 57-60; Breternitz 1964: 22) were apparently occupied throughout the entire period of Kayenta Branch history. However ancient and persistent the Kayenta utilization of caves might be, it is inaccurate to impute too much importance to this pattern, as Gladwin (1957: 219-20) has done. It is extremely unlikely that the number of Kayenta people living in cliff shelters ever exceeded the number living in open sites, even during late Pueblo III times when most of the Tsegi Canyon population was concentrated in a relatively few cliff sites.

Even in the restricted area encompassed by the Tsegi Phase there are a number of open sites. Some of these are quite large.

Long House in Long House Valley, Marsh Pass 7:4 east of the pass, and a site near Kayenta range in size from 50 to 100 rooms. All these large sites---open or sheltered---have one important characteristic in common: they are located on eminences raised above the surrounding countryside. The three open sites mentioned all occupy rock outcrops or ridges overlooking the valley floor. In this regard they exhibit a definite tendency to avoid the alluvium (Fig. 5). The reasons for this are not known. However, if a period of active stripping and sheet erosion had set in by this time (Cooley 1962), the alluvial flats would have been a precarious and uncomfortable place to live. Or the villagers may have wanted to preserve the alluvium for farming. Whatever the reasons, the preference for building on rocky eminences above the alluvium is a definite part of the Tsegi Phase settlement pattern. Figure 5 illustrates the results of this preference at Long House and at a site near Kayenta.

In addition to the larger open sites, there are many smaller ones. A few scattered architectural sites with a Tsegi Phase ceramic assemblage occur throughout the canyon. Such sites can account for only a very small percentage of the total population. A great many open sites of the period consist only of a scatter of sherds across a sand dune or alluvial terrace, with no evidence of associated structures. These may represent camp sites or spots from which people kept watch over their fields. Adams (1951: 61-3) suggests a pattern of winter residence in the sheltered cliff villages and summer residence in small farm houses and larger, but temporary, communities near the fields. This hypothesis deserves testing, although it seems

a

b

Fig. 5. Representative Tsegi Phase surface pueblos. In their locations on rocky eminences near the junctures of two streams, both of these sites exemplify the Tsegi Phase settlement pattern. a, Long House; b, the Parrish Creek Site, which consists of a number of rooms pecked into the rock of the large Navajo sandstone erosional remnant.

unlikely that the larger open sites were occupied only seasonally. The Tsegi Phase population seems to have been divided between open and sheltered communities ranging in size from small, isolated units to large villages of up to 150 persons. Within the confines of Tsegi Canyon only the cliff shelter type of village is found. Despite the abundance of high ground overlooking the alluvial terraces, no large open sites occur.

Figure 1 illustrates the fact that nearly all the Tsegi Phase sites are located in tributaries of the major canyons rather than in the main canyons themselves. This pattern of residence is related to a number of geographical and environmental factors.

Location in the side canyons puts the villages near the junction of at least one, and sometimes several, tributary canyons with a main stem channel. These juncture areas provide the best farming areas within the Tsegi Canyon system. There are two reasons for this. First, there is much more farm land in these areas than in stretches of the canyon where no tributaries breach the confining walls of the narrow gorge. Figure 2 illustrates this phenomenon at the Confluence of Betatakin and Kiet Siel canyons with the main Tsegi. Second, there are as many sources of water as there are tributaries plus the main channel. Fields located along enclosed stretches of canyon could normally draw only on the water of the main stream. In effect, water from a large drainage area is channeled toward these areas by the converging streams. This situation is well suited for ground-water or flood-water farming, in that runoff from the crucial summer rains is directed to the fields. Irrigation water could be

diverted from the shorter more steeply graded tributary streams at a distance much nearer the fields than it could be obtained from the more gently graded main stream. Thus, a simpler system of canals could be constructed by using the tributaries instead of the main channel. This pattern of irrigation is found at the Beaver Creek community at the confluence of Beaver Creek with the San Juan River (Lindsay 1961). Water for irrigation was diverted from the tributary rather than from the San Juan.

There is one major exception to the generalization that the villages are located in tributary canyons. Swallow's Nest is located in a cave in the Lukachukai member of the Wingate sandstone, directly overlooking Laguna Creek. At this point the canyon widens near the confluence of three major tributary canyons.

The explanation offered above for the situation of major sites near the convergence of two or more streams does not constitute an explanation of the location of these sites in caves near the heads of the tributaries. If the use of caves can be explained, the location of sites in tributary canyons is automatically explained. The largest, deepest, and thus most suitable caves are found in the tributaries where headward erosion has had its maximum effect. Caves along the main stem canyons are generally quite shallow and lack developed floors. Compare the shallow, poorly developed cave in the upper left of Figure 3 with the deep overhang of Betatakin Cave shown in Figure 15 b.

A number of factors probably caused the Tsegi Phase people to build in the caves and shelters. First, is the general pattern of

Tsegi Phase avoidance of the alluvium and preference for homesites elevated above the floodplains. In the canyons this pattern performed a very useful, if incidental, function in that it kept large villages off the floodplain, which could then be devoted exclusively to agriculture. Usable farmland was not overabundant in the narrow Tsegi. This in itself does not explain the preference for caves, because there are innumerable ledges, ridges, and rock benches which would have suited this predilection. Second, the caves were dry and protected from the elements. They provided a ready-made roof, and many outdoor activities which might otherwise have to be suspended during a rainstorm could have been continued in the cave. Other things being equal, a cave might have been chosen over an open site because of the shelter it afforded from the elements. Third, the inhabited caves are shady and cool during the summer when the sun is high, and warm in the winter when the low sun shines into them and heat is reflected from their sandstone walls. The last two factors are incidental benefits of residence in caves, and probably would not in themselves constitute primary motivation for use of the shelters. Even in combination the three are not crucial to the habitation of caves, since these requirements could be satisfied at open sites as well.

A universal characteristic of these sites is their association with springs. Although a few have no flowing springs at present, there is good evidence that they once did. Gregory (1917: 133-4) has pointed out the causal relationship between seeps and springs and caves in the Navajo sandstone. This undoubtedly made the caves even

more suitable for habitation. It is important to note that these springs do not depend on the ground water in the alluvium. Thus, their attractiveness would have been greatly enhanced if the stripping phase of the Tsegi-Naha erosion interval had lowered the water table in the alluvium to the point where water no longer flowed permanently in the stream bed. At any rate, a spring of cool clear water was not likely to be ignored in choosing a home site.

One final reason for locating in the relatively inaccessible cave and ledge sites suggests itself. This is that they are defensive in nature (Kidder 1924: 128; Gladwin 1957: 277; Jett 1964: 291)---an interpretation favored by those who believe that the final Pueblo abandonment of the San Juan drainage was due to warfare with enemy peoples. Actually, little but their isolation and the difficulty of clambering up steep slopes of loose talus to reach them suggest a defensive function. Both these characteristics are functions of the geological processes which produced the caves and determined the locations of springs.

Little or no defensive preparations are discernible at any of these sites. The springs so vital to the welfare of the villagers are not protected by any kind of defensive structure. Often the spring is so far removed from the village that an enemy could capture and hold it with no danger to themselves, and then wait until the defenders, driven by thirst, came out to meet their fate. A reasonably circumspect enemy could approach to within a few hundred feet of some of the Tsegi Phase sites and never be seen by the villagers, who seemingly lacked

the foresight to build where they could get a good view of the approaches to their abode.

Recognizing the improbability that a group of nomads could successfully storm a large village like Pueblo Bonito or Kiet Siel, the "enemy peoples" proponents often have their nomads adopting tactics of guerilla warfare à la Mao Tse-tung. This is generally thought to involve a lightning-like raid on a Pueblo cornfield and a hasty retreat to a point of concealment where a few of the hotly pursuing villagers are dispatched from ambush (Gladwin 1957: 217-18; Jett 1964: 292). A logical concomitant of this theory is that the Pueblo people had to huddle together in large defensive villages in order to protect themselves from their rapacious and crafty foes who had a penchant for picking off farmers one by one as they tilled their fields. Thus, "farmers dependent on outlying fields would no doubt be the first to be killed or to have their fields destroyed and be forced to leave..." (Jett 1964: 292).

Unfortunately, the data from the Tsegi contradict these attractive postulations. The Tsegi Phase people displayed a perplexing nonchalance by building many of their villages completely out of sight of the supposedly threatened fields and often as far as a mile away from them. Furthermore, apparently no measures were taken to protect the fields from attack, as easy as this would be to accomplish in the narrow canyon where dispersal of fields was not possible. Finally, the isolated location of such small, defenseless sites as Lolomaki and the abundant evidence for isolated farming

"camps" away from the villages argues strongly that there was no pressing need for defense during the Tsegi Phase.

In conclusion, the evidence available indicates that the villages were built in caves and on ledges for a number of reasons related to the physical environment and to the subsistence needs and technology of the people. The presence of springs in the caves and proximity to arable land were probably vastly more important than any defensive requirements. Subsidiary advantages such as protection from the elements were probably welcomed but not critical in the decision to locate along the cliffs.

ARCHITECTURE

The Tsegi Phase builder had at his command a variety of techniques and materials. Many of these have been fully described elsewhere and need only be mentioned here; others have been less well described and merit closer scrutiny.

Several different types of material went into the construction of these villages. Chief among these are stone, clay, wood, bark, reeds, and grass. Each of these materials was used alone and in combination with the others for a variety of purposes. One constructional feature notable for its absence is the use of clay and grass, juniper bark, or corn husks to form unfired adobe "bricks." Such bricks occur in late Pueblo III sites in Navajo Canyon and, on an earlier time level, in Tsegi Canyon at Guernsey's (1931: 12) Bubbling Springs Canyon, Cave II.

Masonry

"Typical" Kayenta masonry, as it occurs in Tsegi Phase sites, is rather crude. Coursing is nonexistent at worst, half-hearted at best, and random in most cases. Tsegi Phase masons preferred thin tabular slabs of sandstone. They trimmed these slabs to size but did not formally dress them. The masonry is characterized by the predominance of mortar over stone. Small stone spalls were used profusely but not in the manner of Chaco Canyon masonry to separate rows of larger stones. Instead they were pressed rather haphazardly into the mortar (Fig. 6 a). The contrast between this type of masonry and the coursed, often banded masonry of Mesa Verde and Chaco Canyon has frequently been cited as a major difference between the Kayenta Branch and the Chaco and Mesa Verde branches (Kidder 1924, Pl. 20; McGregor 1965: 337).

Styles of masonry construction other than the so-called typical Kayenta do occur in sites of the Tsegi Phase. Figure 6 illustrates the variety that is found. Variety notwithstanding, "typical" Kayenta masonry (Fig. 6 a) predominates in all the Tsegi Phase cave villages.

Despite the crude appearance of this type of masonry, it has one distinct advantage. Because of the quantity of mortar used, walls can be "glued" to rather steeply pitched cave floors. At Betatakin Rooms 56 through 65 were built on a portion of the cave floor which is inclined at an angle approaching 60 degrees. To increase the stability of walls built on such steep slopes, the lowest course of stones was often laid in a shallow groove pecked into the bedrock. Nevertheless,

a

b

c

d

Fig. 6. Tsegi Phase masonry styles. a, "typical" masonry in Room 7 at Betatakin; b, tabular masonry in Room 30 at Scaffold House; c, massive masonry at Long House; d, "cyclopean" masonry in Kiva 9 at Guernsey's Cave 1 in Bubbling Springs Canyon.

the tenacity of the mortar undoubtedly made the construction of walls on such steep inclines possible. This may be an important reason for the use of this type of masonry in the caves, for open sites in the area---such as Long House (Kidder and Guernsey 1919: 61-3; Fewkes 1911: 10, Pl. 4)---often possess a somewhat different type of masonry characterized by larger stones, more regular coursing, less mortar, and occasional rubble coring (Fig. 6 c).

A type of masonry unique to Tsegi Canyon is found in Room 55 at Betatakin. This is a double-faced wall with a core of adobe and small sandstone spalls, quite similar to the walls of Long House. The facings of these cored walls are of the "typical" variety.

Jacal

Another trait which distinguishes Kayenta architecture from that of the Chaco and Mesa Verde is the frequent occurrence in the Kayenta of walls built by the wattle-and-daub, or jacal, technique. The techniques of jacal wall construction have not heretofore been adequately described; therefore, a discussion of these methods is presented below. Since some of the tree-ring dates come from timbers used in jacal construction, an understanding of the nature of these walls is necessary to an adequate interpretation of the dates.

The builders of the Tsegi Phase cliff pueblos employed jacal walls in a number of different ways. Usually only one wall of a room is of the jacal type, but rooms with two and even three jacal walls do occur, notably at Scaffold House. No structures with four jacal walls have been preserved.

The method of construction is uniform throughout the Tsegi (Fig. 7 a). The first step in constructing such a wall was to set several posts firmly into the ground at regular intervals along the line to be followed by the wall. Usually these posts were from $1\frac{1}{2}$ to 2 inches in diameter and long enough to reach the roof level. In instances where the doorway was to open through the wall, a post was set at each side of the proposed doorway. The necessity to sink the posts into the ground required that jacal walls be built where there was some kind of fill---either sand or trash---rather than bedrock underfoot. This requirement is an important determinant of the location of jacal-walled rooms.

Next, a single row of vertical twigs or reeds was set up between each pair of support posts. These sticks were not embedded in the ground but were anchored to the support posts by a series of paired horizontal sticks. Two sticks were placed opposite each other on either side of the wall of twigs and lashed firmly to the support posts with yucca-leaf ties. At regular intervals between each pair of support posts the horizontal withes were bound tightly together by yucca-leaf ties which passed through the wall of twigs. The twigs themselves were not tied or fastened to anything. At least four sets of horizontal withes were used per wall, the lowest being at floor level and the others set above that at intervals of 18 to 24 inches. The wall of support posts and sticks usually reached to rooftop level or higher. Often no attempt was made to trim the tops of the sticks or posts, so they projected in ragged fashion above the rooftop. The base of the wall, including the lowest pair of

a

b

Fig. 7. Jacal wall construction. a, front wall of Room 35 at Betatakin showing constructional techniques; b, front wall of Room 33 at Kiet Siet showing the finished appearance.

horizontal withes, was frequently covered with a heavy footing of clay about two inches high and three to four inches thick. Occasionally, also, a footing consisting of a single row of stones was set against the base of the jacal wall, either outside or inside the room.

Finally, both sides of the wall were covered with a thick coating of mud plaster which was rammed into the interstices among the sticks. Such walls, although they could support little weight, were completely serviceable and remarkably sturdy. Their durability is demonstrated by the good preservation of many jacal walls throughout the Tsegi (Fig. 7 b).

Roof Construction

Pueblo methods of roof construction, both prehistoric and historic, have been discussed several times in the literature. It is, therefore, hard to justify another discussion here. However, none of the previous descriptions are entirely applicable to the situation in the Tsegi. Furthermore, the tree-ring dates will be much more meaningful if it is known from what particular type of beam they come. Ferguson's (1959) discussion is the best to date, and is also the most applicable to the Tsegi Phase sites in question. Therefore, his terms will be used as a starting point from which to develop a nomenclature for the Tsegi Phase ruins.

Figure 8 is a sketch of a composite roof; that is, a roof which possesses all the different types of support observed. This sketch is similar to that of Haury (1934, Fig. 8), but several important differences may be noted.

Fig. 8. Roof construction. Structural elements and constructional techniques are indicated in the cutaway drawing of an idealized Tsegi Phase roof.

The major structural member in the roof is the primary beam (Ferguson 1959). Depending on the number of these beams, they range in diameter from 6 to 12 inches. Primary beams may run either the length or width of the room, and no preference for either alternative can be observed. These beams are often paired, especially when long distances are to be spanned. When paired they are placed butt to tip. Wherever possible, both ends of primary beams are embedded in masonry walls. The number of primary beams per room varies considerably, depending on the size of the room and on whether or not the beams are paired. A given roof may possess one to ten primary beams.

On top of and at right angles to the primary beams lies a series of lesser beams---usually from one to four inches in diameter---which are called secondary beams (Ferguson 1959). Secondary beams are rarely paired.

Ferguson (1959: 30) applies the term closing material to the roof elements which lie directly atop the secondary beams. The most common closing materials are small sticks or canes or both, one inch or less in diameter. These are laid close against one another at right angles to the secondary beams on which they rest. Often, elements of the closing material are bound to the primary beams by loops of split yucca leaf or lengths of fur- or feather-wrapped cord. The use of "boards" formed by the splitting of logs as closing material is common. "Transverse boards" such as those described by Haury (1934: 38, 39, Fig. 8) were not observed in the Tsegi.

Matting is the material used to cover the closing material and form a base for the mud seal and sand and dirt covering (Ferguson 1959: 30). Matting material normally is either grass or more commonly juniper bark. The matting was covered by a layer of mud which in turn was covered with sand.

Another type of beam in addition to those listed above can be recognized. In rooms with one wall formed by the vertical face of a natural rock ledge beams could not conveniently be set into the solid rock of the cliff face. Therefore, the builders simply added another beam, each end of which was set into the masonry walls abutting the cliff face. This beam was adjacent and parallel to the face of the rock ledge. The ends of the primary beams, which would otherwise have to be set into the rock, rested upon the extra beam, while the other ends of the primary beams were embedded in the opposite masonry wall. This additional beam is referred to as an auxiliary beam. This type of beam is an adaptation to the special requirements of building on a series of stepped ledges.

The roof figured and described above is a theoretical construct; few, if any, roofs possess all the structural members shown. Indeed, almost every conceivable variation on the basic theme does in fact occur. The most common departure from the ideal is the lack of an auxiliary beam, which was required only under particular circumstances. The next most frequent departure is the omission of primary beams in rooms of small size or in rooms which, by virtue of their locations, would receive little cross-roof traffic. In such cases it is better to think of the major beams as secondaries

rather than primaries, even though they are the most important structural members. This usage accurately reflects the relationships among the components of the roof. A few very small storage chambers lack even secondary beams, the roofs consisting only of closing material and the mud seal. Wherever possible, rooms were built so that the ceiling of low overhanging caves served as the roof of the room.

Roofing rooms that have one or more jacal walls presented the builders with problems not encountered in rooms with four masonry walls. In rooms with only one jacal wall the problems were met in one of two ways. One alternative was to set the primary beams parallel to the jacal wall with their ends embedded in opposite masonry walls, which thus bore the full weight of the roof. The jacal wall was bonded to the roof with clay.

The other method involved the placing of the primary beams perpendicular to the jacal wall with one end embedded in the opposite masonry wall. Since the wattle-and-daub wall was not strong enough to support the weight of the roof, the ends of the primaries abutting this wall were supported by large, upright posts set just inside or within the wall. A physical cause of the use of this method is present in Room 35 at Betatakin where the northwest wall is of native rock; consequently, the primary beams could have been erected parallel to the jacal wall only with difficulty. However, no such limitations apply in Rooms 27 and 41 at the same site, where both side walls are of masonry and could easily have taken the primary beams. Apparently the choice between the two methods was up to the builders, who tended to favor the first method.

Rooms with three jacal walls were roofed by setting large support posts at each of the four corners of the room. Horizontal beams connected each of these posts to form a rectangle around the periphery of the room. This rectangle served as a platform upon which the roof was constructed in the usual manner.

A word might be said about the roofing of kivas. All evidence from the Tsegi and elsewhere in the Kayenta Branch indicates that the methods of kiva roof construction differed very little from those of secular rooms. The system of primary and secondary beams, closing material, matting, and mud seal seems to have been used throughout. Generally, however, the primary beams were larger than those used in secular rooms, no doubt because of the greater distances which had to be spanned. The presence of pilasters in Tsegi Phase kivas does not necessarily indicate cribbed roof construction.

The tree-ring dates are presented in terms of this system of classifying roof members. The discussion of the dates makes clear the usefulness of this type of analysis.

Room Typology and Function

An important, and until recently neglected, aspect of Kayenta Branch archaeology is the analysis of the functions of the various structures and their associations with one another. The Glen Canyon Project of the Museum of Northern Arizona has devoted considerable attention to this problem in regard to late Pueblo III sites excavated in the vicinity of Navajo Mountain. Little attention has been paid to this problem in the Tsegi, despite the abundance of data bearing on

it. The correct identification of living rooms, storage chambers, and ceremonial rooms is necessary for adequate interpretation of the sites.

Five different kinds of room may be identified: living rooms, granaries, storerooms, ceremonial rooms, and grinding rooms. Other features of importance are courtyards, trails, and abrading areas. Each type of room and the criteria used in its identification merit detailed analysis for several reasons. First, the interpretation of the tree-ring dates is much more meaningful when the type of room from which they come is known. Second, these data constitute an increment to our knowledge of the Kayenta Branch and the Tsegi Phase. Third, the Tsegi Phase data may be compared with those from contemporaneous Kayenta sites in other areas in an effort to isolate similarities and differences across a fairly wide geographical range. Fourth, the well preserved cliff dwellings provide more data than are available from less well protected sites. The criteria developed in the following discussion apply to all the Tsegi Phase cliff dwellings. The room-feature tables for each site present the raw data upon which this analysis is based. Many of the features described here are illustrated in figures that accompany Chapters 7, 8, and 9. Exceptions to these generalizations are considered under the discussion of the appropriate site or sites.

Living Rooms

Many architectural features differentiate living rooms from other types of room. The presence of a jacal wall usually signifies a

living room. The masonry walls of living rooms are often less well made and contain fewer chinking stones and more mortar than the walls of granaries. A coat of plaster on the inside of a room usually marks a dwelling. Many living rooms also have one or more shallow niches in one or more walls.

The entrance is an excellent indicator of the function of a room. Both hatchways in the roofs and doorways in the walls are found in living rooms. Doorways are more common, but probably one-quarter of the living rooms observed have roof entrances and many have both. In every living room with a jacal wall the doorway, if any, is in the jacal wall rather than in one of the masonry walls.

The character of the doorway is also diagnostic. The sills of living room doorways---whether in masonry or jacal walls---invariably lie at or below the level of the ground outside the room. The height of the doorway is generally greater than that of storeroom doorways, and large, T-shaped doorways are found at Kiet Siel. These doorways may have been covered with a skin or cloth hanging. A negative criterion of living room doorways is the absence of the features which characterize storeroom doorways.

The floors of dwellings built on sloped surfaces are always leveled, either by adding loose fill on the downhill side, by chipping away the bedrock on the uphill side, or by both chipping and filling. Living room floors are nearly always plastered, even when they are built on solid bedrock.

Floor features are very useful indicators of a room's function. Living rooms possess the conspicuous complex of features found just

inside the doorway---a complex to which the name entrybox has been appended (Fig. 9; Jennings 1966: 59). In rooms with lateral entries, a firepit is set into the floor about two feet inside the doorway. To lessen the blast of air through the doorway, a masonry or stone slab deflector was placed at the end of the firepit nearest the door. The deflector was joined to the doorway by the entrybox. Although the entrybox concept was well defined, the form was not standardized; consequently, several variations on the basic theme occur. One form consists of two wing walls connecting each side of the deflector with the corresponding jambs of the doorway. These wing walls may be of masonry or, much more commonly, of upright slabs. In other instances only one side of the deflector is joined to the doorway, leaving one side open. In nearly every example of this type observed in the Tsegi drainage, the wing wall was to the left, leaving the right side open as one entered the room. One variation of the entrybox concept is a platform two or three inches high, which joins the doorsill to the deflector. The platform is a continuation of the level of the surface outside the room, which is normally a few inches above the level of the room's floor. The platform type entrybox often lacks wing walls of any kind. The entrybox complex is a major diagnostic trait of Kayenta Branch architecture and is found nowhere else in the Southwest.

Certain regularities in the associations of entryboxes with other architectural features were noted. In almost every instance that the doorway opens through a masonry wall, the deflector is of masonry construction, as are the wing wall or walls, when present (Fig. 9 a). In living rooms in which the doorway opens through a

a

b

Fig. 9. Entrybox complexes. a, masonry entrybox in Room 83 at Kiet Siel; b, slab entrybox in Room 15 at Scaffold House.

jacal wall the entrybox and deflector are usually constructed of upright slabs (Fig. 9 b). The platform variety of entrybox occurs only with masonry deflectors and doorways in masonry walls.

Living rooms entered solely by means of roof hatches have no entryboxes. Nevertheless, the slab-lined firepit is present, usually located one to two feet inside a small floor-level ventilator. A deflector made of an upright stone slab lies between the ventilator and the fire hearth. No wing walls connect the deflector to the wall. If the firepit does not lie near the hatch, a small, rectangular smoke hole is usually located in the roof above the hearth. Rooms with both doorways and roof hatches usually possess the entrybox complex in the form appropriate to the doorway with which they are associated.

Holes of various sorts are commonly found in living room floors. Some of these are large enough to have been used for storage, while others are too small or too shallow to have served any recognizable purpose. Since most of the rooms are built directly on the floor of the cave, these holes are ground into the bedrock.

"Benches" are another common feature of living rooms. These features should probably be considered shelves rather than benches, since they are of all sizes and occur in various parts of the rooms. Usually they are constructed so as to take advantage of the natural configuration of the bedrock upon which the room is built; consequently, there is no standard form or size.

One or two superficial characteristics are also useful in identifying living rooms. Size may be used as a criterion insofar as there are minimum dimensions below which a room becomes too small

for living purposes. These limits cannot be absolutely defined, but any room smaller than five feet square was probably not a dwelling. Another characteristic of living rooms is the smudging of the walls and ceiling by smoke from the fire. Where floor features have been destroyed, smoke-blackening is the most important indicator of a dwelling. When living rooms were converted to storage purposes, a not uncommon practice, the firepit and entrybox complex were ripped out, thus leaving the smudged walls and possibly the doorway as the only clues to the room's former function. Often a fresh coat of plaster was applied over the smoke-blackened plaster, but this is fairly easy to detect.

Granaries

The granary is a specialized storage chamber which is thought to have been used for storing foodstuffs such as corn, squashes, and beans. This function is inferred for rooms which possess several features that seem to be designed to provide maximum protection for the contents of these rooms. Another type of storage chamber which lacks these diagnostic features is inferred to have been used for the storing of material other than foodstuffs.

Granaries and other storage chambers, as opposed to dwellings or ceremonial rooms, are usually easy to identify. A primary criterion is the absence of smoke-blackening on the walls. Granaries (Fig. 10) are characterized by features designed to protect the contents of the room from the inroads of rodents, insects, and the weather; that is, designed to keep things out. The exterior masonry

a

b

Fig. 10. Typical granaries. a, Room 6 at Betatakin has grooved door jambs, door loops, a clay coping around the doorway, a plastered exterior, and footholds; b, Room 72 at Kiet Siet has grooved door jambs and an exterior platform with a step.

is often of excellent quality, usually superior to that of dwellings. The inner faces of these same walls, however, may be quite crude. When the walls of granaries are plastered, the plaster normally is applied to the outside rather than the inside of the room. Granaries with even one jacal wall are extremely rare. Wall niches and masonry shelves are rare and often indicate the previous use of the room as a dwelling. Shelves made of two or three horizontal poles, set parallel and adjacent to one another occasionally occur in granaries, and only rarely in other types of room. Rows of six- to ten-inch pegs set into one or more walls just below the level of the primary roof beams are common in granaries. Such rows of pegs are occasionally found in living rooms, also. Granary entrances take two forms: roof hatch and doorway. Both are characterized by features designed to seal them from the outside. Roof hatches are often flanked on all sides by slabs, which presumably provided a seat for another slab that sealed the hatch (Fig. 13 a).

Doorways are more common than hatches, and the features associated with them assume major importance in the identification of granaries (Fig. 10). The sill of the doorway is one to three feet above the ground, and footholds in the wall below the doorway are often necessary to provide access to the entry. In rooms which have been converted from living to storage purposes, the lower part of the original, large doorway is invariably walled up to raise the sill.

The jambs, sill, and lintel of most granary doorways are grooved to seat a stone slab door. Set into the wall on either side of the doorway are loops made of cordage or bent twigs. After the

slab was set in place, a stick was passed across it and through the loops, thus securing the slab in the doorway (Fig. 10). Hargrave (1935: 33) illustrates all these features in place at Twin Caves Pueblo. Occasionally, grooves are present with no loops, and, even more commonly, loops are found with no accompanying grooves. Either condition is adequate to indicate a granary, although these are borderline cases between the two discernible types of storage chamber.

Some granaries have a thick coping of clay around the doorway. The coping bears the impression of the stone slab with which the doorway was sealed. Apparently some granary doors were sealed with clay to further ensure the safety of the rooms' contents. This may have been done when long-term storage was anticipated. This type of seal would have been impractical if continual use was being made of the granary.

Another common feature of granaries is a small platform set just outside the doorway (Fig. 10 b). Normally, the tops of these platforms are level with the doorsill. Occasionally, the platforms possess niches like that shown in Figure 10 b, which probably served as steps to facilitate ingress and egress. The exact function of the platforms is not known. Perhaps it served as a shelf to be used while replacing the door after removing something from the room.

Granary floors are characterized by the absence of features found in living and ceremonial rooms; usually there are no floor features. If the room was built directly on bedrock, there was often no attempt to level or otherwise modify the natural rock floor, even when steep slopes were involved. If the room was built over trash, a

well made clay floor sometimes sealed off the refuse. Second story granaries usually possess thick, well made floors of clay laid on the ceiling of the room below. At Betatakin the only floors made of stone slabs were found in granaries (Judd 1930: 43-4), whereas slab floors in other types of rooms are fairly common in other Kayenta sites.

Storerrooms

Storage chambers which cannot be identified as granaries are designated as storerooms. Such rooms lack the features designed to seal the room from the outside. The absence of traits such as the raised doorsill, the grooved doorway, the with loops, the careful wall construction, and the plastering of the outside distinguish these rooms from granaries. Furthermore, such chambers often possess one or more jacal walls, none of which would constitute much of a deterrent to insects or to an industrious rodent. These rooms must have been used for the storage of non-edible materials such as household goods or ceremonial paraphernalia.

In the abstract, the two types of storage chamber---the granary and the storeroom---are quite distinct from one another. However, the arche-types represent end points on a continuum of variation. Some rooms fall near the middle of this continuum and a clear-cut assignment of them to one or the other type cannot always be made, although actual cases of this were surprisingly few. For the sake of procedural consistency, all rooms with any of the features designed to keep things out were called granaries; only those rooms with none of

the protective features were designated storerooms. Thus, if there is a bias, it is toward the granary end of the continuum.

Size is not a good criterion for the definition of either granaries or storerooms, except insofar as there are certain minimum dimensional limits below which a room could have no conceivable use other than storage. Indeed, some rooms are so small that they should more properly be regarded as cupboards. There appears to be no limit on the maximum size of storage chambers; the largest rooms in both Betatakin (Room 21) and Kiet Siel (Room 89) are granaries.

Ceremonial Rooms

The ceremonial structure identified with the Anasazi Tradition is, of course, the kiva, which attains its most specialized form in the Pueblo III sites of Chaco Canyon and Mesa Verde. These kivas possess certain distinctive architectural and associational features that serve as criteria for their identification. In sites of the Kayenta Branch, also, many kivas have been found that exhibit most of the features of their Chaco and Mesa Verde counterparts. In general, however, Kayenta kivas are characterized by a much greater degree of structural variability. At some Tsegi Phase sites, such as Betatakin and Batwoman House, the situation becomes so extreme that there are no rooms which possess enough diagnostic characteristics to be positively identified as kivas. This unusual situation has caused considerable comment and speculation on the nature and significance of ceremonial rooms in the Kayenta area. In order to lay the foundations for the subsequent identification of ceremonial chambers at each of

the sites to be considered, it is necessary to present an extended discussion of the problem at this point.

Before this problem can be approached, a set of criteria upon which a decision may be based must be developed. Watson Smith, in his "When is a Kiva?" (Smith 1952: 154-65), provides the best discussion to date of the problem of Kayenta Branch kivas. Smith summarizes the published data on kivas in the Tsegi Canyon--Marsh Pass--Chinle--Kayenta area in order to identify any regular correspondences in structural detail among these chambers and to determine, if possible, on what criteria the excavators based their assignment of ceremonial function to each structure (Smith 1952: 156-7). The "kivas" considered in his summary exhibited a bewildering variety of features, showing that there were no absolute architectural criteria by which a given structure could be positively identified as a kiva in the Western San Juan area. Furthermore, he concludes that the basic criterion used by the original investigators was the fact that the structures identified as kivas differed in some way from the other architectural units with which they were associated (Smith 1952: 161-2). Thus, Smith advances contextual uniqueness as a major criterion for the identification of ceremonial structures in the western Anasazi area.

While context may serve to isolate unusual or unique rooms, it alone does not necessarily indicate that these rooms are ceremonial. Other, more conclusive, evidence must be presented before religious functions can be ascribed to them. This evidence is to be found in the details of identifiable Tsegi Phase kivas. Fortunately, there are

a number of such kivas. My main purpose here is to describe the characteristic features of these kivas, in order to form a basis for comparison with less clear-cut structures. Because of the difficulty of isolating kivas at Betatakin and Batwoman House, both these sites are omitted from this consideration. Each is taken up in turn below. Photographs of representative kivas are included in the individual site analyses (Chapters 7, 8, and 9).

Unfortunately, very little useful information has been published on Tsegi Canyon kivas. Much of the data for this summary is based on my field work in the Tsegi, and the remainder comes from the literature. The well known variability of Kayenta Branch kivas has been so emphasized that the many regularities among such structures have been somewhat overlooked. The purpose of this discussion is to isolate similarities useful for comparative purposes. In spite of the many similarities, a "typical" or "ideal" Tsegi Phase kiva cannot be abstracted from the data; for this reason the discussion is concerned with details and frequencies of occurrence of various traits.

Fourteen definite Tsegi Phase kivas are preserved well enough to provide data for this analysis. These kivas are found at seven sites: Kiet Siel, Turkey Cave, Scaffold House, Guernsey's (1931: 4) Cave 1 in Bubbling Springs Canyon, Twin Caves Pueblo, Nagashi Bikin, and Swallow's Nest. The data on which this analysis is based are presented in the architectural tables for each site.

It is obvious that the builders strove to meet the ideal of a subterranean structure. To this end, kivas were often located in the talus slopes in front of the bedrock cave floor so that they

might be more easily excavated into the ground. Where this was not possible---for example, where the cave floor sat high above the talus accumulation---an attempt was made to give the impression of underground construction. The floors in most of the caves in this region slope sharply downward from back to front. Located as they were in the front part of the pueblo, the kivas were lower than the secular rooms behind them. In addition, fill was sometimes banked up against the back walls of kivas, forming a ground surface level with the kiva roof at least along the back wall. In one instance at Kiet Siet a kiva was constructed with a double outer wall, the space between the walls being filled with sand, thus neatly fulfilling the requirement of underground construction with a minimal expenditure of labor.

The most common shape is circular or oval, with or without an encircling bench. An interesting variation on the circular shape is found in Cave 1, Bubbling Springs Canyon (Guernsey 1931: 4, Fig. 2), where a sub-octagonal form occurs. The next most common form is the keyhole; that is, a circular or oval kiva with a recess or banquette usually located on the south or southeast side. The keyhole-shaped kiva may be restricted to the later part of the Tsegi Phase. There are no D-shaped kivas in any of these sites.

Rectangular kivas have long been attributed to the Kayenta Branch as a result of Fewkes' (1911: 14-16) misidentification of living rooms as kivas at Betatakin. Unfortunately, Fewkes' report served as a basis for most subsequent discussions of Kayenta ceremonial architecture (Kidder 1924: 69). The knotty problem of ceremonial structures at Betatakin is considered in the section of this report

dealing with that site. Therefore, the data from Betatakin are not used here. The same restrictions apply to several problematic structures at Kiet Siel and Batwoman House. Only unequivocal kivas are considered in this general discussion.

Since Fewkes' time many undoubted rectangular kivas have been discovered in all parts of the Kayenta country. Morss (1931: 12) reports a rectangular, subterranean kiva from the Navajo Canyon system. Rectangular kivas, both above and below ground, occur in surface sites near Navajo Mountain. Subterranean and above-ground rectangular kivas are reported from Calamity Cave near the head of Nakai Canyon (Adams 1951: 36), and from the Chinle drainage at Morss' Ruin 36 (Adams 1951: 49). Thus, true rectangular kivas are common in the Kayenta area. In general, the architectural features of rectangular kivas are quite similar to those of circular ones. The southerly oriented ventilator-deflector-firepit complex is usually present; benches, southern recesses, and pilasters may or may not occur.

The only unequivocal rectangular kivas in the Tsegi are two at Betatakin (Anderson 1966b). Other, more problematical, rectangular ceremonial structures occur at Kiet Siel, Batwoman House, and Nagashi Bikin.

Size varies considerably, but since no horizontal measurements were taken, nothing more can be said about these dimensions. Height, however, was found to be very uniform and very significant. Without exception, the distance from the floor to the bottom of the primary beam socket was 68 inches or more. This height contrasts with that of living room ceilings. Though no measurements were taken, it was

obvious that living room ceilings were much lower; in no dwelling was there clearance sufficient to permit one to stand upright, while in every kiva clearance was at least adequate, if not ample. The relatively great height of the ceiling seems to be the one feature which is universal in Tsegi Canyon kivas, and which sets them off from secular rooms. Additional support for this conclusion is found in Calamity Cave, where the roof of a kiva is a foot higher than that of an adjoining room (Adams 1951: 36).

Several lesser architectural features seem to be characteristic of Tsegi Phase kivas. While no single feature can be considered diagnostic, several occurring in combination provide good supporting evidence for kiva identification. The kivas that have retained all their walls were obviously entered through the roof, for no breaks occur in the walls. Roof entrances are inferred for the other, less well preserved kivas for two reasons: (1) the desire to maintain at least the impression of subterranean construction would probably require roof entrances; and (2) analogy with other kivas strongly suggests roof entry entrance. All kivas have firepits, and all kivas in which the southern section was preserved possessed the full ventilator-deflector-firepit complex. This complex differs from that of secular rooms in that it is not associated with a lateral entrance; it is much more elaborate and formalized than that found in dwellings entered through the roof; and it is invariably oriented to the south, while those in living rooms have no particular orientation.

Other, less exclusive features of kiva construction include loom anchors, wall niches, sipapu, rock-paved floors, decorated walls,

and pilasters. Loom anchors are commonly found in kivas, although they are not restricted to these structures, for they occur also in living rooms and courtyards. Small niches are often found in kivas, usually in the wall opposite the ventilator; niches also occur in dwellings. Sipapus, when they can be recognized, indicate ceremonial usage; however, not all kivas possess sipapus, and not all holes in floors are sipapus. A fairly common feature of Tsegi kivas is a stone slab floor paving, a feature not found in dwellings, although some granaries have paved floors. Kivas also possess floors of plaster and of native bed-rock. Two kivas at Kiet Siel have white painted bands on the interior walls; these are the only examples of kiva wall decoration in the Tsegi.

The method of roofing kivas did not differ from that of roofing living rooms. The partially roofed kiva at Scaffold House is constructed in this manner. Pilasters occur in only two kivas in the Tsegi: Kiva 2 at Turkey Cave and Kiva 1 at Twin Caves Pueblo. That pilasters do not necessarily indicate cribbed roof construction is shown by Morss' work in the Chinle Valley, where he found a rectangular kiva with pilasters that was roofed in the conventional Kayenta manner (Morss 1927: 32).

Comparative data on late Pueblo III Kayenta Branch kivas beyond the confines of Tsegi Canyon are abundant. Contemporaneous kivas in the area east of the canyon have been reported from Marsh Pass and Long House Valley (Kidder and Guernsey 1919: 56-61, 64-5), Comb Ridge (Kidder and Guernsey 1919: 47-54), and the Chinle Valley (Kidder and Guernsey 1919: 71-4; Guernsey 1931: 33, 53; Morss 1927:

27-32; Adams 1951: 48-51). These kivas are most notable for the bewildering variety of forms and features that they exhibit. Tsegi Phase kivas conform well to their eastern counterparts, but exhibit less variability. This may be due to the capacity of Tsegi Canyon to confine and channel the movement of people, a factor which would have fostered a greater degree of inter-village communication.

The best comparative data come from the Navajo Mountain area to the northwest. Cummings (1945) describes several kivas from Red House, Yellow House, and Segazlin Mesa. Recently, a number of kivas have been excavated by the Museum of Northern Arizona as part of their Glen Canyon Dam salvage work (Ambler, Lindsay, and Stein 1964; Hobler 1964: 78-89). There are few significant differences between Navajo Mountain and Tsegi Canyon kivas, except that those from Navajo Mountain are more standardized. In form and features, Tsegi Phase kivas fall well within the total range of other late Pueblo III Kayenta Branch kivas.

The most striking feature of Kayenta Branch ceremonial architecture is the apparent total absence of great kivas after Basketmaker III times. The only structure in the entire Kayenta area that qualifies as a great kiva is the large ceremonial chamber at Juniper Cove, an extensive Basketmaker III village at the foot of Skeleton Mesa northeast of Marsh Pass (Cummings 1953: 62). In this respect, the Kayenta Branch contrasts strongly with the Mesa Verde, Chaco, and Western Pueblo areas, where great kivas are common. The possible significance of this is discussed later.

Grinding Rooms

Grinding (or mealing) rooms are easily identified, since only one criterion for their recognition exists. That criterion is the presence in the floor of a battery of two to four mealing bins which theoretically held a series of metates graded from coarse to fine. Such rooms lack other floor features that might indicate any additional function. Some living rooms have one or two mealing bins, but the other floor features leave little doubt as to their function. Furthermore, the walls of mealing rooms are not usually smoke-blackened.

Most grinding rooms appear not to have been roofed. Furthermore, a number of them are enclosed on only three sides. The fourth side is either completely open or is closed only by a flimsy jacal screen or a few courses of masonry. Some grinding rooms were entered through the open side while others have regular doorways in addition to the open site. This situation suggests that grinding rooms were not designed for use in bad weather, since most of them are as exposed as courtyards.

Grinding rooms are not numerous, even in the large villages, and some sites have none at all. In no site is the number of mealing rooms adequate to have handled all the corn grinding which must have taken place. The frequent occurrence of mealing bins and metates in courtyards and living rooms shows that most of the corn grinding was done in the home rather than in the special rooms.

In general, grinding rooms are associated with household units, but a few have no recognizable connections with any other room or group of rooms. Why certain households should possess grinding rooms

while others do not is a question which at present cannot be answered. These special chambers are not associated with room clusters that lack courtyards or have especially small living rooms, which indicates that they did not replace dwellings or courtyards that were inadequate for the task of corn grinding.

An interesting feature that characterizes the Tsegi Phase is the destruction of mealing bins, presumably at the time the villages were abandoned. Typically, metates were ripped from their bins and sometimes destroyed. This practice was common in Pueblo III sites near Navajo Mountain, where apparently it was also customary to dismantle the bins as well as remove the metates (Ambler, Lindsay, and Stein 1964: 48, 55, 56, 58; Hobler 1964: 30-1, 63). The reasons behind this habit are not apparent, but it was widespread and persistent among Kayenta people from as early as A.D. 850 to at least 1300.

Courtyards

A courtyard is recognized chiefly by context rather than by the presence or absence of any specific features. Characteristically, it is an open area surrounded by both living and storage rooms, all of which open onto it (Figs. 11 and 13). Rooms may be found on one, two, three, and occasionally four sides of a court. In contrast to rooms, which are usually rectangular, courtyards may be irregular in shape. When built on a sloping surface, courtyards were often terraced by building a retaining wall on the downslope side and filling the interior with trash in order to produce a level floor. Many courts have prepared floors consisting of artificially leveled

a

b

Fig. 11. Representative courtyards. a, Court 12 at Kiet Siet is surrounded by the rooms of Room Cluster 2; b, courtyard on the roof of Room 69 at Kiet Siet. Note the firepit against the far wall and the partially sealed roof hatch at right.

bedrock, clay plaster, or both. Because trash accumulated in courtyards, their floors are often several inches higher than those of adjoining living rooms. In some cases measures to prevent the trash from spilling into the dwellings were necessary; this is one reason for stone doorsills. One trait valuable in identifying a courtyard is the absence of any evidence for a roof. This is particularly true in caves where preservation is greatest, less true in open sites where preserved walls may not be high enough to indicate the presence or absence of any roof structure.

Several structural features characterize courtyards. Most common are firepits. These are in addition to firepits inside adjoining living rooms. Several courts also contain large circular holes ground into the sandstone bedrock. These holes may be 10 to 15 inches deep and 8 to 12 inches in diameter. Their exact function is unknown, but they may have been used for temporary storage or as mortars. Metate bins are commonly found in courtyards.

Courtyards occur on rooftops as well as between rooms. This is partly a function of the terraced nature of some of the sites, such as Betatakin, where the rooftop of one room may be level with the floor of its immediate neighbor. This situation represents an attempt to make the most of what little space was available to the builders. Rooftop courtyards may be a function of cave building, for in open sites the space limitations are usually less severe. The extensive use of rooftops has carried over to the present day Pueblo peoples, among whom "... a person's house is still considered a public thoroughfare and no Pueblo ever takes umbrage at its being

used as such" (Kidder 1924: 40). Figure 11 b shows a rooftop courtyard at Kiet Siet.

The possession of several features typical of dwellings---firepit, mealing bins, mortars (?)---indicates that courtyards served some of the functions of the living rooms. During periods of favorable weather most of the household activities probably took place here---the living room being used primarily for sleeping. Tsegi Phase living rooms are undersized at best, and the low ceilings make any activity tedious. Furthermore, these rooms are very dark, and no adequate method of lighting them was available to the inhabitants. A fire would perhaps give some light but only at the expense of filling the room with smoke. It is not difficult to imagine that the people preferred to live and work outside as long as the weather permitted. During the warm months the villagers probably spent most of their time out-of-doors in the courtyards, moving into the living rooms only when driven there by the cold of winter.

Certain areas included in this category are perhaps not true courtyards in the sense outlined above. That is, they did not serve as living areas. These features are really walkways which provide access to rooms that would otherwise be very difficult to reach. Walkways resemble courtyards in most respects, but lack domestic features and are usually too small or too narrow to have served as true courts. Some courtyards performed both functions.

Room Clusters

A consistent pattern of association among the different types of rooms is apparent in the Tsegi Phase cliff villages. This pattern is manifested in the grouping of rooms around a courtyard. I propose here to refer to these groupings as room clusters.

A room cluster consists of at least one living room, one to four storage chambers, and, in all but a few cases, a courtyard. The rooms of a cluster open onto the courtyard or are connected with other rooms that do; consequently, a room belonging to a particular cluster can usually be entered only from its courtyard, either directly or by way of another room. Thus, the courtyard is the focal point of the grouping. This pattern may be clearly seen on the individual site plans by focusing on any courtyard and observing the grouping of rooms around it.

The room cluster seems to be the smallest identifiable structural unit of which the villages are made. These sites are not agglomerations of individual rooms, but rather are formed by the joining together of a number of room clusters. Larger structural units made up of a number of room clusters within a single village are difficult to recognize, although occasionally it is possible to infer that two or more room clusters are related. There is no consistent formal relationship among room clusters that can be identified on the basis of the evidence now available. Nor is there any recognizable instance of a kiva being formally associated with any room cluster or group of clusters. Computer analysis of the type used by Longacre (1964) at the Carter Ranch Site could possibly be used to identify nonrandom

association among different room clusters or among kivas and room clusters. Unfortunately, the Tsegi Phase sites have been so thoroughly cleaned out that the data for this type of analysis cannot now be obtained.

Examples of room clusters from different sites are presented in Figures 12 and 13. The wide range of formal variation in this particular architectural unit becomes apparent in the discussions of individual sites. Despite considerable variability in form, the conceptual unity of the room cluster is obvious.

Groupings of rooms such as those found in the Tsegi Phase sites also occur in open pueblos near Navajo Mountain (Lindsay, Ambler, Stein, and Hobler 1966: 19-20). Here, they are occasionally grouped into more complex associations than are recognizable in the Tsegi. The large Segazlin Mesa community is composed of several small pueblos, each in turn made up of a number of room clusters (Alexander J. Lindsay, Jr., letter quoted in Jennings 1966: 58-9).

The excavators of the Navajo Mountain sites designate the unit which I call a room cluster by the term courtyard complex (Lindsay, Ambler, Stein, and Hobler 1966: 19-20). Since the latter name has precedence, my use of a different term must be justified. In this report the term courtyard complex is applied to a larger structural unit which can occasionally be identified. This unit is made up of room clusters whose association is usually determined by their possession in common of a single courtyard. Room clusters do not depend on the presence of a courtyard for their recognition, although one is almost always present. Several clusters have been identified solely

Fig. 12. Floor plans of representative Tsegi Phase room clusters. *a*, Room Cluster 16 at Betatakin; *b*, Room Cluster 2 at Kiet Siel; *c*, Room Cluster 10 at Batwoman House; *d*, Room Cluster 8 at Scaffold House. Not to scale.

a

b

Fig. 13. Typical Tsegi Phase room clusters. a, Room Cluster 16 at Betatakin; b, Room Cluster 5 at Betatakin.

on the basis of association between granaries and dwellings in the absence of a focal courtyard. Furthermore, groups of rooms opening onto a single courtyard can sometimes be divided into two or more room clusters on the basis of the relationships of rooms to one another. In such cases the term courtyard complex would be misleading, since courtyards have no part in the recognition of the unit. The two terms are used here in order to distinguish two different types of architectural association that are archaeologically significant. Single room clusters that possess a courtyard to themselves can be thought of as small courtyard complexes. In most instances the two units are coterminous, but the few cases in which they do not coincide deserve to be distinguished.

The room cluster and courtyard complex are characteristic, though not universal, traits of late Pueblo III Kayenta Branch architecture, and constitutes an important aspect of the settlement pattern. Similar clusters of rooms, called suites, have recently been reported from Mug House on Mesa Verde (Rohn 1965). This indicates a more widespread distribution of this trait among the Anasazi.

Courtyard Complex

Courtyard complexes are defined by the association of courtyards with other architectural units. Specifically, they consist of two or more room clusters grouped around a single courtyard, or two or more room clusters associated with related courtyards (Fig. 14). Such units are not common, but are significant when they do occur. As

Fig. 14. Floor plans of two courtyard complexes. a, Courtyard Complex 1 at Betatakin; b, Courtyard Complex 4 at Betatakin.

stated above, room clusters with focal courtyards may be thought of as single-unit courtyard complexes.

Galleries

Several Tsegi Canyon cliff dwellings possess features which have been called galleries. The typical gallery is a low wall built along the lip of a ledge situated high on the back wall of the cave, well above the rooms below. Betatakin, Batwoman House, and Swallow's Nest have galleries of this type. The superbly constructed scaffold at Scaffold House is analogous to the galleries. The specific architectural features which characterize the Batwoman and Betatakin galleries are unknown because these two structures are inaccessible. The Swallow's Nest gallery and Scaffold House scaffold are discussed below under the appropriate site headings.

The functions of the galleries are not obvious. It is easy to say that they were used as a last retreat in the defense of the villages, but this theory will not hold up. By the time either the Betatakin or Batwoman villagers had retreated to the gallery, an enemy would have had possession of the village. Even arrows could reach only limited areas of either village from the galleries, so that no threat could be offered attackers from these vantage points. Furthermore, very little water, if any, was available on the gallery ledges, making survival of a long siege impossible. A few of the galleries could possibly have served as lookouts. Most of them, however, would have been useless even for that limited defensive purpose. All this, plus the lack of any evidence for violence or defensive

measures, argues against a defensive interpretation of these structures.

It seems much more plausible that they were used for storage rather than for defense. They are ideal places to store grain and other food products, since they are protected from the inroads of animals by 15 to 30 feet of sheer cliff face. Furthermore, they are admirably dry so that the people did not have to worry about spoilage due to moisture. The Swallow's Nest gallery is almost certainly a storage structure, since it has an identifiable granary.

Trails

Two types of prehistoric trail may be distinguished in the Tsegi. The first of these are trails in and out of the canyon. These so-called trails consist of shallow holes pecked into the cliff face to provide purchase for the fingers and toes of the climber. Several such trails are known for the Tsegi, but few can be precisely dated or associated with any specific sites. A major exception to this generalization is that trail leading from the canyon floor to Woodchuck Cave which was discovered and used by the Rainbow Bridge--Monument Valley party in 1934 (Hargrave 1934b). No systematic effort to locate and map trails has been undertaken in the Tsegi; no doubt many more exist than have been recorded. Similar trails are common in the Glen Canyon area (Adams, Lindsay, and Turner 1961: 22-3) and on Cummings Mesa (Ambler, Lindsay, and Stein 1964: 12-13).

The other type of trail is that found within the Tsegi Phase cliff dwellings. Many of these trails are identical to those already described---hand and toe holds pecked into the bedrock of the cave floors. This type occurs in sites such as Betatakin, where the cave floor is steeply pitched. In some instances these intra-site "trails" reach the proportions of streets, consisting of broad leveled walkways running through the villages. This type is most elaborately developed at Kiet Siel. Intra-village trails are often of value as relative chronological indicators, in that rooms were sometimes built over them, thus necessitating a rerouting of the trail. Such rooms were probably built later than most others, since lack of building space is the most probable cause for building on a main trail or street.

Abrading Areas

A minor feature of most of the sites is what, for want of a better term, may be called abrading areas. The many abrading areas, identified by smoothed grooves in the rock, were probably used for shaping and sharpening ground stone artifacts. Grinding grooves are usually found in the bedrock floors of the caves, but they also occur on loose slump boulders, on rocks in walls, and on stone door sills. The quantity of areas and grooves implies that a great deal of pecking and grinding was done. Occasionally, grinding grooves provide some information on the relative date of a room. For example, grinding grooves are sometimes found in the bedrock beneath the floors of rooms.

Social Implications of Tsegi Phase Architecture

Any attempt to make social interpretations of archaeological data is fraught with uncertainties and hazards. Nevertheless, since the reconstruction of prehistoric cultures is one goal of modern archaeology, the archaeologist would be remiss if he ignored the problem because of the inherent difficulties involved. At the very least, an attempt should be made to explore the interpretive possibilities of the data. In this case, the data are almost exclusively architectural. Other types of evidence were removed when the sites were originally excavated. An exhaustive search might locate much of the material recovered from some of the sites; however, the refined associational data necessary for these analyses are not available.

Rohn (1965) discusses some aspects of the social interpretation of structurally distinct architectural units with reference to Mug House on the Mesa Verde. He points out that the social groups which produced such architectural units can best be thought of as socio-economic groups; "that is, their cohesion probably rests on sociological factors, but their recognition by the archaeologist depends on cooperative economic behavior" (Rohn 1965: 65). In other words, the cooperative economic activities undertaken by a social unit are so structured as to produce recognizable physical remains; in this case, a consistent clustering of certain architectural traits. These activities have produced at Mug House an architectural unit, the suite, nearly identical to the Tsegi Phase courtyard complex. It is not stretching the point too far to infer that these architectural similarity resulted from the activities of similarly structured

social groups. Rohn invokes the smallest economic unit in a society, the household, as the most likely occupant of a suite. He stresses that this is a socio-economic designation, for nothing precise can be said about the social structure of the group. Using ethnographic analogy, he postulates that "the basic role of the household in modern Pueblo society differs little, if at all, from that in 700-year-old Mug House" (Rohn 1965: 67). This conclusion might be also applied to the Tsegi Phase sites.

It is possible, however, to descend to a level of analysis more specific than that used by Rohn. Dozier (1965) discusses in detail social units and their architectural and spatial expressions which are ethnographically known from the Southwest. On the assumption that the historically known social units have deep roots in the prehistory of each tribe (Dozier 1965: 38), Dozier's analysis can be used to limit the range of possible interpretations of the observed archaeological phenomena. The comparative analyses can be limited not only to the Southwest but to the Pueblo cultures within that area. Further limitations may be made even within the total range of Pueblo organization. The undisputed cultural and historical connections between the Kayenta peoples and the Hopis permits the application of the direct historical approach to this problem. Instead of making broad comparisons between generalized Pueblo social units and the inferred prehistoric units, it is possible in this case to use the Hopis as a point of reference.

The basic architectural unit of the Tsegi Phase villages is the grouping of rooms and courtyards, to which the name room cluster has been applied. No smaller combinations of room can be identified,

and individual rooms apparently are significant only with respect to the room cluster. Such consistent groupings of rooms are not produced by chance. The highly standardized composition of the room cluster and its almost invariable occurrence in Tsegi Phase sites suggest that it fulfilled a definite function in the culture of the Tsegi Phase people. Since it is an architectural unit of residence, it should correspond to a social unit of residence.

Like the Mug House suite, the Tsegi Phase room cluster was undoubtedly occupied by a household. The grouping of rooms characteristic of the room cluster is a result of the cooperative economic activities and the residence pattern of the members of the social unit. Dozier (1965: 38-40) lists two basic types of household: nuclear family and extended. Those room clusters with one living room must have been occupied by nuclear families, since it is improbable that more than a single family occupied a dwelling. Aside from the social factors involved, there is hardly enough room in the average living room for one family, let alone two or more. Despite the existence of many households that consisted of only one nuclear family, the Tsegi Phase household was probably not of the nuclear type.

Several lines of evidence indicate that multi-family households were common during the Tsegi Phase. Room clusters with more than one living room, the addition of second and even third dwellings to already existing room clusters, and the existence of the courtyard complex all point in this direction. These multi-family households probably represent extended families defined on the basis of descent and a residence rule. There is no evidence that the single and multiple family room

clusters represent different types of unit. Both types occupy identical positions within the architectural structure of the village. It therefore seems reasonable to infer that they represent socio-economic units which occupied identical positions within the social structure of the village. The multi-family and single family households were structurally if not formally identical. Therefore, there was but one type of household---the extended family type. The fact that the extended family type was often represented by a nuclear family does not appear to be structurally significant.

The existence of a majority of single family households in villages inferred to possess an extended family type of household deserves comment. A number of factors may have produced this situation. Each village was probably settled by immigrants from a number of different sources rather than from a single source. The population was apparently in a state of flux, and people moved in and out of villages that never really had stable populations. The villages were occupied for a maximum of 50 years---not much time for multi-family households to develop from single family units. A final factor that may be involved here is the difficulty of recognizing associations among different room clusters. Such associations may be more common than the few that were identified and designated courtyard complexes.

Analogy with Hopi social organization suggests that the Tsegi Phase extended family households were based on matrilineal descent and a matrilocality rule of residence. Thus, the addition of a new living room to a room cluster probably represents the marriage of a daughter and the creation of a nuclear family which had to be accommodated by

the household. Among the Hopi, as apparently among the Tsegi Phase people, the only localized social unit within the village is the matrilocal extended family household. Eggan (1950: 29-30) describes this social unit as follows:

The basic family unit is an extended family based on matrilocal residence and thus may consist of a woman and her husband, married daughters and their husbands, unmarried sons, and children of the daughters. This group normally occupies a set of adjoining rooms which it uses in common and may thus be designated, for convenience, a "household."

The Tsegi Phase household was probably very similar to the Hopi household, except that the Tsegi Phase nuclear families may have been more autonomous than those of the Hopi.

The next larger architectural unit that can be recognized in Tsegi Phase villages is the courtyard complex. The social significance of this unit is difficult to estimate. Recognizable courtyard complexes are not numerous and are secondary to room clusters as far as the composition of the village is concerned. Courtyard complexes probably represent nothing more than especially obvious or especially large extended family households. It is much less likely that they represent localized lineages, segments of lineages, or even clans. Although Pueblo lineages and clans are not now localized, there is some evidence that they were in prehistoric times (Dozier 1965: 40; Eggan 1950: 299-300; Steward 1955: 151-72).

No other architectural units can be recognized within the Tsegi Phase villages. This parallels the Hopi situation where the only localized sub-village social unit is the household. However, a large number of nonlocalized units crosscut one another to provide

the basis for Hopi village integration. These include kinship units such as lineage, clan, and phratry; ceremonial units such as the Katsina cult and men's associations; and village associations such as those for warfare and clowning (Dozier 1965). Since these are all non-localized, little evidence for their existence should be discernible in architectural data. Identification of special rooms set aside for lineage or association use on the basis of associated ceremonial artifacts as suggested by Dozier (1965: 45-6) is not possible in the Tsegi because of careless handling of the collections from these sites. Nevertheless, a few inferences may be made about some of the units.

Dozier (1965: 39) points out that nowhere in the Southwest did the extended family exist as an independent social unit; it always occurred within the context of some larger unit. Among the Hopis, the household forms an important segment of a lineage. Therefore, if a matrilineal extended family type of household may be inferred for the Tsegi Phase it is also possible to infer the existence of matrilineal lineages as among the Hopi. With the unlikely exception of the courtyard complex, there is no architectural unit which could correspond to a localized lineage or lineage segment. The "unit pueblo" architectural pattern of a spatially localized block of rooms with an associated kiva has long been equated with a localized lineage or clan (Steward 1955: 163, 166; Aikens 1966: 56). Many sites throughout the Southwest grew by the accretion of such habitation units (Roberts 1931: 90-109; Rohn 1965: 67). No such units exist in Tsegi Phase sites. Therefore, the lineages inferred to be present during the Tsegi Phase must have been nonlocalized, as they are among the Hopis.

Whether or not clans or phratries were present is beyond the range of the available evidence.

Eggan believes that lineage and clan organization were not highly developed among Kayenta Branch peoples until they arrived at the Hopi Mesas in the 14th century where "by utilizing matrilineal descent and matrilocal residence, [the newcomers] could maintain a certain amount of their group integrity and ceremonial possessions while integrating themselves with the other groups already there" (Eggan 1950: 130). The clan and later the phratry systems developed as mechanisms for the integration of the new arrivals into the established cultural patterns. However, the processes of clan formation may have begun as early as 1200 in the Hopi Mesa area in response to the population amalgamations represented by the founding of large villages such as Awatovi. The similarity of late Pueblo III Hopi Mesa and Kayenta sites (Smith 1962: 1168) suggests that clans may have come into existence by the time of the Tsegi Phase. Indeed, the lack of evidence for localized lineages in Tsegi Phase sites may be due to a restructuring of the lineage organization toward a more Hopi-like configuration which took place shortly before the sites were founded. Rohn (1965: 67) records a somewhat similar breakdown in the integrity of the "unit-type" habitation unit in Pueblo III sites on the Mesa Verde, as shown by the growing dissociation of the kiva from the habitation unit.

While evidence bearing on social groups larger than the extended family household is scant from the Tsegi Phase, contemporaneous Kayenta sites in other areas do exhibit such evidence. Many

surface sites near Navajo Mountain possess a settlement pattern quite different from that of the Tsegi Phase (Ambler, Lindsay, and Stein 1964; Hobler 1964; Lindsay, Ambler, Stein, and Hobler 1966). Instead of being agglomerations of room clusters, these sites consist of a number of masonry rooms or pithouses oriented around at least three sides of a large plaza which contains one or more kivas. The fourth side of the plaza is often enclosed by a wall pierced by a small entryway. Recognizable room clusters do not occur in these sites. Obviously a social unit larger than the extended family is involved here---perhaps a localized lineage. These sites coexist with other sites, such as that on Segazlin Mesa, which are composed of room clusters and courtyard complexes. Aikens (1966: 41) suggests that sites like the Segazlin Mesa community indicate the persistence of independent lineage organization in the Kayenta area. I would suggest that the courtyard complex sites such as Segazlin Mesa and the Tsegi Phase cliff pueblos represent a step beyond pure lineage organization. Presumably, the plaza sites represent a localized lineage type of organization, while the courtyard complex sites represent the development of nonlocalized lineages and at least the beginnings of their organization into a clan system. The courtyard complex sites approach the typical Hopi settlement pattern more closely than do the plaza sites. It therefore seems logical to infer that the social organization of the inhabitants of the former resembled Hopi organization more closely than did that of the plaza-oriented sites.

Beyond the room cluster and courtyard complex, the only architectural unit which can be isolated is the village itself. Some

sort of cultural mechanisms must have operated to produce a certain amount of village integration. The compact and fairly standardized layout of Tsegi Phase sites leads to the conclusion that they were tightly integrated (Dozier 1965: 41-2). There are any number of ways in which this integration could have been brought about. In view of the historical relationships and formal similarities between the Tsegi Phase and modern Hopis, it is probable that the mechanisms of village integration were similar also. Hopi villages are integrated by means of a network of interlocking social and ceremonial obligations vested in a number of social units, including lineages, clans, phratries, the Katsina cult, men's associations, and village associations (Dozier 1965). Which of these units were present or absent in the Tsegi Phase cannot be known for certain. However, it is probable that the Katsina cult was absent, since none of the artifacts associated with it have ever turned up in the extensive collections from the cliff pueblos. Presumably, the Katsina cult is of southern origin and was introduced into the Hopi area after the Kayenta region was abandoned.

A few remaining bits of evidence give some clues as to how village integration was not accomplished. In this regard, the absence of great kivas is significant. Where present, the great kiva has been inferred to represent a set of social and ceremonial relations which served to integrate smaller social units into larger village units or even to integrate several villages into a larger inter-village social unit (Martin, et al. 1962: 222; Vivian and Mathews 1965: 109, 114).

Its absence in the Tsegi Phase may be inferred to indicate the absence of a type of organization whereby a village was integrated by overriding ceremonial obligations.

The pattern of occurrence of kivas in Tsegi Phase sites is also germane to this problem. As has been pointed out, no consistent associations with any sub-village architectural units may be detected. There are no localized socio-economic units associated with a particular kiva. Kivas seem to be associated only with the village. Again, this is very similar to the present Hopi situation and suggests a similar type of integration in which interlocking ceremonial rights and duties on the part of a number of different social units are a strong factor in binding these units together into the whole that is a village.

In summary, distinct formal similarities between modern Hopi village patterns and Tsegi Phase sites suggests that similar mechanisms of social integration were operative in both groups. Probably this involved sets of crosscutting social and ceremonial structures and behavioral patterns without benefit of any strong overall religious or political institutions. It is remotely possible that Tsegi Phase village society was not integrated at all beyond the bonds of contiguity, habitual association, friendship, and affinal ties. This would seem to be Jennings' (1966: 58, 63, 66) view. I think this to be very unlikely in view of our knowledge of modern Pueblo village organization, the close similarity between Tsegi Phase and Hopi villages, and the formally structured pattern of the sites themselves.

Additional evidence that supports this viewpoint appears in the analysis of the tree-ring dates.

At present there is no evidence of inter-village organization in the Tsegi Phase. The absence of inter-village great kivas suggests the absence of formalized inter-village ceremonial organization. Although kinship, affinal, trading, and communication relationships undoubtedly existed, it is unlikely that any of these were formalized into defined, inter-village social ties. The Hopis---descendents of the Kayenta peoples---have not yet managed to bring about meaningful social cohesion above the village level.

CERAMICS

It might be well to present once again Colton's list of pottery types which define the Tsegi Phase. These are (Colton 1939: 59): Kiet Siel Gray, Tsegi Orange, Tsegi Red-on-orange, Tsegi Polychrome, Dogoszhi Polychrome [Tusayan Black-on-red], Kayenta Polychrome, Kayenta Black-on-white, and Tusayan Black-on-white. As was the case with the settlement pattern and architecture, Colton's ceramic assemblage needs modification in view of developments in Kayenta archaeology since 1939.

Several pottery types should be added to the list. Some of these types occur in earlier phases as well, and some are restricted to the Tsegi Phase. The former are Tusayan Corrugated and Tusayan Polychrome. The latter include Tsegi Black-on-orange, Kiet Siel Black-on-red, and Kiet Siel Polychrome. These types plus those listed by Colton comprise the characteristic ceramic assemblage of

pure Tsegi Phase sites. A particularly significant problem in this connection is the Tsegi Phase occurrence of Tusayan Black-on-red. This problem is discussed at greater length in a subsequent section; suffice it to say here that its association with the Tsegi Phase sites is genuine.

Detailed analyses of the ceramics of the cliff pueblos have never been made and probably never will be. All the sites were excavated before the development of modern archaeological theories and techniques of ceramic analysis and before the full value of pottery as a cultural and chronological indicator was fully appreciated. Consequently, the early archaeologists showed little interest in the broken fragments of pottery scattered about the sites, and no sherd collections are reported. Two generations of visitor traffic have stripped the sites of most of their remaining surface sherds, despite conscientious efforts of Navajo National Monument personnel to prevent it. The time has long since passed when these sites could contribute much toward refined analysis of correlations between ceramic type frequencies and architectural units or tree-ring dates. The one exception to this gloomy ceramic picture is Anderson's recent excavations in the trash at Betatakin and Kiet Siel. The significance of this work is discussed under individual sites.

NON-CERAMIC MATERIAL CULTURE

Any discussion of this aspect of Tsegi Phase archaeology is pointless, since no detailed studies of this important facet of the material culture have ever been published. At most there are a few

individual specimens illustrated in various reports and an occasional discussion of some particularly interesting pieces. All this nonsystematic analysis and random comment will be superseded by Anderson's study of Tsegi Phase technology. Thus, any statement here about non-ceramic material culture would be premature and undoubtedly inaccurate.

BURIAL PATTERN

A discussion of Tsegi Phase burial patterns is impossible, since no such burials have been reported, and very few have been found. On evidence from other areas it is assumed that the Tsegi Phase people interred their dead in a flexed or semi-flexed position along with grave goods consisting primarily of personal possessions such as clothes, ornaments, weapons, and pottery vessels (Aikens 1966: 49).

CHAPTER 6. METHODS OF COLLECTION AND ANALYSIS OF THE DATA

The number and variety of problems toward which this report is oriented can be approached only through a correspondingly varied and comprehensive body of factual data. This chapter describes how the data were collected and the ways in which they are presented. Since the data can be classified into two different categories---archaeological and dendrochronological---it is useful to consider the collecting and analytical techniques under these two headings. Of course, the collecting of archaeological and dendrochronological data often went on simultaneously and could not be operationally separated.

ARCHAEOLOGICAL DATA

The tree-ring data are of limited value if not accompanied by good archaeological controls. The magnitude of this problem is compounded by the fact that all of the sites in question had been more or less completely cleaned out long before my investigations. Consequently, some of the data which was gathered may be rather badly skewed, because of previous excavations and collecting. Therefore, my archaeological data are strongest in regard to items which cannot be carried away---such as architectural details, village layout, settlement pattern, and site location. Data on material culture and particularly ceramics are much less reliable.

No excavations were undertaken at any of the sites sampled. Previous digging had sufficiently exposed the contextual relationships

between architecture and tree-ring specimens. Furthermore, the conceptualization of the field program necessary to attain the objectives of the study did not include excavation. Any digging on my part would have been limited in scope and exploratory in nature, and would have removed much of what little material remains in these sites. I felt that further excavation in any of the sites could be justified only as part of an extensive, well conceived and organized, problem-oriented attack on the archaeology of Tsegi Canyon or the Tsegi Phase. Much information can yet be gleaned from the few undisturbed deposits remaining, but only by using the most sophisticated techniques now available to the archaeologist.

The vast bulk of archaeological data from these sites is in the form of field notes. Detailed notes were taken on each site. In addition, sherd collections were made which, combined with already existing survey collections at the Museum of Northern Arizona and the Arizona State Museum, give a fair representation of the pottery types present at each site. Sherd counts and percentages are not representative, because previous collecting activities have skewed the true percentage composition to a degree which cannot be compensated for. Therefore, sherd counts are not presented in this report. The sherds collected are now in the survey collections of the Museum of Northern Arizona at Flagstaff or the Arizona State Museum at Tucson. Copies of the field notes are at the Laboratory of Tree-Ring Research in Tucson.

In the following chapters most of the archaeological data is presented in tabular form. Each site is represented by a series of

tables designed to present the necessary information. A few of the sites have several different sets of room numbers. Therefore, a table of concordance for these room numbering systems is presented wherever necessary. A second table is designed to illustrate the grouping of the various types of rooms into clusters. Tables summarizing the architectural detail for each site are included. Finally, the ceramic types occurring at each site are listed. In addition to the tables, a plan of each site rounds out the presentation of purely archaeological data.

TREE-RING DATA

The primary purpose of the field work was the collecting of specimens of wood for dendrochronological analysis. This activity occupied most of the time spent in the field. Although specimens were collected from almost every site, the bulk of them come from Betatakin and Kiet Siel, where attempts were made to sample every suitable piece of wood in the ruins. Material was also collected from Scaffold House, Guernsey's Cave 1, NA-8435, Batwoman House, and Nagashi Bikin.

FIELD PROCEDURES

The very magnitude of the project created several major problems of a technical nature which had to be overcome before the study could begin. These problems centered around methods of collecting a very large number of specimens within the limited time available, while adhering to National Park Service desires to maintain the protected sites in their original condition. It was obvious that the accepted collection techniques would not suffice to do the job. A

completely new set of tools and techniques had to be devised to handle the problems envisioned. These tools and techniques were tested at Betatakin where they proved their worth.

Two principal methods had previously been used in the collection of tree-ring specimens: sawing and coring. Sawing has the advantage of relative speed. However, large collections of sawed specimens are bulky, and transportation and storage problems increase proportionately. Furthermore, sawing had to be rejected because it destroys the appearance of the beams, a circumstance incompatible with the principles of the National Park Service. On the other hand, the taking of cores from a beam does little damage to it, leaving only a relatively small hole. Consequently, it was decided that only coring fulfilled the several requirements which had to be met.

Up to that time cores had been taken with a one-inch diameter tubular borer attached to a carpenter's brace. The cutting edge of the borer was fitted with a series of saw teeth that chewed their way into the wood as the brace was turned. Coring with the manually-powered brace was extremely slow---up to two hours being sometimes required to get a single core. This was much too slow when considered in terms of the number of specimens to be collected at Betatakin and Kiet Siet. With this in mind, the Laboratory of Tree-Ring Research embarked on a program to develop new techniques and a new tool kit for the taking of cores from archaeological wood.

Attention was turned to a method worked out by Douglass in the 1930's for the removal of cores from Egyptian wooden coffins at the Oriental Institute of the University of Chicago. This was a small

tubular borer, $\frac{1}{2}$ inch in diameter, fitted to an electric drill. It seemed likely that it should now be possible to devise some way of getting a power source into the field. After considerable experimentation with Douglass' basic concept in combination with more recently developed equipment, a set of tools was assembled which laboratory tests showed to possess the twin attributes of portability and efficiency. A field season at Betatakin provided a rugged practical test of the equipment.

The tool kit consists of several components that are available on the open market and several others that had to be specially made. The special components---coring tubes, starting plates, chucks, and core-breakers---were made for the Laboratory by the Arizona Gear and Manufacturing Company of Tucson. The coring tool itself is the familiar tubular borer reduced to $\frac{1}{2}$ inch in diameter and constructed to fit a special chuck. The chuck fits a standard Sears Craftsman $\frac{3}{8}$ -inch electric drill, which has the advantage of an easily removable chuck. A Sears David Bradley portable 1000-watt generator provides the power to run the drill. This generator weighs only 55 pounds, and, when mounted on an aluminum pack frame, can be transported by a man or a horse.

Two additional pieces of equipment complete the tool kit. The starting plate is a circular or rectangular flat piece of aluminum with three holes in it. Two small holes at opposite edges of the plate receive the nails which secure the plate to the beam to be cored. A larger hole in the center of the plate holds the bit of the coring tool steady until it chews its way into the wood. The

core-breaker is a long flattened piece of thin metal with a handle at one end and a sharp right-angled tip at the other. This tool is used to extract the core from the beam.

At Betatakin and Kiet Siel an attempt was made to core every suitable beam whether it was actually in situ or merely lying loose in the cave. In general, all beams two inches or more in diameter were cored. Each core was assigned a Laboratory of Tree-Ring Research catalogue number and, whenever possible, this number was stamped on the beam near the hole left by removal of the core. Detailed field notes were taken on each specimen. These notes include the exact provenience of the beam, the location of the core in the beam, the diameter of the beam where cored, the condition of the outside of the beam, and any other information that might have value in dating or in interpretation.

The new techniques and equipment surpassed all expectations in their speed and efficiency. The new techniques proved to be faster, more efficient, and less destructive than the older methods. Another advantage of the new system is the small amount of storage space required by the specimens; the collections of cores from both Betatakin and Kiet Siel occupy only one storage box.

After a week's work in the field the procedures followed in taking specimens became standardized in a form that provided maximum speed and convenience. First, the starting plate was nailed to the beam over the spot judged most likely to represent a true outside (as determined by the presence of bark, beetle galleries, or other indications). The coring tube was then inserted through the hole

in the starting plate, pressed firmly against the wood, and the drill started. As soon as the bit had penetrated the beam about 1/8 inch it was withdrawn and the starting plate removed. With the sides of the hole providing support, the remainder of the core was taken to the desired depth, usually halfway through the beam, but occasionally a full diameter core was taken. At intervals during the process of drilling the core, the bit was run back and forth in the hole in order to remove the sawdust which otherwise backed up in the tube and caused it to bind. When the desired depth was reached the bit was removed and the core-breaker was inserted into the hole alongside the core and twisted. When twisted, the sharp tip snapped the core loose from the beam. The core-breaker was then withdrawn and with it the core. The specimen number was written on the core and stamped on the beam near the hole. The specimens were stored, in the order that they were taken, in 1/2-inch diameter plastic tubes. Finally, notes were taken on the specimen.

In sampling the ceiling of a room a definite procedure was again followed so as to make the most efficient use of generator time. Initially, all the necessary equipment was moved into the room. The generator was then started and the operator entered the room. Notes were then taken on the room itself. These notes included a brief description of the room's features, function assignment, and a sketch of the ceiling with all the beams numbered. The coring procedure was then begun. It was found that the greatest efficiency was attained by completing each step of the coring process for the room as a whole, rather than proceeding beam by beam. All the beams were cored, then

the cores were removed and labeled, and finally notes on the beams were taken.

Once this definite coring routine had been established, the new equipment proved to be even more efficient and rapid than had been hoped. Much of the collector's time was occupied with taking notes or moving the equipment from room to room. The actual coring process was usually of relatively short duration. An average of about 12 cores per working day was attained, with a maximum of 36 attained in one ten-hour day in a group of closely spaced rooms at Kiet Siel. This was a distinct improvement over the old methods, especially in that it permitted the taking of much better notes on a greater number of specimens in the same amount of time.

As good as this equipment was, its utility was limited to field situations of a more or less stationary nature. The generator was portable only in a relative sense, since automotive vehicles could not be used. Plans for the second field season called for an extensive survey work as well as for intensive work at Kiet Siel. The generator-powered equipment would serve the latter purpose very well, but something more portable had to be developed for the survey work. The only alternative was to use a hand-driven, tubular borer or to take sawed samples, both of which had been done at a few sites in 1962.

To solve the survey problem we turned to several battery-driven power drills which had just appeared on the market. After a series of laboratory tests, we selected as best suited to our purposes the Black and Decker $\frac{1}{2}$ -inch Cordless Electric Drill powered by a

rechargeable nickel-cadmium battery. It was the sturdiest of the lot, and we felt it would best withstand the rigors of travel on horseback throughout the Tsegi Canyons. Furthermore, only a very minor modification was required to permit all the coring equipment developed for the generator-powered drill to be used with the Black and Decker tool.

The field work of the summer of 1963 proved the Black and Decker Cordless Drill to be admirably suited for taking cores under survey conditions. Although less powerful and therefore slower than the generator-powered drill, it was much more satisfactory than either a hand-driven borer or sawing. Up to 13 cores could be taken on a single battery, and the use of two batteries made possible the collection of 26 cores per day. The batteries could be recharged at night either by using the portable generator at a base camp or by using commercial electricity if such were available. Collection of cores with this apparatus was accomplished by the same routine as that used with the generator-powered drill.

LABORATORY ANALYSIS

The tree-ring specimens were studied at the Laboratory of Tree-Ring Research during the school years of 1962-63, 1963-64, and 1964-65. Ward F. Weakly and I did the analyses. The skeleton plot method of analysis as described by Glock (1937) and Stallings (1960) was employed. In addition to the specimens collected in 1962-64, a complete review was made of all other tree-ring specimens from Tsegi Canyon which were in the possession of the Laboratory. This included all specimens previously collected by the Laboratory, by Gila Pueblo,

and by the Museum of Northern Arizona. This work was part of the Laboratory's Synthesis of Southwestern Dendrochronology Project sponsored by National Science Foundation Grants GS-247 and GS-908. The greater chronological control provided by the mass of new material made possible the refinement of some of the old dates and the dating of many of the specimens which had not formerly yielded dates. Duplicate specimens among all three collections were identified, and the dates were combined to leave a single date for each individual tree. All work was checked by a second party: Weakly's by me, and mine by Bryant Bannister.

Several specimens of each species from each site were measured. The measurements were submitted to analysis by a computer program (Fritts 1963) which calculated standardized indices for each specimen and derived composite series of indices combining all specimens of a single species, a series of indices combining all the specimens into a mixed-species site composite, and a combined tree-ring chronology for the whole Tsegi Canyon. Several important statistical parameters were derived by the same program (Fritts 1963). This purely chronological and statistical data will be presented in the Tree-Ring Bulletin as part of the Synthesis Project's procedure for publication of the raw data derived therefrom. Schulman (1948) documents the crossdating and presents a standardized chronology for Tsegi Canyon. The dates reported here were derived by comparison with Schulman's chronology.

METHODS OF PRESENTING THE DATA

The data on the individual tree-ring specimens from each site are presented in a series of tables. Tables of undated specimens include data useful for analyses of tree-cutting activities and the aboriginal use of different species. The first two tables for Betatakin and Kiet Siel include provenience and terminal ring data on the undated specimens from that site. Several factors may account for the failure of any tree-ring specimen to date. The majority of the undated specimens from Tsegi Canyon did not date because they belonged to tree species whose growth characteristics are such that they do not produce crossdatable ring series. In the Southwest deciduous species do not ordinarily date, and in the Tsegi none of the oak, aspen, or boxelder specimens dated. The failure to date any of the aspen was the greatest disappointment of the project. At the outset, it was hoped that the large number of aspen specimens from Betatakin and Kiet Siel together with the excellent dating control provided by the coniferous species would make it possible to date some of the aspen. This goal was not attained; the aspen ring series proved generally to contain too few rings for analysis and to be either complacent or erratic. The situation was so unfavorable that only tenuous crossdating among different aspen specimens was achieved.

Juniper is the least datable of the conifers. Some juniper specimens date perfectly while others do not. This probably is in part the result of species differences. It may also be due in part to micro-environmental differences. The majority of the dated

juniper specimens come from beams which are straight and which exhibit no spiral grain. In contrast, most undated junipers exhibit lobate growth and spiral grain. Juniper trees growing today in the vicinity of Betatakin fall into the same two types. On the south side of the stream the junipers are twisted and exhibit lateral dominance; that is, a great proliferation of large limbs with little or no development of a main stem or trunk. A number of this type also grow on the north bank. However, here there also grow junipers characterized by apical dominance; that is, the development of a major stem which grows straight and without spiraling. Instead of sprouting off in all directions at the base, the limbs on this type of tree sprout from the trunk and remain subordinate to it. It is possible that slightly different environments cause the two different types of growth. However, only a study of modern juniper in the area will disclose the true relationships.

In addition to specimens of species unsuitable for dating purposes, many specimens of datable species---Douglas-fir, white fir, ponderosa pine, and pinyon---did not date. Often this was due to short or complacent (lacking in ring width variation) ring series, especially in Douglas-fir. A few Douglas-fir and pinyon exhibited erratic growth (rings varying unsystematically in width around the circumference) and were not dated. A few specimens with ring series which appeared suitable simply did not date.

Data on undated specimens are presented for Betatakin and Kiet Siel, but not for the other sites. Only the Betatakin and Kiet Siel collections provide samples adequate for the types of analysis to

which the data are submitted. The first table of undated specimens for the two major sites includes the frequency distribution of the different species in relation to the use-categories in which they occur. In the second table the different species are cross-classified against the nature of the terminal rings; that is, whether the terminal rings are complete or incomplete. By definition, a terminal ring is the last ring produced by a tree before its death. The last ring on a tree-ring specimen is not necessarily a terminal ring, since weathering, breakage, and burning remove exterior rings. Therefore, there are fewer than the total number of undated specimens, because only those specimens with identifiable terminal rings are included. The criteria for recognizing terminal rings are the same as those discussed below for the identification of cutting dates.

The symbols used to represent the various species in these and all subsequent tables are:

DF	Douglas-fir (<u>Pseudotsuga menziesii</u> [Mirbel] Franco)
WF	White fir (<u>Abies concolor</u> [Gord. and Glend.] Hoopes)
PP	Ponderosa pine (<u>Pinus ponderosa</u> Laws.)
PNN	Pinyon pine (<u>Pinus edulis</u> Englm.)
JUN	Juniper (<u>Juniperus</u> species)
Oak	Oak (<u>Quercus gambelli</u> Nutt.)
Pop	Quaking aspen (<u>Populus tremuloides</u> Michx.)
Box	Boxelder (<u>Acer negundo</u>)
Unkn	Unknown non-coniferous

Pertinent data on the dated specimens are presented for each site. The presentation differs from that of the undated specimens, in

that the dated specimens are listed individually. The format of the dated specimen tables is as follows.

Provenience. The specimens are listed not by catalogue number but by architectural unit; therefore, provenience is given preference over specimen number. The major category under provenience is the room number. Following this in order are the auxiliary beams, primary beams, secondary beams, jacal wall posts, and loose logs. The beam or post number is given in each case.

Catalogue Number. The catalogue number is the number assigned to the specimen by the collecting institution. The GP- specimens were collected by Gila Pueblo, and the F- specimens by the Museum of Northern Arizona. Other letter designations refer to specimens included in the Laboratory of Tree-Ring Research's Douglass Collection. All three collections are now in the possession of the Laboratory. Asterisks mark specimens that were measured for computer analysis.

Form. This column indicates the form of each specimen. Except for those otherwise indicated, all specimens are wood, and this condition is not specifically noted. The abbreviations that appear in this column are:

Chc1.	Charcoal
Sec.	Section; specimens of less than a full section are indicated by a fraction appropriate to their size, such as 1/2, 1/3, or 1/4.
Frag.	Fragment
Core	Since most of the cores are 1/2 inch in diameter, the size is indicated only in the case of one-inch diameter cores; the notation "core" always signifies a 1/2-inch core.

TR. This column describes the character of the terminal ring of a specimen. A "C" indicates that the terminal ring is complete; that is, the tree had completed its seasonal growth before being felled. The symbol "I" means that the outer ring is incomplete, and, consequently, that the tree was cut before the end of the growing season represented by that ring. In the case of dated specimens, the terminal ring can be assigned a date. Thus, it is possible to state that a tree died during or after the growing season of a particular year, depending on whether the ring is incomplete or complete. These conditions and inferences are valid only for cutting dates; therefore, the column is left blank in cases where non-cutting dates are involved.

CD. An "X" in this column indicates that the date for the specimen is an actual cutting date. A cutting date precisely records the final year of growth before the tree died, either by natural causes or as a result of being cut down by human beings. The methods for determining a cutting date are described under Dates. The need for this column arises out of considerable confusion among archaeologists over the meaning and interpretation of the symbols applied to tree-ring dates by the dendrochronologist.

Cutting dates are of primary importance in the dating of prehistoric structures. It is highly probable that the majority of beams used by the prehistoric people were felled while living (Haury 1935: 103-4); consequently, a cutting date represents the year that a particular tree was cut for use in a structure.

Dates. This column lists the dates derived from each specimen. The year of the innermost ring on the specimen is given first and is

followed by the year of outermost ring on the specimen. Each of these years is accompanied by a set of symbols which serve to describe various pertinent facts about either the specimen or the date. The meaning of these symbols have been explained elsewhere (Bannister, Hannah, and Robinson 1966: 5-6). Nevertheless, confusion regarding the use of the symbols demands further amplification of the problem.

It has been difficult in the past for archaeologists to determine a cutting date solely from the symbols appended to the date. This is due chiefly to a somewhat ambiguous use of the symbols by dendrochronologists. While certain symbols, such as those for bark or for beetle galleries, almost always indicate a cutting date, in certain cases they do not. It is from these latter cases that confusion has developed to plague the entire symbol system. The confusion lies in the fact that dendrochronologists use the symbols to describe certain features present on the specimen or particular characteristics of the chronology of that specimen, and not to specifically indicate whether or not the date is a cutting date. In this manner, the symbol for bark, usually the hallmark of a cutting date, may appear after a date which is not the actual calendar date of the last ring. For example, a specimen with 300 rings may date perfectly for the first 200 years but, because of non-climatic factors such as physical damage or competition from other trees, the last 100 rings do not follow the chronology and cannot be dated. A count may then be made from the last dated ring, the 200th, to the outermost ring which yields for this ring a date 100 years later than the date of the 200th ring. The final ring is not dated in terms of

the Christian calendar, and even though the specimen may have bark it is not a cutting date. In order to solve this problem, the symbols are kept as a descriptive device and the "cutting date" column is used to indicate cutting dates. A brief explanation of the symbols follows.

The symbols used with the inside date of a specimen are few and simple. A "p" indicates that the innermost ring is the pith ring; that is, the initial growth layer. The symbol "+p" indicates that although the pith ring is present, an exact date cannot be assigned to it because of the difficult nature of the ring series near the center of the specimen. The "+" symbol alone means that an absolute date cannot be assigned to the innermost ring and that the innermost ring is not the pith ring. Whenever a "+p" or a "+" are used, a note in the Remarks column indicates the year at which the ring count out from the first ring ends.

The symbols used with the outside date are more complicated. These symbols fall into four groups. The first group consists of the symbols "L," "G," and "B" and describes three characteristics of the outer surface of the specimen. The "L" indicates a characteristic surface patination and smoothness that develops just under the bark of a tree and is considered indicative of a true outside on the specimen. The "G" signifies the presence of phloem-beetle galleries on the outer surface of the specimen. These galleries are made by beetle larvae who burrow in the cambium of recently dead trees; consequently, they are indicative of a true outside. The "B" indicates the presence of bark, the best indicator of a true outside. All of these symbols may be used in combination with one another and with those of groups two

and four. In the tables of dated specimens many of the symbols of this group are underlined. This means that the particular condition represented by the symbol was observed in the field to be present on the beam but could not be observed on the small surface available on the laboratory specimen.

The second group of symbols consists of the letters "c" and "r," both of which are considered good indicators of a true outside. The "c" means that the outermost ring is continuous around the full circumference of the specimen. This symbol can be assigned only when a full section is available for study. The "r" is used when less than a full section is present and when the outer ring is continuous around that portion of the circumference which is available. These symbols are mutually exclusive but may be used in combination with those of groups one and four.

Group three consists of the symbols "v" and "vv" which are used only when there is no evidence on the specimen for the presence of a true outside; in other words, when none of the symbols of groups one and two apply. Consequently, these symbols may not be used in combination with the symbols of the first two groups. They may, however, be used with the symbols of the fourth group. The "v" and the "vv" indicate a subjective judgment on the part of the dendrochronologist as to how near a true outside is the last ring on a specimen which cannot be given any of the symbols in group one or two. The "v" indicates that there is some reason for believing that the last ring is within a few years of being a cutting date. The "vv" signifies that there is no way of telling how far the last ring is from a true

outside, whether one year or a hundred years. These symbols are mutually exclusive and may be used only with the symbols of group four.

The fourth group, consisting of the symbols "+" and "++," describes certain characteristics of the ring record of a specimen. The "+" indicates that the nature of the dating is such that one or more rings may be missing near the end of the ring series and that their presence or absence cannot be absolutely determined because the specimen does not possess enough additional rings to provide an adequate check. When the "+" is used the maximum number of possibly missing rings will be listed in parentheses in the Remarks column. This number should be added to the listed date in order to obtain the date that would be correct if that number of rings are indeed missing. The "++" is used when a ring count is necessary because beyond a certain point the specimen cannot be dated. Although a true outside may be present, a "++" means that it cannot be considered a cutting date. When the "++" is used the date from which the ring count begins is indicated in the Remarks column. The two symbols in this group are mutually exclusive but either may be used with the symbols from the other three groups.

A few of the dates are enclosed in parentheses. These are "tentative placement" dates---dates which, although probably correct, for one reason or another are less certain than the majority. Usually these are dates derived from specimens which are complacent, very short, or both. In addition to the parentheses, the notation "Tentative Date" appears in the Remarks column opposite the date.

Remarks. This column contains any essential information not indicated in the other columns.

The tables of undated and dated specimens for each site are followed by a detailed analysis of the tree-ring data for that site. Three different types of information may be derived from such dendro-chronological data. These are chronological, cultural, and environmental in nature. The theoretical bases for the derivation of each type of information from tree-ring data have been developed and discussed in detail in the preceding pages of this report. Each class of information is analyzed separately for each site insofar as the data permit.

CHAPTER 7. BETATAKIN

NA-2515; Arizona D:6:7 (ASM)

Betatakin is the second largest of the prehistoric "cliff dwellings" in Tsegi Canyon. It is probably the best known because of its relative accessibility and the scenic beauty of its setting. Several thousand people visit the ruin each year. Betatakin has been recorded in two archaeological survey systems. It is listed as NA-2515 in the Museum of Northern Arizona Survey and as Arizona D:6:7 in the Arizona State Museum Survey.

HISTORY AND ENVIRONMENTAL SETTING

The first recorded visit to the site was on August 5 (Judd 1930: 5) or August 9 (J. Wetherill 1955b: 23), 1909, when an exploring party led by Byron Cummings and John Wetherill was directed up a small side canyon of the main Tsegi by a local Navajo informant. Later that same month Neil M. Judd, one of Cummings' students, conducted W. B. Douglass, Examiner of Surveys for the United States Land Office, on a tour through Tsegi Canyon which included a visit to Betatakin. From August to November, 1909, Douglass performed a number of surveys in the Navajo country, during which he mapped the locations of many sites and made the first detailed ground plan of Betatakin. In September Cummings returned to Betatakin with his University of Utah field party and devoted the next three months to the excavation of the site. In 1910 J. Walter Fewkes, inspired by a 1908 recommendation

of W. B. Douglass, made an exploratory trip to the "Navajo National Monument" which included a brief visit to Betatakin.

Seven years later, in March of 1917, Neil M. Judd, representing the United States National Museum, undertook the repair and stabilization of the ruin (Judd 1930). Surmounting a succession of formidable obstacles and setbacks, including the United States' entry in World War I, he accomplished his objectives with such success that Betatakin stands today much as he left it in 1917. The National Park Service performed additional stabilization work in 1958 (Richert 1958) and 1964.

Despite the amount of work done at Betatakin, it has been poorly published. No reports on Cummings' work at the ruin have appeared. Preliminary drafts of such a report are on file at the Arizona Pioneers' Historical Society in Tucson.

Fewkes (1911) discusses selected aspects of the ruin and published Douglass' 1909 map. Since the site had been excavated before his visit, Fewkes' remarks are limited to descriptions and interpretations of architectural features. Judd (1930) provides the only adequate description of Betatakin. His room-by-room description is admirably thorough, and it is to be regretted that no studies of the associated material culture are yet available to accompany it.

Betatakin is located in a large cave near the head of a small side canyon which enters the Tsegi from the southwest about five miles from Marsh Pass (Fig. 1). Betatakin Canyon is one of a number of short southern tributaries which enter the main canyon below Bubbling Springs Canyon. It shares most of the topographical,

geological, and vegetational characteristics of the main canyon described above; however, certain features of topography differentiate it from the main canyon in a few rather important ways (Fig. 15 a).

Numerous small springs and seeps near the head of the canyon feed a small intermittant stream that generally flows feebly during all but the summer months. About 1/3 mile downstream from the head of the canyon the stream plunges over the edge of the Kayenta bench and falls into the arroyo below where it is swallowed up in the sand. The channel continues onward in a northeasterly direction until, about 1½ miles below Betatakin, it reaches Laguna Creek opposite the mouth of Kiet Siel Canyon.

The Kayenta bench encircles the head of Betatakin Canyon and is an important topographical feature. The floor of the canyon upstream from the ledge lies atop the Kayenta formation some 40 feet above the floor of the arroyo below the "falls." This produces a base level for the head of Betatakin Canyon that has undoubtedly remained stable for centuries, in contrast to the base level for the Laguna Creek drainage which has fluctuated considerably. Today the upper portion of the canyon contains an accumulation of talus derived from the Navajo sandstone but none of the Recent alluvium characteristic of the floors of Tsegi Canyon and its tributaries. Furthermore, the surface of the dissected alluvium lies well below the top of the Kayenta bench at the "falls," which suggests that there never was any such alluvium above this point. This is not an isolated phenomenon; Brainerd's map (Beals, Brainerd, and Smith 1945, Map 1) shows that the same conditions prevail in all the southern tributary canyons of the

a

b

Fig. 15. The local environment of Betatakin. a, Betatakin Canyon looking downstream from the head. Note that the thick growth of aspens ends abruptly at the lip of the Kayenta bench. b, Betatakin Cave.

Tsegi. As a consequence of these factors, the upper reaches of Betatakin Canyon must not have been too severely affected by the cycles of erosion and deposition that took place in the Laguna Creek drainage. Therefore, it may be inferred that conditions at the head of Betatakin Canyon in A.D. 1250 were much as they are today, and that Betatakin Cave and its environs had much the same appearance then as they do today.

The importance of the difference in base level is demonstrated by the abrupt change in vegetation as one crosses the Kayenta ledge. This change can be clearly seen in Figure 15 a; the dark band of aspen and oak growth conforms exactly to the area of the bench. Downstream, the vegetation in Betatakin Canyon is identical to that described for the Tsegi as a whole. Pinyon and juniper trees dot the talus slopes, and Douglas-firs grow along the foot of the Navajo sandstone cliffs on the southeast side of the canyon. A sparse growth of grass and brush covers the alluvial terraces.

Above the Kayenta ledge, arroyo cutting in the talus is minimal. The ground is moist, and even after stream flow has ceased for the season, pools generally remain in the creek bed throughout the summer. Along the stream channel the canyon bottom is choked with a heavy growth of quaking aspen, brush, and ferns. Growing among the aspen and on the south and east facing slopes is a dense stand of Gambel oak that extends up to the mouth of Betatakin Cave. Directly under the edge of the cave overhang, where after every rain they receive a deluge of water from the mesa top, grow several boxelder

trees. Inside the cave, where no rain falls, plants are concentrated at the spring and around the seeps.

The north and west facing talus slopes of this part of the canyon present a different vegetational picture. These slopes resemble those further downstream with the addition of scrub oak and a somewhat denser brush and grass cover. Juniper trees dot the slopes while large Douglas-firs grow against the cliff face and in small coves. Here, however, probably due to the greater amount of soil moisture, Douglas-firs extend further down the slopes, and a few very large ones are found on the south bank of the stream bed, where they mingle with aspen and oak. That approximately the same conditions prevailed in prehistoric times is shown by the presence of all these tree species in the Betatakin collection of tree-ring specimens.

The nearest arable land of any extent is in the main canyon over a mile from the site. Here, at the confluence of Betatakin and Kiet Siel canyons with Laguna Creek, the Tsegi widens providing a large area of alluvial surface suitable for farming. Prehistorically, water for irrigation would have been available from at least the three streams---Laguna and Kiet Siel creeks and Betatakin Wash. Farmland is quite limited in Betatakin Canyon itself and almost nonexistent above the Kayenta bench. Thus, Betatakin conforms to the general settlement pattern of the Tsegi Phase in being located in a side canyon near an area where the Tsegi is widened by the confluence of several tributary streams.

The ruin of Betatakin overlooks the lush upper part of Betatakin Canyon (Fig. 15 b). It covers the floor of a large cave

eroded from the Navajo sandstone. The cave resembles a huge half-dome and measures 370 feet in width, 135 feet in depth, and 452 feet in height. The base of the cave lies at the contact between the Navajo sandstone and the Kayenta formation. From the front, the floor of the cave slopes sharply upward in a series of discontinuous ledges to merge with the back wall some 70 feet higher. The back wall of the cave is lined with seeps which are active for most of the year. At the eastern end of the arch a permanent spring issues from the Navajo sandstone--Kayenta formation contact, thus providing a good supply of water throughout the year. The spring lies at an elevation of 6522 feet above sea level (Richert 1958: 4). A steep talus slope falls away from the front of the cave to a small stream channel approximately 100 feet below. The stream, which is fed by the spring joins the main Betatakin Canyon stream just before it plunges over the edge of the Kayenta bench.

DESCRIPTION OF THE SITE

The plan of Betatakin used here (Fig. 16) is that officially adopted in 1962 by the National Park Service. It is an adaptation of that published by Judd (1930, Pl. 3), and the room numbers are the same. Judd's site plan is a modification of W. B. Douglass' 1909 map (Fewkes 1911, Pl. 10). I have made a few changes so that the functions of the architectural units may be shown. In addition, I have assigned numbers to units that were previously unnumbered.

Six different systems for numbering Betatakin rooms have been devised during the half century since its discovery. This reflects

the duplication of effort that has characterized work at the site due to lack of publication. For the benefit of future students who may find it necessary to work with one or another of these systems, a correlation of the six is presented in Table 1. An explanation of the table follows.

Column 1 includes the numbers used in Figure 16, by the National Park Service, and by Judd (1930, Pl. 3). In the table all other systems are referred to this one. Room numbers I have added are not included in the table, because units to which they apply were not numbered on any of the earlier maps.

Column 2 includes the room numbers from W. B. Douglass' map (Fewkes 1911, Pl. 10). Since Douglass' map served as the basis for Judd's, the two are quite similar. Nevertheless, several differences are evident in the table.

Columns 3-5 represent three maps produced by Cummings. One of the maps accompanies his field notes, while two of them belong with an unpublished manuscript. The field notes and manuscript belong to the Arizona Pioneers' Historical Society in Tucson, with whose permission they are used here. Copies of these documents were kindly loaned to the Laboratory of Tree-Ring Research by Alexander J. Lindsay, Jr., then Director of the Glen Canyon Project at the Museum of Northern Arizona.

Cummings' field notes room designations are listed in this Column 3. The numbers in parentheses are the work of Cummings and apparently represent his correlation of the field notes room numbers with those of one of his manuscript maps (Column 4). An incomplete

correlation of his numbers with those of W. B. Douglass is also included in the field notes, but is omitted from Table 1 for the sake of clarity.

The numbers in Column 4 were taken from one of the maps which accompany Cummings' Betatakin manuscripts. It is given the designation "15a" because this figure appears at the top of the map. The use of these numbers in the text of the manuscripts shows that this map was in final form and was to be included in any publication of the work.

The other manuscript map provides the numbers listed in Column 5. The designation "n" is given only to aid in identification of the original, for the "n" obviously stands for "north." It is, however, the only distinguishing mark on the original map. Although the plan is complete, only 38 of the rooms are numbered. Probably this is a preliminary map, but it is included here for the sake of completeness.

Column 6 lists numbers which appear on a sketch map that accompanies A. E. Douglass' field notes on his 1927 collecting trip to Betatakin. Douglass' room numbers have recently been used by Breternitz (1963). The lower-case letter symbols are eliminated from this column because all rooms shown are numbered.

Table 1. Correlation of Betatakin Room Numbers

Fig. 16 NPS Judd	W.B. Douglass	Cummings Field Notes	Cummings Manuscript 15a	Cummings Manuscript n	A.E. Douglass
1	1	1	1	1	
2	2	2	2	2	1
3	3	3	3	3	2
4	4	4	4	4	-
5	5	6	6	6	4
6	6	5	5	5	3
7	7	7	7	7	5
8	8	8	8	9	-
9	b	9	9	8	-
10	10	b	b	b	-
11	11	10	10	10	6
12	12	11	11	11	7
13	13	b	12	b	-
14	14	12 (13)	13	12	15
15	15	13 (14)	14	13	16
16	16	14 (15)	15	14	-
17	17	37 (44)	44	b	14
18	18	36 (43)	43	b	13
19	19	b	b	b	-
20	20	46 (52)	52	b	8
21	21	47 (53)	53	b	9,10,11
22	22	48 (54)	54	b	12

Table 1--Continued

Fig. 16 NPS Judd	W.B. Douglass	Cummings Field Notes	Cummings Manuscript 15a	Cummings Manuscript n	A.E. Douglass
23	23	70 (55)	55	b	-
24	24	15 (16)	16	15	-
25	25	17 (18)	18	17	19,20
26	26	16 (17)	17	16	-
27	27	20 (19)	19	20	21,22
28	28	21½(20)	20	22	-
29	30?	23 (26)	26	25	25,26
30	29?	22½(25)	25 ^d	b	-
31	31	22 (24)	24	23	-
32	32	19 (23)	23	19	24
33	33	18 (22)	22	18	23
34	34	b	b	b	-
35	35	43 (49)	49	b	27
	36 ^e				
37	37	42 (48)	48	b	-
	38 ^e				
39	39	39 (46)	46	b	18
40	40	40 (47)	47	b	-
41	41	38 (45)	45	b	-
42	42	71 (56)	56	b	-
43	43	25 (27)	27	26	-
44	44	24 (30)	30	29	-

Table 1--Continued

Fig. 16 NPS Judd	W.B. Douglass	Cummings Field Notes	Cummings Manuscript 15a	Cummings Manuscript n	A.E. Douglass
45	45	44 (50)	50	b	-
46	46	45 (51)	51	b	-
47	47	a	b	a	-
48	48	25½	b	a	-
49	49	26 (28)	28	27	-
50	50	a	a	a	-
51	51	33 (29)	29	28	-
52	52	34 (33)	33	37	-
53	53	35 (34)	34	38	-
c (54)	c (54)				
55	55	49 (57)	57	b	-
56	56	27 (31)	31	30	32
57	57	28 (32)	32	31	34
58	58	a	a	a	k
59	59	29 (33) ⁱ	37	32	
60	60	30 (36)	36 ^d	35 ^f	
61	61	31 (35)	35	34	
b	b	32	b	b	
b?	a	76 (39)	39	k	
	62 ^g				
63	63	75 (38)	38		
64	64	74 (41)	41		

Table 1--Continued

Fig. 16 NPS Judd	W.B. Douglass	Cummings Field Notes	Cummings Manuscript 15a	Cummings Manuscript n	A.E. Douglass
65	65	73 (40)	40 ^d		
66	66	51 (59)	59		
a	a	52 (60)	60 ^d		
67	67	a	a		
68	68	a	a		
	69 ^e				
70	70	a	a		
71	71	a	a		
c (72)	c (72)				
73	73	61 (78)?	78?		
74	74	54 (67)? ^h	67? ^h		
75	75	56 (73)	73		
76	76	64 (84)? ^h	84? ^h		
77	77	64a(85)? ^h	85? ^h		
78	78	66 (88)	88		
79	79	67 (88) ⁱ	89		
80	80	68 (90)	90		
81	81	69 (91)	91		
82	82	57 (74)	74		
83	83	58 (75)	75		
84	84	59 (76)	76		
85	85	60 (77)	77		

Table 1--Continued

Fig. 16 NPS Judd	W.B. Douglass	Cummings Field Notes	Cummings Manuscript 15a	Cummings Manuscript n	A.E. Douglass
86	86	86 (103)	103		
87	87	84 (101)	101		
88	88	83 (100)?	100?		
b	b	82 (99)	99?		
89	89	81 (98)?	98?		
90	90	80?	97?		
91	91	a?	a?		
92	92	77 (92)	92		
93	93	78 (93)	93		
94	94	a	a		
95	95	79 (94)	94		
96	96	95,96?	a		
b	k	91	96		
b		92	95		
a		87 (104)	104		
c (97-99)		c (88-90)			
100		21 (21)	21		
101-106		a	a		

a - Room not indicated on map.

b - Room indicated on map, but not numbered.

c - Gap in sequence of room numbers. Numbers missing indicated in parentheses.

- d - Second-story room; number not shown on map, but first-story room and number shown. This number assigned on the basis of Cummings' field notes correlations.
- e - Number assigned by W. B. Douglass to hypothetical second-story room which has since proved to be non-existent.
- f - Number inferred; not shown on map.
- g - This room, indicated by W. B. Douglass, does not exist.
- h - No correspondence between Cummings' field notes map and "15a" map; number equivalence based on field notes correlations.
- i - Typographical error in field notes.
- j - Map is inaccurate; these rooms cannot be identified.
- k - Room designations carried no further.

Betatakin is an arc-shaped pueblo which may originally have possessed more than the 135 rooms presently recognized. In plan it follows the curve of the cave (Figs. 16 and 17), and its shape is not a culturally determined feature. At present the rooms appear to be concentrated a little to the west of the center of the arc. This is entirely fortuitous. At some time between the abandonment of the site about 1300 and its discovery in 1909, a huge section of the cave roof and back wall collapsed and, in its descent down the steep cave floor, swept away most of the rooms which occupied the area just east of center. It is possible to trace the approximate outlines of these rooms by following the wall-footing grooves pecked into the cave floor. In such a manner Judd was able to identify those rooms indicated by dashed lines on the plan (Fig. 16).

Viewed from the front, the ruin appears to rise to a height of three or four stories (Fig. 15 b). Actually, this is not the case; there are no structures of more than two stories. The multi-storied appearance derives from the steepness of the cave floor which rises in a series of discontinuous ledges, giving the buildings a step- or terrace-like profile (Fig. 16). Several rooms (Rooms 86-98) are located at the foot of the cliff just outside the east end of the cave. A low wall built along the lip of a narrow inaccessible ledge forms a gallery high above the rest of the ruin.

For a number of reasons Betatakin might serve as the type site for the Tsegi Phase. Not the least of these may be found in the details of its construction. These details are much more uniform from structure to structure than they are at any of the other Tsegi

a

b

Fig. 17. General views of Betatakin. a, central and western section of the ruin; b, eastern part of the pueblo.

Phase sites. Consistency of association among various architectural features indicates that Betatakin's builders had in common a very uniform set of formal standards and constructional techniques. In other words, their building activities seem to have been channeled by a more rigid set of cultural determinants than were those of the builders of most of the other Tsegi Phase sites.

In general, Betatakin masonry is superior to that of other Tsegi Phase cliff dwellings. Almost all the masonry at Betatakin falls within the range of "typical" Kayenta masonry (Fig. 6 a). Coursing is somewhat more regular, although there is a great deal of variation. Both unbonded and bonded corners occur. A few corners have an unusual type of unbonded joint. Here the abutments are reversed at the midpoint of the height of the wall. Whether this produces a stronger joint is debatable. The only example of a cored wall in a Tsegi Phase cliff pueblo occurs at Betatakin. The walls of Room 55 have an adobe and spall core faced with regularly coursed stones set in quantities of mortar.

Jacal walls at Betatakin exhibit an extremely regular pattern of occurrence, another feature which sets Betatakin apart from other Tsegi Phase sites. No room possesses more than one jacal wall. In all but two rooms which have walls of this type, the doorway is located in the jacal wall. Both exceptions to this statement were entered through the roof and have no doorways at all. This regularity is an exaggeration of the general pattern in Tsegi Phase sites where the same conditions prevail but do not exhibit the same uniformity of occurrence.

Regularity is also apparent in the details of roof construction, which typify the ideal described in Chapter 5. Although common elsewhere, the use of split timbers as closing material is unknown at Betatakin. Juniper bark and grass were the most frequently used materials for matting. All roofs were covered with a coating of clay.

LIVING ROOMS

Betatakin living rooms are also characterized by a high degree of uniformity, both in their features and the relationships of these features. The entrybox complex is especially uniform. Wherever the doorway is located in a jacal wall, the deflector and entrybox consist of upright stone slabs. In every instance but one in which the doorway opens through a masonry wall, the deflector is of masonry and the entrybox takes the form of a raised platform between the doorsill and the base of the deflector. Shelves are commonly found in rooms with one wall formed by a bedrock ledge and are invariably constructed from natural irregularities in the native rock. Metate bins are absent, but Cummings' (Lindsay 1963a) discovery of many metates and manos in living rooms indicates the use of these chambers for grinding corn. Architectural data on the living rooms are presented in Table 2.

STORAGE CHAMBERS

Betatakin storerooms and granaries are typical of the Tsegi Phase in general and possess few unique features. Room 17 may be the only Tsegi Phase granary with a jacal wall. Both the largest (Room 21) and the deepest (Room 15) rooms at the site are storage chambers. Data on granaries and storerooms at Betatakin are presented in Tables 3 and 4.

Table 2. Architectural Data for Living Rooms at Betatakin

Architectural Features	Living Rooms																							
	3	7	11	14	18	22	25	27	29	35	39	41	43	50	60	64	66	79	82	89	95	121	126	
1st Story	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	
2nd Story																x	x	x						
Walls																								
l Jacal							x	x	x	x	x	x						x	x				x	
Inside plastered	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x				
Inside smoke-blackened	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x ^j	
Floors																								
Modified bedrock	x	x	x	x	x	x	x		x	x	x	x	x	x				x		x	x	x		
Fill	x	x	x					x	x	x	x		x	x				x	x		x	x	x	
Ceiling																x	x	x						
Plastered	x	x	x				x	x	x	x		x	x					x	x		x	x	x	
Roofs																								
Roof destroyed						x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	
Auxiliaries	0	0	0	0	0	0	0	0	0	0	-	0	0	-	-	-	-	0?	0?	-	-	-	-	
Primaries	3	2	3	5	3	2	3	3?	4?	3	-	2 ^j	4	-	-	-	-	2	1?	-	-	-	-	
Secondaries	10	20	25	16	20	-	10?	-	-	-	-	10	8	7 ^j	-	-	-	-	-	-	-	-	-	
Closing material sticks	x		x	?	?	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	
Juniper bark matting			x	?	?	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	
Grass matting	x					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Doorways	A,B																							
Sealed	A	x				x									x ^c							x		
Open	B	x		x	x		x	x		x	x	x	x				x	x	x	x	x			
Jacal wall							x	x		x	x	x						x	x					
Masonry wall	A,B	x	x	x	x	x							x				x			x	x	x		
Low sill		x	x	x	x		x	x		x	x	x	x				x	x	x	x		x		
Stone sill	A,B			x			x			x		x	x				x	x	x	x				
Roof hatches		x	x																					
Inferred	x					x			x													x		
Open		x	x																					
Slab coping			x																					
Made later			x																					
Floor-level ventilators			A,B																					
Original construction	x		A	x	x	x	x		x								?			x	x			
Made later			B																	x				
Sealed			A				x																	
Smoke holes																								
Original construction	x																							
Made later				x	x																			
Sealed	x																							
Firepits	j		x	x	x	x	x	x	x	x	x ^j	x	x					x	x	x	x	x	x ^j	
Former presence inferred	x	x																						
Inside doorway		x ^c		x	x		x	x		x	?	x	x					x	x	x	A	x	x	?
Against wall			x			x			x															

Table 2--Continued

Architectural Features	Living Rooms																							
	3	7	11	14	18	22	25	27	29	35	39	41	43	50	60	64	66	79	82	89	95	121	126	
Slab deflector			x			x			x															
Jacal deflector			x ^c																					
Entrybox complex																								
Closed right																	x ^j	x						
Closed left												x									?			
Closed both sides								x													x			
Slab deflector								x		x		x						x	x					
Slab entrybox								x		x		x						x	x					
Masonry deflector					x	x											x				x	x		
Masonry entrybox																					x			
Entrance platform					x	x								?			x	x ^j		x	x			
Shelves																								
Masonry								x		x		j												
Modified bedrock					x	x	2		x															
Pole																								
Niches				2 ^c			1	2													1			
"Windows"					1	1		1			1						1		1					
Wall pegs		x			x		x	x		x														
Holes in floor					1	1		1														1 ^j		
Loom anchors			x ^{cj}							x ^j		x ^j									x ^j			
Benches																							x	
Designs scratched in wall plaster					x	x ^j	x	x	x															
Doorway opens onto																								
Court		x	x	x	x	x		x	x		x	x	x	x					x	x	x	x	x	
Another room																								
Rooftop								R23													R121			
Wall dado										7 ^c											x			

A, B - designates multiple occurrence of the feature

c - presence of feature indicated by Cummings (Lindsay 1963)

j - presence of feature indicated by Judd (1930)

? - possible presence of feature

- - evidence of this feature destroyed

Table 3--Continued

Architectural Features	Granaries																			
	1	2	5	6	12	15	17	20	21	26	31	32	33	44	46	51	78	84	85	100
Open							x	x										x	x	
Slab coping							?	x										x	x	
Shelves																				
Masonry																				x
Modified bedrock								x												
Niches								x						x						
Wall pegs	x	x			x	x		x	x				x							
Grinding grooves in bedrock floor					x															
Doorway opens onto																				
Court			x		x							x	x		x	x	A			x
Another room							R14										B R79			
Roof top	R2		R7								R29			R51						

A, B - designates multiple occurrence of the feature

c - presence of feature indicated by Cummings (Lindsay 1963)

j - presence of feature indicated by Judd (1930)

b - room burned

? - possible presence of feature

- - evidence of this feature destroyed

Table 4. Architectural Data for Storerooms at Betatakin

Architectural Features	Storerooms														
	4	48	59	61	63	65	73	80	81	87	88	90	92	93	127
1st Story	x	x	x		x		x	x	x	x	x	x	x	x	x
2nd Story				x		x									
Walls															
1 Jacal		x						x ^j	x ^j						x ^j
Inside plastered	x														
Inside smoke-blackened		x													
Floors															
Modified bedrock	x			x		x			x						
Fill	x							x ^j							
Plastered	x							x ^j							
Unmodified bedrock		x	x		x		x						x		
Roofs															
Roof destroyed	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Auxiliaries	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-
Primaries	-	0	3	-	-	-	-	-	-	-	-	-	-	-	-
Secondaries	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Closing material sticks	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
Grass matting	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
Doorways															
Open		x	x					x ^j		x					
Jacal wall		x						x ^j							
Masonry wall			x							x					
Low sill		x	x					x ^j							
High sill										?					
Inferred roof hatches				x		x					x	x			
Firepit present	x														
Shelves															
Masonry		x													
Modified bedrock											x				
Grinding grooves in bedrock floor									x						
Doorways open onto															
Court	x							x	x	x					x
Another room			R43	R58											

j - presence of feature indicated by Judd (1930)

? - possible presence of feature

- - evidence of this feature destroyed

CEREMONIAL CHAMBERS

The difficulties of identifying ceremonial structures in sites of the Kayenta Branch in general and the Tsegi Phase in particular were discussed in Chapter 5. For a number of reasons, these difficulties are even more acute at Betatakin than elsewhere. An effort to resolve these difficulties may best be made on the basis of the criteria developed in the analysis of Tsegi Phase ceremonial structures. First, Watson Smith's criterion of context may be used to isolate structures which seem to differ significantly from other structures at the site.

Second, structures isolated as contextually unique may then be evaluated with regard to ceremonial status by comparing them with other Tsegi Phase structures of undoubted ceremonial function. The theoretical basis for this procedure is simple. Unless the people of Betatakin belonged to a different cultural tradition, their religious life must have been similar to that of their neighbors. The great similarity among all Tsegi Phase sites in all aspects of culture which can be determined archaeologically conclusively shows that the Betatakin villagers shared in the local culture. Thus, a relatively uniform set of religious beliefs and practices---a concomitant of a common culture---would impose certain fairly standardized requirements on religious architecture. The result of these requirements should be observable in similarity in details of religious structures at various sites that belong to the same tradition. Therefore, ceremonial structures at Betatakin should be recognizable on the basis of features shared with known Tsegi Phase kivas.

The magnitude of this problem at Betatakin is shown by the fact that there are no chambers which can on inspection be immediately and unequivocally identified as kivas. Nevertheless, several workers have designated certain rooms as ceremonial in function. These identifications cannot be accepted as final, for these so-called ceremonial rooms share identical features with other chambers which have been called dwelling rooms by the same people.

Smith (1952: 158-61) presents a succinct discussion of the kiva problem at Betatakin. Using Judd's (1930) identifications of room functions, he compares the 6 ceremonial rooms against 15 living rooms and 16 "unidentified rooms" (Smith 1952: 159, Table 15). The "kivas" are found to differ in no significant respect from the other types of room, each class possessing a majority of the features belonging to the other classes. He concludes (Smith 1952: 160):

... it is very difficult to see on what standard Judd based his identifications, for his classifications are certainly not mutually exclusive.... It looks as if he had in mind the notion that in a general way kivas were relatively large and tended to possess certain other features, none of which was, however, conclusively diagnostic, and that his estimates were largely subjective, as he himself frequently implies by the use of expressions of uncertainty.

This demonstrates that the criteria by which ceremonial rooms were identified are inadequate, and, consequently, that this particular subject is open to further scrutiny.

Fifty years later we are in a somewhat better position to analyze the problem of ceremonial rooms at Betatakin than were the earlier investigators. Much additional information from other Kayenta sites which was not available to the excavators is now available and

provides a basis for comparisons. The previous designations were based in great measure on features considered to be unique to pueblo architecture as it was known at that time, which in actuality meant Mesa Verde, Chaco, and modern pueblo architecture. The situation at Betatakin was aggravated by the absence of a structure which could have been unequivocally identified as a kiva. This, coupled with the conviction that a pueblo must include a kiva, necessitated an intensive analysis of the rooms and their features in order to isolate and define ceremonial chambers. This analysis probably would not have been attempted had Betatakin possessed one or two circular, subterranean structures, and the present problem would not exist.

The analysis of the Betatakin ceremonial room situation is conducted as follows. Each room designated a kiva by Judd (1930) is discussed with a three-fold purpose: (1) to attempt to isolate the criteria upon which their identification as kivas was based; (2) to apply Smith's criterion of context to see if these rooms differ significantly from the other rooms; and (3) to compare the characteristics of these rooms with those of Tsegi Phase kivas as outlined above.

Judd (1930) lists the following rooms as kivas: Room 11 (p. 12), Room 14 (p. 16), Room 18 (p. 18), Room 22 (p. 20), and Room 55 (p. 34). Judd is not solely responsible for these identifications, for in some instances he follows the designations of Cummings and Fewkes.

Room 11 "is one of the most interesting chambers in Betatakin since it obviously is an old dwelling, remodeled for ceremonial

purposes" (Judd 1930: 12). The presence of a roof hatch was probably one of the major reasons why Judd listed Room 11 as a kiva. Perhaps even more important, the room was remodeled by sealing a doorway in the southwest wall and cutting a hatchway through the roof near the south corner, a change in function being assumed to accompany a change in structural detail. However, this type of entrance conversion and its converse, the sealing of a roof hatch coupled with the construction of a doorway, are not at all uncommon in living rooms at other Tsegi Phase sites. Indeed, this particular remodeling could have resulted from a desire to alter the ventilation pattern, for the old doorway opened directly into the teeth of a down-canyon wind which sweeps through the cave from west to east. The other features of this room (Table 2) are typical of the standard Kayenta living room.

Random design motifs scratched into the plaster of the walls (Judd 1930: 14, Fig. 1) are too haphazard to represent "wall decoration" and probably are nothing more than idle doodlings or preliminary sketches of pottery, basketry, or textile designs. Similar scratchings occur in both living rooms and kivas throughout the Tsegi.

No special features exist to differentiate Room 11 from other rooms at Betatakin. The criteria probably used by Judd are not in themselves adequate to remove it from the living room class and ascribe ceremonial function to it. It possesses few of the features characteristic of Tsegi Phase kivas. Furthermore, the interior arrangement of its features does not conform to that typical of kivas. Room 11 was a secular rather than a ceremonial chamber.

Room 14 was identified as a kiva by Cummings (Lindsay 1963a: 49) and by Judd (1930: 16). No specific reasons for this identification are given by either writer. Probably the room was so identified because of its resemblance to Room 18. The interior features (Table 2) are typical of those normally found in Tsegi Phase living rooms. Because of its identity with other Kayenta Branch living rooms, and because of factors discussed more fully for Room 18, Room 14 is identified as a dwelling.

Room 18 was identified as a kiva by Cummings (Lindsay 1963a: 59; Cummings 1915: 277), Fewkes (1911: 15), and Judd (1930: 18). The data in Table 2 show that Room 18 differs in no significant respect from other dwellings in Betatakin and other Tsegi Phase sites. When Betatakin was excavated, however, these features were rather new to Pueblo archaeology, and were considered unique enough to denote ceremonial use. This reasoning, in turn, was based on an assumption of almost absolute cultural unity among all prehistoric Pueblo peoples, an assumption which has been conclusively refuted by subsequent archaeological work in all the major Anasazi branches. Thus, on the basis of the criteria noted above, Room 18 is considered a living room rather than a kiva.

Room 22 was classified as a kiva by Judd (1930: 20-1). This room possesses several features which were undoubtedly responsible for this identification (Table 2). These are: roof entry inferred from the absence of lateral doorways, a paved bench against the southwest wall, a niche in the middle of the bench, and designs incised into the wall plaster. Most of these features, however, are found in

living rooms or can be explained by special circumstances. The roof entry is not unusual in living rooms, and in this case was probably a necessity due to the situation of Room 22. The only practical approach to the room is from the northwest side, and since the northwest wall is formed by the face of a bedrock ledge, this approach is at rooftop level. A sheer drop of about 20 feet below the southeast wall obviates any approach from that side. The northeast and southwest walls separate Room 22 from the rooms on either side, both of which are storerooms with roof entries. In old photographs, what appears to be a sealed doorway may be seen in the northeast wall. This doorway would have given access to a second floor or the roof of Room 23. The former doorway argues against a ceremonial function.

The bench was produced by artificially leveling and paving a natural ledge of bedrock. The niche in the bench is made from a natural crack in the bedrock formed when the block of rock on which Rooms 20, 21, and 22 are located split away from the floor of the cave and settled outward about 18 inches. The niche was constructed by extending the southwest wall down into the crack and by paving the bench, one of the paving stones serving as a ceiling for the niche.

The incised wall designs (Judd 1930: 21, Fig. 2), like those in Room 11, are random design units and are not formal wall decoration.

In summary, Room 22 has several features that set it somewhat apart from other rooms at Betatakin and that resemble features commonly found in Tsegi Phase kivas. Several factors militate against a ceremonial function. First, its unusual features can be explained

on the basis of special circumstances due to the location of the room. Second, the features reminiscent of kiva architecture do not follow the usual kiva plan. For example, in a kiva the ventilator should open beneath the bench, and a very neat ventilator of this type could easily have been constructed by using the natural crack, which instead was walled up to form a niche. The only ventilator in Room 22 is a floor-level hole in the southeast wall. In addition, the deflector and firepit do not conform to the usual linear orientation found in kivas; instead, both lie against the southeast wall near the ventilator. Finally, the small size of the room and especially the low height of the ceiling---67 inches (Judd 1930: 72)---make ceremonial use unlikely. Room 22 probably served as a living room.

Room 55 bears very little resemblance to any other rooms in the ruin (Fig. 16; Table 5). "The east and west walls stand over 7 feet (2.13 m.) in height without trace of beam seatings; unlike any others in the ruin, they measured over two feet thick and include a core of sandstone spalls and adobe faced on each side with masonry" (Judd 1930: 34). Other unusual features include a narrow bench along the north wall, a triangular bench across the northwest corner, niches in the north wall and in the triangular bench, and a row of four loom-anchor holes parallel to the north wall. The south wall is missing and with it any evidence of a southern recess, ventilator, deflector, or firepit which once may have been present; the loss of this wall also renders impossible a decision as to how the room was entered.

Table 5. Architectural Data for Kivas at Betatakin

Architectural Features	Kivas	
	55	NA-3533
Subterranean		x
Pseudo-subterranean	?	
Walls		
Cored	x	
Inside plastered	x	x
Inside smoke-blackened	x	
Floors		
Modified bedrock	x	
Plaster over fill		x
Roofs		
Roof destroyed	x	x
Auxiliaries	-	-
Primaries	-	-
Secondaries	-	-
Closing material	-	-
Matting	-	-
Inferred roof hatches	x	x
Floor-level ventilator present		x
Firepit present		x
Entrybox complex		
Masonry deflector		x
Masonry shelves	2	
Niches	2	
Loom anchors	4	8
Benches		x
Recesses		x
Designs scratched in wall plaster	x	

? - possible presence of feature

- - evidence of this feature destroyed

Room 55 has many features characteristic of Tsegi Phase kivas. Attention should be drawn to four additional facts: (1) the room's location at the front of the village; (2) its large size; (3) the fact that the ceiling was over 84 inches high---the only ceiling in Betatakin (excluding storerooms) which equals the limit of 68 inches established for Tsegi Phase kivas; and (4) it cannot be assigned to a room cluster. To be sure, some aspects of this room differ from other Tsegi Phase kivas. The rectangular shape is rather unusual in the Tsegi but relatively common throughout the Kayenta Branch as a whole. It is not subterranean because it is built on solid rock, a considerable amount of which had to be removed just to level the floor. The cored walls may represent an effort to achieve a pseudo-subterranean effect. Room 55 may be confidently identified as a kiva.

Of the five rooms at Betatakin formerly identified as ceremonial, only one---Room 55---has survived the tests applied to them. Thus, it would appear that Betatakin possessed only one ceremonial chamber, a situation unlikely for a village of this size. In actuality, an additional kiva may have existed east of and adjacent to Room 55 (Anderson 1966b: 62). It is also possible that one or more kivas, which have since been destroyed by erosion, formerly existed in the talus slope in front of the ruin.

In addition, a kiva that undoubtedly belongs to Betatakin is located in a small cave just upstream from Betatakin Cave (Anderson 1966b). This structure and its associated rooms are designated NA-3533. Like Room 55, the kiva is rectangular. In contrast to

Room 55, it is subterranean, being excavated into loose talus out in front of the cave overhang. The structure is lined with masonry of the typical "Kayenta" type. It has a rectangular recess on the north side. The floor features are quite typical of Tsegi Phase kiva architecture (Table 5). The only other structures in this small cave are a surface room adjacent to the kiva and a small chamber located on a large rock shoulder against the back wall of the cave.

On the basis of his work at Betatakin, Fewkes suggested that above-ground rectangular ceremonial chambers with lateral entrances be termed "kihus" in order to differentiate them from kivas, the term kiva to be restricted to "circular chambers" (Fewkes 1911: 15). For a number of reasons the term kihu should be dropped, at least as far as the Kayenta Branch is concerned. First, it was coined with specific reference to Betatakin Room 18 and general reference to a supposed class of similar ceremonial rooms. Since rooms of this type are secular in character, the term is left without a physical referent. Second, although both Betatakin ceremonial chambers are rectangular, one is above-ground, and the other is subterranean. This difference is adequately explained by the physical facts of their respective locations and does not necessarily indicate a difference in function. Undoubtedly each structure was the site of similar ceremonies, and each was involved in a single system of beliefs and attitudes; therefore, it seems unwise to refer to them by different terms which imply different functions. Third, the high degree of similarity between these chambers and other Tsegi Phase kivas indicates that the above-ground structures served essentially the same functions as those

below ground. Finally, a general objection must be raised to the attempt to restrict the term "kiva" to circular structures when in its native language, Hopi, it refers to rectangular chambers.

The problem of ceremonial structures at Betatakin is a thorny one, and it is hoped that this discussion has helped slightly to clarify it. There are two well defined kivas---both rectangular; one subterranean, one above-ground. In addition, there may have been more kivas located on the same rock ledge as Room 55 and in the talus in front of the cave. The data on each of these kivas are presented in Table 5. Information on NA-3533 is taken from Anderson (1966b).

GRINDING ROOMS

At present two chambers, Rooms 56 and 117, can be positively identified as grinding rooms by the presence in them of batteries of mealing bins containing series of metates graded from coarse to fine. The bins were in place when the rooms were originally excavated (Lindsay 1963a: 57; Judd 1930: 48-9). The metates had been removed from the bins in prehistoric times. Judd (1930: 35, 48-9) placed metates recovered from other parts of the ruin into the bins.

Room 16 may have been a mealing room also. Its narrow shape and lack of a front wall conform to the appearance of a number of other Tsegi Phase grinding rooms, especially Room 56 at Betatakin and Rooms 16 and 107 at Kiet Siel. At present there are no metate bins or metates in the room. Cummings' field notes mention the finding of a firepit and three manos (Lindsay 1963a: 52). Since Cummings also referred to the mealing bins in Room 56 as a firepit (Lindsay 1963a:

57) and since the walls of Room 16 are only slightly smoke-blackened, it is possible that the "fire box" in Room 16 was actually part of a mealing bin or bins.

Three mealing rooms are far too few to account for the amount of corn grinding which must have taken place at so large a village as Betatakin. Most activity of this sort probably took place in the living rooms and courtyards. This inference is supported by Cummings' recovery of many metates and of manos from the dwellings and courtyards of Betatakin.

All three grinding rooms appear to be associated with room clusters. Room 16 quite clearly is part of Room Cluster 3. If it is indeed a grinding room it constitutes the best example of such an association at Betatakin. Room 56 probably belongs to the shattered Room Cluster 11. Room 117 is less definitely associated with other chambers but probably belongs to Room Cluster 13. Table 6 includes architectural data on the grinding rooms and a number of rooms whose function is unknown.

COURTYARDS

Betatakin courtyards are in every way typical of the Tsegi Phase. The majority of them were formed from the steeply sloping bedrock by constructing a retaining wall and leveling the floor behind with a deposit of trash or sterile fill. Often the fill was covered with a clay floor. In various combinations Betatakin courtyards possess all the characteristic features of such units except metate bins. The lack of bins is probably an artifact of the vagaries

of preservation, as indicated by Cummings' discovery of many manos and metates in courtyards.

Rooftop courtyards are fairly abundant at Betatakin because of the terraced nature of the construction. Examples of this situation are found in a firepit on the roof of Room 84 (Fig. 13 a) and in Court 34, which probably included the roofs of Rooms 27, 100, and 29.

Walkways such as Courts 28 and 40 are common at Betatakin. Courts 10 (Fig. 14 a) and 99 performed the functions of both courtyard and walkway. Architectural data on the courtyards at Betatakin are included in Table 7.

ROOM CLUSTERS

Room clusters at Betatakin conform quite well to the normal Tsegi Phase pattern (Fig. 13 a). In general, the associations among living rooms, storage chambers, and courtyards are quite regular. No definite associations between room clusters and kivas can be established. Indeed, the presence of NA-3533 in a separate cave, far removed from any room clusters, indicates that there is probably no association between these two features and that they represent the activities of different social units.

While room clusters are easily recognized at either end of Betatakin, they are more difficult to isolate in the middle portion of the ruin. This is a result of two factors: (1) the rooms are much more densely packed in the middle of the village, and (2) this part of the ruin is less well preserved than the sides. There are a few chambers, mostly near the middle of the pueblo, which may

**Table 6. Architectural Data for Grinding Rooms and
Rooms of Unknown Function at Betatakin**

Architectural Features	Grinding Rooms			Rooms of Unknown Function									
	16	56	117	8	9	23	42	47	57	58	73	116	
1st Story	x	x	x		x	x	x	?	x	x	x	x	x
Walls													
1 Jacal			?										
Inside smoke-blackened	x												
Floors													
Modified bedrock	x ^j								x				x
Fill	x ^j	x			x				x	x			x
Plastered	x ^j	x			x				x	x			x
Unmodified bedrock							x	x					
Roofs													
Originally unroofed			?	?		?	?				x		
Roof destroyed	x ^j		?			?	x ^j	?	x			x	x
Auxiliaries	-						-	-	-			-	-
Primaries	-						-	-	-			-	-
Secondaries	-						-	-	-			-	-
Closing Material	-						-	-	-			-	-
Matting	-						-	-	-			-	-
Doorways		A,B											
Sealed		A											
Open		B											
Masonry wall		A,B											
Stone sill		A,B											
High sill		A,B											
Inferred roof hatches							x					x	
Bedrock shelves	x												
Metate bins	x ^{c?}	x	x										
Retaining wall and artificial fill		x											
Doorways open onto													
Another room													

A, B - designates multiple occurrence of the feature

c - presence of feature indicated by Cummings (Lindsay 1963)

j - presence of feature indicated by Judd (1930)

? - possible presence of feature

- - evidence of this feature destroyed

Rooms 52-53, 67-71, 74-77, 91, 94, 96, 101-115, 118-120, 122-124, and 128-135
destroyed; presence determined by pecked grooves

Table 7. Architectural Data for Courtyards
at Betatakin

Architectural Features	Courtyards															
	10	13	19	24	28	34	36	37	40	45	49	83	97	98	99	125
2nd Story						x										
Walls																
Inside smoke-blackened										x						x
Floors																
Fill	x	x		x	x	x		?	x	x		x				x
Plastered	x	x		x				?	x	x		x				x
Unmodified bedrock	x	x	x	x				?		x			x			
Originally unroofed	x	x	x	x	x	x	x	x	x	x		x	x	x	x	
Firepits																
Present	x	x										x ^j	x			
Inferred				x		x						x ^j				
Niches							2									
"Windows"												1				
Holes in floor		x ^{c,j}	x	x												
Loom anchors												2 ^j				
Grinding grooves in bedrock floor		x														
Retaining wall and artificial fill	x	x		x	x	x		x	x	x		x				x
Pecked steps		x		x				x	x			x			x	
Poles						x				x						

c - presence of feature indicated by Cummings (Lindsay 1963)

j - presence of feature indicated by Judd (1930)

? - possible presence of feature

logically be placed in more than one room cluster. Despite the ambiguous nature of the rooms near the middle of the ruin, at least 18 room clusters can be positively identified. The data on these clusters are summarized in Table 8. Figure 18 illustrates the spatial distribution of room clusters and courtyard complexes at Betatakin. Perhaps five or six additional clusters, which cannot now be identified, once existed.

COURTYARD COMPLEXES

Betatakin presents four fairly clear-cut examples of two or more room clusters linked by a common courtyard. Courtyard Complex 1 includes Room Clusters 1 and 2; Complex 2 consists of Clusters 6 and 7; Complex 3 is comprised of Room Clusters 11 and 12; and Courtyard Complex 4 includes Room Clusters 14 and 15. These courtyard complexes are discussed in more detail below.

GALLERY

A striking feature of Betatakin is the "gallery" located on a high ledge at the rear of the cave some 30 feet above the rooms directly below it. It consists of a low wall built along the lip of the ledge. The masonry is reinforced with small sticks set perpendicular to and embedded in the fill behind the wall. A long Douglas-fir pole reaches from the floor of Court 10 to the edge of the gallery ledge. Judd (1930: 52) hypothesizes that this pole was used to reach the gallery. It is possible that the pole was so used, but it would be almost impossible to carry anything up the gallery that way. A series of six wide and deep steps pecked into the bedrock just below

Table 8. Composition of Room Clusters at Betatakin

Room Cluster	Structural Units						Total Number of Rooms
	Court- yards	Living Rooms	Granaries	Store- rooms	Grinding Rooms	Unknown	
	Room Numbers						
1	10	3	1,2	4	-	-	4
2	10	7,11	5,6	-	-	8,9	6
3	13	14	12,15	-	-	-	3
4	24	25	26	-	16	-	3
5	19	18	20,21	-	-	-	3
6	37,40	22	-	23?	-	-	2
7	37,40	39,41	17	-	-	-	3
8	28,34	27,29	31,33,100	-	-	-	5
9	36, 49-50	43	32,44,51	48	-	-	5
10	45	35	46	-	-	-	2
11	-	60	-	59,61	56	57,58	6
12	-	64	-	63,65	-	-	3
13	Roof 121	66,121	-	116,118, 119	117	-	3
14	99,125	126	-	127	-	124	4
15	99	79	78	80,81	-	-	4
16	83	82	84,85	-	-	-	3
17	97	95	-	92,93 94,96	-	-	5
18	98	89	-	86,87 88,90	-	91	6

the base of the gallery wall indicate that a ladder extended from the roof of Room 33 up to these steps, and that access was normally gained in this manner.

The exact function of this structure is unknown. For reasons cited in Chapter 5 it is not thought to be defensive. Indeed, the gallery would be almost useless for defense because of its lack of water. Furthermore, it could not have been a lookout, for it overlooks only the head of Betatakin Canyon; an enemy could approach to within a few hundred yards of the village before being seen from the gallery. The gallery can best be explained as a storage structure admirably suited for this purpose by its dryness and inaccessibility to animal pests.

TRAILS

A number of trails were made on the bedrock floor of the cave so as to permit access to all parts of the village. These trails consist of niches pecked into the bedrock which served as hand and toe holds. There are many such trails, as can be seen on the plan (Fig. 16).

The main trail through the village parallels the route used today by visitors. The approach is from below and to the east, past the spring, and along the top of the talus to the west side of the kiva, Room 55. Here the trail leaves the talus and becomes a set of pecked steps that angle upward to join the main east-west trail at Room 105. The main trail runs eastward across the cave along a natural cleavage plane until it reaches Room 71. Here it angles up

in a series of steps to reach Court 99 and the high eastern tier of rooms. From its juncture with the entrance trail, the main trail runs westward across the raised floor of Court 36 and is lost in the confusion of rooms and courtyards that form the central part of Betatakin. In this area there are several alternative routes to any particular room cluster, all involving passage over roofs and through courtyards. Side trails lead from the main trail to several room clusters.

There are a number of instances of rooms built astride trails, necessitating the rerouting of the trails. Such rooms must have been built later than most others, since only lack of space could account for the blocking of the main trail. For example, Rooms 51, 52, 53, 107, 108, and 109 were built on the main trail. In like manner, Room 122 was built squarely astride the main trail. "Following construction of Room 122 its roof may have been crossed by aid of ladders or the old trail may have been abandoned in favor of the pecked steps one notes higher up on the slope" (Judd 1930: 50).

ABRADING AREAS

Two major abrading areas are present in Betatakin. Both of these are high up in the eastern part of the cave (Fig. 16). In addition to these formalized areas, there are hundreds of individual grooves scattered about the ruin. Most of these are in the bedrock, but some are found in stone doorsills and in the stones of the uppermost course of courtyard retaining walls.

CERAMICS

Three primary sources for the ceramic assemblage of Betatakin exist. Two are survey collections at the Museum of Northern Arizona and at the Arizona State Museum, while the third is the collection recovered in 1963 by Anderson from excavations in thin nonstratified trash deposits (Anderson 1966a). The pottery types represented in these three collections are: Tusayan Corrugated, Moencopi Corrugated, Kiet Siel Gray, Tusayan Black-on-white, Betatakin Black-on-white, Kayenta Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, Kayenta Polychrome, Kiet Siel Polychrome, Tsegi Orange, Tsegi Black-on-orange, and Jeddito Black-on-orange.

Two important facts emerge from the ceramic assemblage of Betatakin. First is the temporal homogeneity of the assemblage as a whole. The maximum time range and the periods of greatest abundance of the indigenous pottery types from the site (Breternitz 1963) are graphed in Figure 19. The only period of time during which all these types occur together is that from 1250 to 1300. With one apparent exception (Tusayan Black-on-red), there is a complete absence of earlier types. Furthermore, the assemblage is identical to that given in Chapter 5 for the Tsegi Phase. The ceramic picture permits no doubt that Betatakin is a single component site, built and occupied entirely during the Tsegi Phase with a maximum possible time range of 50 years (1250 to 1300). This situation provides an ideal opportunity to test the accuracy of ceramic dating against the more refined dating provided by dendrochronology. As a pure Tsegi Phase site, Betatakin

Fig. 19. Temporal ranges of pottery types from Betatakin. The dates are those assigned by Breternitz (1963). Vertical lines represent the total time spans of the types; heavy vertical bars indicate the periods of abundance.

is ideally suited for the type of dendrochronological analyses to be presented here.

The second fact which stands out from the Betatakin ceramic data is the unquestionable presence of Tusayan Black-on-red in a late pottery complex. The absolute lack of any other pre-Tsegi Phase pottery types renders untenable a hypothesis of presence due to an earlier occupation of Betatakin Cave. Its presence in an otherwise pure Tsegi Phase site argues for its inclusion in the ceramic assemblage of that phase. The evidence from Betatakin strongly favors raising Breternitz' upper temporal limit of Tusayan Black-on-red (1200) to conform with the upper limit of 1300 given by Colton (1956) for the same type. Further attention is given to this problem under the consideration of other Tsegi Phase sites.

TREE-RING DATA

The Betatakin collection includes 292 individual tree-ring specimens. There are Betatakin specimens in all three of the institutional collections: the Douglass Collection (BK-series), the Gila Pueblo collection (GP-series), and the Museum of Northern Arizona collection (F-series). The vast majority of the specimens are contained in the Douglass Collection. BK-1 through BK-27 were collected by A. E. Douglass in 1927; BK-28 through BK-267 were collected during my field work in the summer of 1962; BK-268 through BK-279 were collected at the time of my next visit in the spring of 1963; BK-280 through BK-295 were collected by Keith M. Anderson in 1963. GP-4269 and GP-4270 were collected by Deric O'Bryan in 1941. F-3685 and

F-3686 were collected at an unknown date (possibly 1936 or 1937) by an unknown party (John C. McGregor?).

One hundred thirty-three of the 292 specimens could not be dated for reasons discussed in Chapter 6. The pertinent data on these specimens are presented in Tables 9 and 10. The symbols that appear in these tables are explained in Chapter 6.

One hundred fifty-nine of the 292 specimens were dated, a good 54.5%. The quality of the dating is especially evident when the 53 undatable nonconiferous specimens are eliminated. Of the 239 coniferous specimens 66.5% were dated. This high percentage can be attributed to the great number of specimens of Douglas-fir, which exhibits the best chronological characteristics of all the datable species, and to the very distinctive local tree-ring chronology which is one of the most consistent and easily recognized in the Southwest. The data on all the dated specimens from Betatakin are presented in Table 11. The symbols and abbreviations used are defined in Chapter 6.

Table 9. Use-Category and Species of Undated
Tree-Ring Specimens from Betatakin

Use-Category	Species							Total
	DF	JUN	PNN	Pop	Box	Oak	Unkn.	
Roof beams	24	14	1	29	6	1	0	75
Jacal wall posts	0	1	0	1	0	0	0	2
Pole	0	0	0	0	1	0	0	1
Vertical and horizontal logs in masonry walls	1	0	0	1	0	0	0	2
Firepits	0	1	0	0	0	0	0	1
Loose logs in room	0	6	0	1	2	2	0	11
Doorway lintels	1	1	0	0	0	0	0	2
Platform outside door	0	2	0	2	1	0	0	5
Pole to gallery	1	0	0	0	0	0	0	1
Trash excavations	0	8	3	2	0	0	2	15
General and unknown	2	8	1	6	0	1	0	18
Total	29	41	5	42	10	4	2	133

Table 10. Complete and Incomplete Terminal Rings
of Undated Tree-Ring Specimens from Betatakin

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	20	5	25
Juniper	18	8	26
Pinyon	1	1	2
Quaking aspen	23	7	30
Boxelder	4	3	7
Oak	1	0	1
Total	67	24	91

Table 11. Dated Tree-Ring Specimens from Betatakin

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 1</u>								
Primary Beam								
Beam 2	BK-227	DF	Core	C	X	1231	-- 1263L	
<u>Room 2</u>								
Secondary Beams								
Beam 1	BK-231	DF	Core	C	X	1248	-- 1269rB	
Beam 2	BK-232	JUN	Core	C	X	1201	-- 1276+rB	(2)
Beam 3	BK-233	DF	Core	C	X	1253p	-- 1276rL	
Beam 4	BK-234	DF	Core	C	X	1245p	-- 1276rL	
Beam 5	BK-235	JUN	Core	C	X	(1191	-- 1277rB)	Tentative date
Beam 6	BK-236*	PNN	Core	I	X	1200	-- 1276rL	
<u>Room 3</u>								
Primary Beam								
Beam 3	BK-215*	DF	Core	I	X	1202p	-- 1266rB	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 3</u> (cont.)							
Secondary Beams							
Beam 4	BK-216*	JUN	Core	C	X	1189 -- 1255r <u>L</u>	
Beam 5	BK-217	DF	Core	C	X	1236p -- 1258 <u>L</u>	
Beam 6	BK-218	JUN	Core	C	X	1211 <u>+</u> p -- 1277rB	Ring count from pith out to 1225
Beam 8	BK-220*	PNN	Core	C	X	1195 -- 1267r <u>L</u>	
Beam 9	BK-221*	DF	Core	C	X	1189 -- 1261r <u>B</u>	
<u>Room 5</u>							
Secondary Beams							
Beam 2	BK-238	JUN	Core	C	X	1195 -- 1276rB	
Beam 3	BK-239	JUN	Core	C	X	1165 <u>+</u> p -- 1276r <u>B</u>	Ring count from pith out to 1200
Beam 7	BK-243*	JUN	Core	C	X	1172 <u>+</u> p -- 1276rB	Ring count from pith out to 1190

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 6</u>								
Auxiliary Beam								
Beam 2	BK-198	DF	Core	C	X	1226	-- 1276rB	
Primary Beam								
Beam 1	BK-20 BK-197*	DF	1"core Core	I	X	1172p	-- 1273GB	
Secondary Beams								
Beam 3	BK-199*	DF	Core			1194p	-- 1248vv	May be reused beam
Beam 4	BK-200	DF	Core	C	X	1239p	-- 1267L	
Beam 5	BK-201	DF	Core	C	X	1204	-- 1246rL	
Beam 6	BK-202	DF	Core	C	X	1233	-- 1257rB	
Beam 10	BK-204*	DF	Core	C	X	1189	-- 1258L	
Beam 13	BK-207	DF	Core	C	X	1236p	-- 1261rB	
Beam 14	BK-208	DF	Core			1229	-- 1259vv	
Beam 15	BK-209	DF	Core	C	X	1253	-- 1269rB	
Beam 16	BK-210	JUN	Core	C	X	1200p	-- 1257L	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 11</u>							
Primary Beam							
Beam 2	BK-22 BK-186*	DF	1"core Core	I	X	1192p -- 1272r <u>L</u>	
Secondary Beams							
Beam 4	BK-188	DF	Core			1217 -- 1257vv	
Beam 10	BK-190	JUN	Core			1177p -- 1266vv	
Beam 11	BK-191	JUN	Core	C	X	1239 -- 1269rB	
Beam 23	BK-193	PNN	Core	I	X	1118p -- 1270 <u>L</u>	
Beam 24	BK-194	JUN	Core	I		1211 -- 1260+ <u>B</u>	(1)
<u>Room 14</u>							
Primary Beams							
Beam 2	BK-158 GP-4270	DF	Core 1"core	C	X	(1210p -- 1258r <u>B</u>)	Tentative date
Beam 3	BK-159	DF	Core	I	X	1220 -- 1277r <u>L</u>	
Beam 4	BK-160*	DF	Core	C	X	1218 -- 1260r <u>L</u>	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 14</u> (cont.)								
Primary Beams								
Beam 5	BK-161*	JUN	Core	C	X	1175	-- 1261r <u>L</u>	
Secondary Beams								
Beam 16	BK-167	DF	Core	C	X	(1235p	-- 1269r <u>L</u>)	Tentative date
Beam 21	BK-170*	JUN	Core	C	X	1140p	-- 1270rB	
<u>Room 15</u>								
Primary Beams								
Beam 1	BK-171	DF	Core			1214p	-- 1257vv	
Beam 2	BK-172*	DF	Core	C	X	1206	-- 1260 <u>L</u>	
Beam 4	BK-174	JUN	Core	C	X	(1197	-- 1275rB)	Tentative date
Beam 5	BK-175*	DF	Core	C	X	1196	-- 1260r <u>L</u>	
Beam 6	BK-176	JUN	Core	C		1083	-- 1275+rB	(1)
Beam 7	BK-177	DF	Core	C	X	1232	-- 1260rL	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 15 (cont.)</u>								
Secondary Beams								
Beam 9	BK-178*	DF	Core	C	X	1223p	-- 1269r <u>L</u>	
Beam 10	BK-179*	PNN	Core	I	X	1170p	-- 1260rB	
Beam 11	BK-180*	DF	Core	C	X	1210p	-- 1269r <u>L</u>	
Beam 12	BK-181*	DF	Core	C	X	1220	-- 1269r <u>L</u>	
Beam 13	BK-182	DF	Core	C	X	1230	-- 1269r <u>L</u>	
Beam 14	BK-183	DF	Core	I	X	1199	-- 1272 <u>L</u>	
<u>Room 17</u>								
Primary Beams								
Beam 3	BK-128*	JUN	Core	I	X	1210	-- 1263r <u>L</u>	
Beam 4	BK-125*	JUN	Core	I	X	1129	-- 1278rGB	
Secondary Beams								
Beam 7	BK-129	JUN	Core	I	X	1182	-- 1276rB	
Beam 11	BK-130*	PNN	Core	I	X	1187p	-- 1268r <u>L</u>	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 17</u> (cont.)							
Secondary Beams							
Beam 14	BK-126*	PNN	Core	I	X	1203p -- 1268r <u>L</u>	
Beam 16	BK-127*	JUN	Core	C	X	1196 -- 1273v	
<u>Room 18</u>							
Primary Beams							
Beam 1	BK-131*	DF	Core	C	X	1133p -- 1272r <u>GL</u>	
Beam 2	BK-132	DF	Core	C	X	1242 -- 1269rB	
Beam 3	BK-133*	DF	Core	C	X	1233p -- 1269r <u>L</u>	
Secondary Beams							
Beam 8	BK-135	DF	Core	C	X	1241 -- 1272rB	
Beam 13	BK-140	DF	Core	C	X	1199p -- 1272r <u>GB</u>	
Beam 14	BK-141	DF	Core	C	X	(1256p -- 1269rB)	Tentative date
Beam 15	BK-142	DF	Core	C	X	(1233p -- 1259rB)	Tentative date
Beam 21	BK-145	DF	Core	C	X	(1245p -- 1275rB)	Tentative date

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 18</u> (cont.)							
Secondary Beams							
Beam 22	BK-146*	DF	Core	C	X	1232p -- 1269rB	
<u>Room 20</u>							
Auxiliary Beam							
Beam 23	BK-259*	DF	Core	C		1155 -- 1263+ <u>GB</u>	(2) Field notes indicate poss. reuse
Primary Beams							
Beam 3	BK-247	DF	Core	C	X	1231 -- 1269rB	
Beam 4	BK-248	DF	Core	C	X	1223p -- 1269r <u>L</u>	
Secondary Beams							
Beam 7	BK-249	JUN	Core	C	X	1164p -- 1275r <u>GB</u>	
Beam 9	BK-250	DF	Core	C	X	1224 -- 1272rB	
Beam 13	BK-252*	JUN	Core	I	X	1142+ <u>p</u> -- 1272r <u>B</u>	Count from pith to 1152
Beam 16	BK-254	JUN	Core	C	X	1136+ <u>p</u> -- 1275r <u>B</u>	Count from pith to 1149

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 20 (cont.)</u>							
Secondary Beams							
Beam 17	BK-255*	DF	Core	C	X	1132p -- 1264r <u>GL</u>	
Beam 18	BK-256*	DF	Core	C	X	1212p -- 1272rB	
Beam 19	BK-257*	DF	Core	C	X	1179p -- 1272rB	
Beam 20	BK-258*	DF	Core	C	X	1196p -- 1270+rB	(1)
<u>Room 21</u>							
Primary Beams							
Beam 3	BK-150*	DF	Core	C	X	1215 -- 1274 <u>L</u>	
Beam 4	BK-149	DF	Core	C	X	1244 -- 1276r <u>L</u>	
Secondary Beams							
Beam 10	BK-148*	DF	Core	I	X	1197 -- 1273 <u>B</u>	
Beam 11	BK-147*	DF	Core	C	X	1228 -- 1275r <u>LB</u>	
Log on floor	BK-153	JUN	Core	I	X	1186 <u>p</u> -- 1278r <u>B</u>	Count from 1st ring out to 1200

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 22</u>							
Primary Beams							
Beam 1	BK-18 GP-4269	DF	1"core 1"core	C	X	1210p -- 1277rL	
Beam 2	BK-123*	PNN	Core	I		944 -- 1234++ <u>LG</u>	Ring count from 1125
<u>Room 25</u>							
Primary Beams							
Beam 1	BK-14	DF	1"core	C	X	1187p -- 1267L	
Beam 2	BK-15	DF	1"core	C	X	1226 -- 1267L	
<u>Room 26</u>							
Primary Beams							
Beam 1	BK-100	JUN	Core	I		1134p -- 1279++r <u>B</u>	Placed by Judd; ring count beyond 1230
Beam 2	BK-101	JUN	Core	C	X	1158+p -- 1273 <u>GB</u>	Placed by Judd; ring count out to 1180

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 27</u>							
Jacal Wall							
Post 5	BK-111	PNN	Core	I	X	1218p -- 1276r <u>B</u>	
<u>Room 31</u>							
Primary Beam							Roof reconstructed by Judd
Beam 1	BK-102*	DF	Core	C	X	1195 -- 1276r <u>L</u>	Probably original beam
Secondary Beams							
Beam 5	BK-103*	PNN	Core	I	X	1196 -- 1268r <u>L</u>	Placed by Judd
Beam 6	BK-104*	DF	Core	C	X	1238p -- 1267r <u>L</u>	Placed by Judd
<u>Room 32</u>							
Primary Beams							
Beam 2	BK-77	DF	Core	C	X	1195p -- 1277 <u>G</u>	Placed by Judd
Beam 3	BK-78*	DF	Core			1262p -- 1284vv	Placed by Judd

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 33</u>							
Primary Beam							
Beam 2	BK-80	PNN	Core			1211 -- 1262vv	Placed by Judd
<u>Room 35</u>							
Primary Beam							
Beam 3	BK-69*	JUN	Core			1158 -- 1280v	
Jacal Wall, posts supporting pri- mary beams							
Post 2	BK-71*	PNN	Core	C	X	1161p -- 1269rLG	
Post 3	BK-72	PNN	Core	I	X	1165 -- 1274LG	
<u>Room 41</u>							
Secondary Beams							
Beam 4	BK-122	DF	Core	C	X	1232 -- 1276GB	
Beam 5	BK-121	JUN	Core			1119 -- 1253++v	Count from 1190 to outside
Beam 10	BK-120	PNN	Core	C	X	1208p -- 1275rB	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 41 (cont.)</u>							
Jacal Wall							
Post 2	BK-115	PNN	Core			1163p -- 1266++v	Count beyond 1258
Post 3	BK-116	JUN	Core	I	X	1187+ -- 1267rB	Count out to 1200
Post 4	BK-117	PNN	Core	I		1152 -- 1267rG	
Post 5	BK-118	JUN	Core	I	X	(1164+p -- 1276rB)	Tentative date; count out to 1170
Post 6	BK-119	PNN	Core	I	X	1176p -- 1275L	
Firepit	BK-277	PNN	Chcl. frag.			1206 -- 1257vv	
<u>Room 43</u>							
Some beams placed by Judd, but cannot be determined which ones							
Primary Beams							
Beam 2	BK-92*	JUN	Core	C	X	1144p -- 1259rG	
Beam 4	BK-94*	JUN	Core	I	X	1193p -- 1272GB	
Post supporting broken Beam 4	BK-95*	DF	Core	I	X	1148 -- 1276rB	Placed by Judd

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 44</u>							
Primary Beams							
Beam 1	BK-73	DF	Core			1241 -- 1266vv	Stub in E. wall
Beam 2	BK-74	DF	Core	C	X	1211p -- 1270r <u>GB</u>	Placed by Judd
<u>Room 46</u>							
Stub in W. wall	BK-66	JUN	Core			1203 -- 1272vv	
<u>Room 48</u>							
Secondary Beam							
Beam 1	BK-98	JUN	Core	I	X	1135 -- 1277r <u>GB</u>	
<u>Room 59</u>							
Upright post in east wall	BK-84	PNN	Core	I	X	1154 -- 1256 <u>G</u>	
Loose Log	BK-87*	DF	Core	C	X	1238p -- 1269r <u>L</u>	
<u>Room 79</u>							
Primary Beams							
Beam 1	BK-54*	JUN	Core	C	X	1190 -- 1262 <u>LB</u>	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 79 (cont.)</u>							
Primary Beams							
Beam 2?	BK-25	JUN	Wood frag.	I	X	1066p -- 1268v	Loose log; probably companion for Beam 1. Fits beam sockets in walls.
Loose Logs							
	BK-49*	PNN	Core	I	X	1209 -- 1267 <u>B</u>	May be original roof members; when dis- covered roof was intact though crushed by huge rock.
	BK-50	JUN	Core	C	X	1104p -- 1268r <u>LB</u>	
	BK-51	PNN	Core	I	X	1171p -- 1268r <u>B</u>	
<u>Room 82</u>							
Primary Beam							
Beam 1	BK-55*	JUN	Core	I	X	1052 -- 1261 <u>B</u>	
Loose Log	BK-53*	DF	Core	I	X	1224 -- 1270B	
<u>Room 84</u>							
Primary Beam							
Beam 1	BK-56*	DF	Core	C	X	1195p -- 1276r <u>L</u>	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 85</u>								
Primary Beams								
Beam 2	BK-262*	DF	Core	C	X	1213	-- 1248rL	Re-used beam; decision based on external appearance
Beam 3	BK-263*	PNN	Core	C	X	1193p	-- 1275rB	
Secondary Beams								
Beam 8	BK-265*	PNN	Core	C	X	1206	-- 1278rB	
Beam 9	BK-266	DF	Core	C	X	1255p	-- 1278rB	
<u>Room 100</u>								
Primary Beams								
Beam 2	BK-109	JUN	Core			1074	-- 1256+rB	Count from 1240
Beam 3	BK-110	JUN	Core			(1162p	-- 1266rLG)	Tentative date
<u>Pile of loose beams, Room 26</u>								
	BK-4	DF	Wood V-cut	C	X	1217p	-- 1271r	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Pile of loose beams, Room 26 (cont.)</u>								
	BK-5	DF	Wood, V-cut	C	X	1212	-- 1275rG	
	BK-7	DF	Wood frag.			1201p	-- 1266vv	
	BK-8	DF	Wood frag.	C	X	1229	-- 1253r	
	BK-9*	PNN	Wood, V-cut	I	X	1172p	-- 1269r	
	BK-13	JUN	Wood frag.			1209p	-- 1275v	
<u>Pile of loose beams, Room 32</u>								
	BK-268	PNN	Core	I	X	1236	-- 1273rL	
	BK-269	DF	Core			1240	-- 1259v	
	BK-271	JUN	Core			1204 ₊	-- 1271vv	Count out to 1220
<u>Log pile, east end of cave</u>								
	BK-24*	JUN	Wood sec.	I	X	1118p	-- 1269rL	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Log Pile #2</u>							
	BK-29	DF	Core	C	X	1242p -- 1271r <u>B</u>	
	BK-34	JUN	Core	I	X	(1244 -- 1268B)	Tentative date
<u>Log Pile #3</u>							
	BK-36	PNN	Core			1176 -- 1267vv	
	BK-41	JUN	Core	I	X	1119 -- 1276r <u>B</u>	
	BK-43	JUN	Core	C		1204 -- 1267+B	(2)
	BK-44*	JUN	Core	C	X	1160p -- 1269r <u>LB</u>	
	BK-45	JUN	Core	C		1115 -- 1259++r <u>LB</u>	Count beyond 1230
	BK-46	JUN	Core	C	X	1172p -- 1266B	
<u>Talus</u>							
	BK-1	DF	Wood frag.			1201 -- 1242vv	No sapwood; probably 30-40 rings eroded from outside
	BK-2*	DF	Wood frag.	I	X	1072p -- 1260LG	

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Talus (cont.)</u>							
	BK-26*	JUN	Wood. sec.	I	X	1152 ₊ -- 1286rL	Count out to 1190
	BK-61	DF	Core			1167 -- 1221vv	
	BK-274	JUN	Core	I	X	(1163 ₊ -- 1276B)	Tentative date; count out to 1180
	BK-276	DF	Chcl. frag.			1242 -- 1268vv	
<u>Trash Excavations</u>							
	BK-291	PNN	Chcl. frag.			1149p -- 1250++vv	Count from 1227
<u>Uncertain or Unknown</u>							
	BK-16	PNN	Wood. sec.	I	X	1226p -- 1263r	Field notes not clear as to pro- venience; may be Room 41, Loose Log.
	BK-275	JUN	Core			1154 ₊ -- 1262+vv	Count from pith to 1170 (1)

Table 11--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Uncertain or Unknown</u> (cont.)							
	F-3685	PNN	Wood sec.	C	X	1157+p -- 1281cB	Ring count out to 1180
	F-3686	PNN	Wood sec.	I	X	1201p -- 1267r	

For key to headings and symbols, see Chapter 6.

CHRONOLOGICAL ANALYSES

The most important result of any tree-ring dating project is, of course, the derivation of chronological information. The dating of Betatakin may be approached from two different, equally valid viewpoints. First, the dates may be analyzed on a room-by-room basis. In this way the sequence and dates of construction may be perceived, and the rate of growth of the village may be estimated. Second, the dates may be analyzed with reference to the site as a whole. This type of analysis should reveal major concentrations of building activity. When both types of analysis are combined, a more meaningful picture of the dating emerges. These procedures are followed in the ensuing analyses. The chronological inferences presented in this section have been tested by the methods described in Chapter 2.

ROOM CLUSTER ANALYSIS

The room-by-room discussion is organized within the framework provided by the larger structural unit---the room cluster. Thus it is possible to abstract not only a room sequence for the site, but also a sequence of dated room clusters. Under ideal circumstances this should provide important information on the dynamics of the growth of the village. Furthermore, chronological analyses of the rooms as members of room clusters and room clusters as members of courtyard complexes provide insight into the internal relationships and dynamics of these sub-village units. The composition of each room cluster and courtyard complex is presented in Table 8 and Figure 18.

In many cases architectural evidence indicates the order in which two or more rooms were built, and this is mentioned wherever pertinent. Wall abutments are usually good indicators of building sequence; however, several factors render them less valuable for this study than is usually the case. Betatakin was a very well constructed village, and corners were often bonded; furthermore, corner abutments were sometimes reversed at the halfway point. In many cases, abutments could not be determined without removing plaster and mortar, which, of course, was out of the question.

Room Cluster 1

Room Cluster 1 consists of Rooms 1 through 4 which are centered on the extreme southwestern end of the large Court 10.

Living Room

Room 3 was probably built in 1277 as indicated by the date of Beam 6, a secondary. All other dates from this room are earlier and scattered. They exhibit no significant clustering and probably represent reused timbers. The sources of these timbers are unknown. Wall abutments indicate that this room was built before or at the same time as Room 2, also dated at 1277. Sometime after the room was constructed, a doorway in the north wall was sealed. This probably took place when Room 4 was added to the cluster.

Granaries

Room 1. The single date of 1263 from this room probably comes from a reused beam, and does not date the room's construction.

Room 1 could not have been built before Room 2 (1277), since they share a wall and Room 1 is higher than Room 2.

Room 2. The evidence from Room 2 overwhelmingly indicates that it was built in 1277. Four of the six beams were cut in 1276, which suggests that plans were made for building this room in that year. One additional beam was cut in 1277. It should be pointed out that all these trees could have been cut within four months of one another in the early spring of 1277. Beam 1, dated at 1269, is a stockpiled timber.

Storeroom ?

Room 4. Although both Cummings (Lindsay 1963a: 46) and Judd (1930: 10) report the presence of a firepit in Room 4, I would not interpret it as a living room. Both the south and west walls of the room bear a thick layer of plaster, conspicuous for its fresh appearance and complete lack of smoke-blackening. Therefore, no fire has burned in the room since the wall plaster was applied. Since it was general Tsegi Phase practice to apply fresh plaster to the smoke-stained walls of rooms converted from domestic to storage use, I infer that its final utilization was as a storage chamber. Furthermore, because the ventilator which opened through its south wall into Room 3 was not sealed, it probably was not a granary, but rather a general storeroom. The firepit was probably originally located in a courtyard associated with Cluster 1 and was built over when Room 4 was added to the cluster.

Room 4 is badly destroyed and now contains no beams, although Cummings reports that the fallen roof lay on the floor in 1909 (Lindsay 1963a: 47). There are no tree-ring dates, but wall abutments clearly show that it was built subsequent to Room 3 and therefore after 1277. Thus, Room 4 is a storeroom that was built in the courtyard after the room cluster had been in existence for an unknown period of time.

Room Cluster 1 was probably begun in 1277 with a living room, Room 3, and at least one storeroom, Room 2. Room 1, a storage chamber, may have been built at the same time or may have been added later. Room 4, a probable storeroom, was added to the cluster at some later time.

Room Cluster 2

This cluster consists of two dwellings, Rooms 7 and 11; two granaries, Rooms 5 and 6; and two rooms of unknown function, Rooms 8 and 9. Court 10 or a portion thereof served as the courtyard. Fire stains at the outer southeast corner of Room 5 probably mark the location of one of this cluster's outdoor firepits (Judd 1930: 11).

Living Rooms

Room 7. Unfortunately, none of the wood specimens from this room are datable. Wall abutments show quite clearly that it was built after Rooms 5 and 6; thus, sometime after 1276. How long after 1276 cannot be determined, but it is probable that this is a second dwelling added to an already existing Room Cluster 2. Before its construction, Room 6 would have necessarily been entered by way of a

ladder. After the construction of Room 7 its roof served as the easiest means of access to Room 6.

Room 11. The absence of any clustering of dates from this room makes interpretation difficult. The fact that the latest date, 1272, comes from a primary beam may mean that the room was constructed in that year. If so, however, it existed for four years with no associated storage structures. An alternative interpretation is that it was built at the same time as Rooms 5 and 6, using mostly reused and stockpiled timbers. Room 11 is probably later than Room Clusters 3 and 5, both of which were built in 1275. If it had been built before these rooms, more of the beams stockpiled in 1269 should have been included in its roof. In actuality the majority of the 1269 beams are found in Rooms 14 and 15 (Room Cluster 3) and Rooms 18 and 20 (Cluster 5). Apparently most of the stockpiled beams had been used up before Room 11 was built. Therefore, a post-1275 date is indicated. Room 11 was probably built in 1276 along with Rooms 5 and 6 and constituted the original dwelling associated with Room Cluster 2.

Room 11 underwent considerable modification after its original construction. A doorway in the southwest wall was sealed with masonry. The seal was recessed on the inside leaving a six-inch deep niche the size of the original doorway. At the same time a hatchway was cut through the roof near the south corner of the room. A ventilator was made by knocking a floor-level hole through the southwest wall near the south corner. A slab deflector was placed just inside this vent. It is probable that an entrybox and firepit were removed when the doorway was sealed, although concrete evidence for this is lacking.

The present firepit, which lies adjacent to the southeast wall, was probably built at the time of the modifications to the room. In place of a smoke hole in the roof above the new firepit, the builders covered this part of the ceiling with a thick coat of clay plaster, obviously to reduce the fire hazard. These modifications prompted Judd (1930: 12) to infer that Room 11 was originally a living room converted to ceremonial use. For reasons discussed above, I believe Room 11 to always have been primarily secular in function. It is likely that these alterations were undertaken to offset the blast of the wind that would have swept unchecked along the curve of the cave wall into the original doorway.

Granaries

Room 5. The dates strongly indicate that Room 5 was built in 1276. Abutments show that it was built before Room 7.

Room 6 could not have been built before Room 5 directly below it. Yet every date but one from Room 6 is earlier than those from Room 5. The wide range of dates and lack of clustering indicate that Room 6 was roofed with reused and stockpiled timbers. This inference is strengthened by the fact that many of the beams project raggedly beyond the east wall, indicating that they were not cut to fit this room. The latest date, 1276, when coupled with the date of 1276 for Room 5, is good evidence that Room 6 was also built in that year.

Rooms of Unknown Function

Room 8. Only a few courses of the walls of this small structure remain, and no function can be assigned to it. It may have been

a small storage chamber or merely a small platform built in a recess in the cliff wall just above the roof of Room 7.

Room 9 is also fragmentary. Furthermore, its association with this cluster cannot be firmly established, though it remains the most likely possibility. It may have been a storage chamber; it is too small to have been a dwelling. It is also possible that it is a remnant of a retaining wall which enclosed a walkway connecting Courts 10 and 19.

The evidence indicates that Room Cluster 2 was built in 1276. At that time it consisted of at least Rooms 11, 5, and 6. Room 7, another dwelling, was added to the cluster at some undetermined later time. The date of 1276 fits very well with the date of 1277 for Room Cluster 1.

Courtyard Complex 1

In their common relationship to Court 10, Rooms 1 through 11 represent one of the best examples of the structural association of more than one room cluster. Therefore, this group of two room clusters has been designated Courtyard Complex 1. The existence of this larger unit of residence suggests the presence of a social unit of residence larger than the nuclear family. It is significant that there are no apparent broader associations which would enable combining this courtyard complex with any other architectural units. It is also worthy of note that there is no ceremonial structure associated with

this complex. Ceremonial obligations were apparently organized in some other way than by residential groups.

The tree-ring dating indicates that Courtyard Complex 1 was not built as a unit. It is clear that accretion took place by room clusters, with Cluster 2 built in 1276 and Cluster 1 added a year later. Additional rooms, such as Rooms 4 and 7, were added to the room clusters and not to the courtyard complex. Thus, the room cluster stands out as the basic architectural unit of which the complex is composed. Further analysis shows that this holds true for the village as a whole: the basic unit of village growth was the room cluster, not the courtyard complex.

Room Cluster 3

This is one of the best defined room clusters in the site. It is definitely set off from the surrounding rooms and forms a compact, self-contained unit centered on Court 13. The living room, Room 14, opens across the courtyard from Room 12, one of the cluster's granaries. Room 15, also a granary, can be entered only from Room 14, to which it is connected by a doorway grooved to receive a stone slab door. In 1917 a firepit, which has since disappeared, was discovered near the north corner of the courtyard (Judd 1930: 15).

Living Room

Room 14. The wide range of dates and lack of clustering make it impossible to assign an exact date to this room. The presence of only one beam, a secondary, dated at 1269 suggests that most of the beams stockpiled in that year had been used by the time Room 14 was

built. Since most of these beams are found in Rooms 15, 18, and 20, Room 14 is inferred to have been built after these chambers. However, wall abutments and logic indicate that it is contemporaneous with Room 15 which was built in 1275. The primary Beam 3 is probably a repair timber added in the spring of 1277. Modification of the masonry is evident at the point where Beam 3 is seated in the southwest wall. The addition of a third primary at this point may have been necessitated by attrition of the roof caused by the considerable cross-roof traffic which must have taken place after the construction of Room Clusters 2 and 1 in 1276 and 1277. It appears then that Room 14 was built in 1275 and the northwest side of the roof strengthened in the spring of 1277 by the addition of a fourth primary beam.

Granaries

Room 15 also exhibits a wide range of dates. The four dates at 1269 represent stockpiled timbers. The fact that there are more 1269 beams in this room than in Room 14 suggests that it was built first, although probably in the same year. The almost complete absence of 1269 beams in rooms built in 1276 is good evidence that Room 15 was built prior to this date. The two dates at 1275 probably record the year in which the room was built.

Room 12. There are no tree-ring dates from this granary, but wall abutments clearly show that it was built after Room 11 (1276). The presence of ax-grinding grooves in the bedrock floor of the room suggests that it was built after Courtyard 13 had been in

use for some time. Room 12, though not absolutely dated, is without doubt the latest room in this cluster, and postdates 1276.

Room Cluster 3 originated in 1275 with the construction of Rooms 15 and 14 in that order and Court 13. Later another granary, Room 12, was built in Court 13 to complete the cluster as it now stands. For reasons discussed more fully below, this cluster was probably built after Cluster 5, although both were built in 1275.

Room Cluster 4

This is a difficult room cluster to define because it is located in an area of dense room concentration and because many of the rooms in this part of the site are wholly or partially destroyed. Room 26, a probable granary, is assigned to this cluster on the basis of its association with Court 24 as indicated by a series of stone steps and pecked toe holds which rise from the floor of the courtyard parallel and adjacent to the southwest wall of Room 26. There is no such connection between Room 26 and Court 34 on the opposite side. Room 16 is an ambiguous structure which may have been a grinding room. It is quite definitely associated with this cluster. There is a remote possibility that Room 17 belongs to this cluster, but for reasons discussed below this is doubtful.

Living Room

Room 25 is rather well dated at 1267, since both primary beams yielded cutting dates.

Granary

Room 26. The dates from this room have no relevance to its construction, since both beams were placed across the room by Judd (1930: 23). Wall abutments suggest that it was built at the same time as Room 25 (1267).

Grinding Room ?

Room 16. Neither tree-ring dates nor clear-cut wall abutments are available to give a clue as to when this chamber was constructed. It may have existed as early as 1267 when Room 25 was built. However, it could not have existed in its present form until Room 15 (1275) had been erected. It is possible that Room 16 was added to this cluster sometime after 1275 by walling off the southwest third of Court 24.

Room Cluster 4 was begun in 1267 with the construction of the living room, Room 25, and a granary, Room 26. This is the earliest dated room cluster at Betatakin. Room 16 was probably a later addition to this cluster, perhaps sometime after 1275.

Room Cluster 5

This cluster is comprised of Rooms 18, 20, and 21 which are centered on Court 19. Room 18 opens directly onto the courtyard. The roof hatch of Room 20 can be reached only by way of Court 19. Room 21 is assigned to this cluster primarily on the basis of its isolation from Room 22. Despite the fact that it adjoins Room 22, the level of its roof is 30 inches above that of the latter. Judd (1930: 20) infers that the roof hatch of Room 21 was in the south

corner, which, if true, would confirm its association with Room Cluster 5. At present there is no evidence as to the location of the hatch. Court 19 is badly destroyed but does contain a large hole ground into the bedrock, and Judd (1930: 19) reports evidence of open fires near the doorway of Room 18.

Living Room

Room 18. Under the conditions of Assumption Number 6 this room should be dated at 1275. A number of beams stockpiled in 1269 were used in the roof of this room. The fact that two of these 1269 beams are primaries suggests that Room 18 was one of the first rooms to be built using these stockpiled timbers.

Granaries

Room 20 was probably built in 1275, the same year as Room 18. Two of the primary beams belong to the 1269 stockpile. Thus, Room 20 joins Room 18 as one of the first rooms to have been built with the stockpiled beams.

Room 21 was probably roofed in 1276 using timbers cut in 1273, 1274, 1275, and 1276. The absence of any 1269 stockpiled beams supports the dating of this room later than Rooms 18 and 20. It is interesting to note that an unused beam lying on the floor gave a date of 1278---two years later than the roof. Perhaps some repairs or remodeling were contemplated but never carried out. Abutments show that Rooms 20, 21, and 22 were probably built at the same time. Therefore, the tree-ring dates probably should be interpreted as dating the roofing of the rooms rather than their entire construction.

Room Cluster 5 was begun in 1275 with the construction of Rooms 18 and 21. A year later Room 21 was roofed and added to the cluster. The presence of primary beams from the 1269 stockpile in the two rooms built in 1275, coupled with the presence of only secondary stockpiled beams in Room Cluster 3, suggests that although Room Clusters 5 and 3 were built in the same year, the former was under construction before the latter.

Room Cluster 6

Because of the poor preservation of rooms in this part of the site, Room Cluster 6 is rather difficult to define. Only two rooms can be assigned to it with certainty: a dwelling, Room 22, and a probable storage chamber which is now almost completely destroyed, Room 23. A possible second story over Room 23 may have provided an additional storage chamber for this cluster. Other rooms belonging to this cluster may have been located in the area designated 42, where no structures are now in evidence. Unless there was a rooftop courtyard, Rooms 22 and 23 must have been associated with Court 37. The area now occupied by Room 17 may once have been a walkway giving access to the upper level of rooms.

Living Room

Room 22. The single cutting date of 1277 may or may not date the room. It fits well with the dates of Room 20 (1275) and Room 21 (1276). Wall abutments show that all three of these rooms were built at the same time. Abutments also show that Room 22 was built before Room 17 which is dated at 1278.

Certain architectural features hint that Room 22 underwent some modification after its construction. Early photographs show what appears to be a sealed doorway in the northeast wall. This possible entrance is high in the wall and, if it were really a doorway, it would have opened onto the roof of Room 23 or into the hypothetical second-story chamber above Room 23. This is further evidence for the association of the two rooms. This doorway was sealed sometime after the construction of the room. No other modifications seem to have taken place in Room 22.

Storage Chamber

Room 23 is almost completely destroyed and cannot be dated except by association with Room 22 with which it is probably contemporary. There is slight evidence that Room 23 was a two-story chamber. The remnant of high wall fronting Court 40 may actually be part of the back wall of a second-story chamber over Room 23.

Room Cluster 6 is hard to define and difficult to date with any precision. The best interpretation of the single date and the abutment patterns is that it was built in 1277.

Room Cluster 7

This is another cluster that is hard to define. Court 37 is the focus of the cluster. The two dwellings opened onto Court 40 which is really a walkway connected by a pecked step with Court 37 (Judd 1930: 27). A retaining wall enclosed the southeast side of Courts 40 and 37 and apparently separated them from the area numbered

42 on the map. The chief problem with this cluster is the absence of any positively associated storage rooms. Room 17, a storeroom of some sort, is assigned to this cluster chiefly because it lacks definite associations with any other cluster and because of its inferred historical relationship to Room 41.

Living Rooms

Room 39 possesses good architectural evidence for modification and change through time, but the absence of associated tree-ring dates prohibits any attempt to date these architectural modifications. The floor of the northwestern half of the room is solid bedrock. Pecked into the bedrock parallel to the northwest wall is a line of four circular holes, three of which still contain wooden crosspieces. This type of feature is usually interpreted as a loom anchor, and it is commonly found in kivas. All four holes were sealed with plaster and Room 39 was used for some time thereafter. It is rather unlikely, but not impossible, that there was originally a kiva in this spot. It seems more likely that a loom was set up in an open court or in Room 39. Later the loom was taken down and the holes plugged with clay. This may have been done on the occasion of the erection of Room 39 in a formerly open space. It is inferred that Room 39 was built after Room 41 (1276).

Room 41 exhibits a wide range of dates. However, four of the nine dates fall at 1275-76 to produce the only real cluster. It is significant that the latest dates from both the ceiling and the jacal front wall fall at 1276. Thus, Room 41 was probably built in 1276.

Wall abutments indicate that both Rooms 39 and 41 were built after Court 24 and Room 25 (1267).

Charred stubs of roof beams in the walls and jacal wall posts burned off flush with the ground indicate that Room 41 was destroyed by fire. It must have burned while the village was still occupied, for Cummings found unburned examples of such combustible items as bundles of feather cord, a yucca basket, rush matting, and pieces of cotton cloth in the fill of the room (Lindsay 1963a: 60). Apparently the room was cleaned out after the fire and used as a courtyard, trash dump, or both. The burning of Room 41 may have caused the construction of Room 39 next door. It is possible, therefore, that Rooms 39 and 41 were not occupied simultaneously.

Storeroom

Room 17, like many other rooms in Betatakin, has a wide range of dates. The latest date, 1278, which comes from a primary beam, probably dates the construction of the room. Since the southeast wall rests partly upon the closing material of the roof of Room 22, it is logical to infer that Room 17 was built after Room 22, tentatively dated at 1277. The northeast wall of Room 17 is also the southwest wall of Room 41. In its original form this wall extended only as high as the roof of Room 41. At some later time it was built up an additional three feet and extended out to meet the northwest wall of Room 22. The roof and southeast jacal wall were then built to enclose the room. It is clear, therefore, that Room 17 was built after

Room 41. The date of 1278 is thus in line with that of 1276 for Room 41.

The space now occupied by Room 17 may originally have served as a corridor by which the residents of Room Clusters 6 and 7 reached the main cross-village trail that passed over the upper tier of rooms. A series of pecked footholds in the steeply ascending bedrock floor of the room lead from Room 22 up to Court 24 on the upper level. If this were the case, the corridor was soon (in 1278) converted into a storage chamber by raising and extending the northeast wall, adding the southeast wall and a roof, and leveling the southeastern half of the sloping floor with a deposit of trash fill topped by a seal of clay. The hatch was probably placed in the west corner of the roof to take advantage of the already existing pecked footholds which had served the corridor.

Although the interpretive situation is not particularly good, it is possible to reconstruct the history of Room Cluster 7 as follows. The cluster was begun in 1276 with the construction of Room 41 which opened onto Walkway 40. The walkway gave access to a large courtyard located in the area now occupied by Court 37 and Room 39. A loom was erected in this courtyard just outside the northeast wall of Room 41. It is not now possible to isolate any storage chambers that might have been associated with the cluster at this period in its history. A corridor extended northwest from the southwest end of Walkway 40 to give access to the upper tier of rooms. In 1278 this corridor was enclosed and roofed to form Room 17, a storage chamber. Some time

after Room 41 was built the roof and jacal wall were destroyed by fire. Whether this happened before or after Room 17 was built cannot now be determined. The destruction of Room 41 probably caused the loom to be dismantled and another dwelling, Room 39, to be erected in its place. The burned debris was cleared out of Room 41 and the area used as a courtyard or a trash dump or both. A new plaster floor may have been applied to the floor of Walkway 40 at the time of the construction of Room 39 (Judd 1930: 29).

Courtyard Complex 2

On the basis of tenuous evidence for a relationship, I have placed Room Clusters 6 and 7 together in a single unit, Courtyard Complex 2. The reasons for this involve the relationships which both Rooms 22 and 41 exhibit with Room 17. Furthermore, Room 22 cannot be even remotely associated with any courtyard other than Court 37, which is directly associated with Room Cluster 7. Walkway 40 gave the residents of both clusters ready access to Court 37. The dating of the two constituent room clusters shows that Courtyard Complex 2 took shape over a period of two years, 1276 and 1277. Subsequently, a number of modifications took place, chiefly on Room Cluster 7 as a result of the destruction of Room 41 by fire.

Room Cluster 8

This cluster consists of two dwellings and three granaries. The cluster underwent a series of modifications which resulted in differing orientations around at least two different courtyards, Courts 28 and 34. One dwelling, Room 27, opens onto a narrow walkway

which leads to Court 28 where a granary, Room 100, is located. The other living room, Room 29, was entered by way of a roof hatch which gave immediate access to Court 34, a large courtyard which probably occupied the roofs of Rooms 27, 29, and 100. One of the remaining granaries, Room 31, was entered from the roof of Room 29; the other, Room 33, by way of Court 34.

Living Rooms

Room 27. The single date from the jacal wall can only suggest that this living room was built in 1276 or later. Wall abutments show that Room 27 was built before Room 100 and after Room 25 (1267).

Room 29. Although there are no tree-ring dates from this room, a few inferences about its constructional history may be made. Abutments indicate that it was built after Rooms 30 and 100 and therefore after Room 27 (1276). It was probably produced by walling off part of a large courtyard which was located northeast of Room 27. The present Court 28 is a small remnant of the larger court. This was accomplished by extending a jacal wall from the east corner of Room 100 out to the southeast wall of Court 28 and roofing the space thus enclosed. The somewhat anomalous location of the firepit and deflector in this room is probably a result of the use of the firepit which originally belonged to the earlier courtyard.

There is no way to assign an absolute date to Room 29. However, a fairly long interval of time between the beginning of the room cluster (1276) and the addition of this room may be inferred. Room 29 was built after Room 100 which in turn was built after Room

27. Furthermore, enough time elapsed before the construction of Room 100 for a heavy deposit of soot to accumulate on the northwest wall of the large court as a result of use of the firepit located in it. A period of several years between the construction of Room 27 and 29 seems indicated.

Room number 30 was assigned by W. B. Douglass and Judd to a supposed second-story room over Room 29. There is no actual evidence that there ever was such a chamber. The high northeast wall of the room is smooth and unbroken to the top with no holes for either primary or secondary roof beams. The smoothed nature of the top of this wall indicates that it went no higher; therefore, evidence for a roof could not have been destroyed by weathering. Furthermore, the southwest and southeast walls of the room do not extend high enough to have received second-story ceiling beams.

Abutments clearly show that the second-story portion of the northeast wall of Room 29 is a late addition. It is not smoke-blackened above the level of the roof, indicating that it was not in place when the area was used as a courtyard. Additional courses of masonry were added to an extant wall to bring it to its present two-story height. This may have been accomplished when the northeastern half of early Court 28 was converted into the dwelling, Room 29. It could have been done to provide a windbreak for a courtyard which included the roofs of Rooms 27, 29, and 100 and the area designated 34 on the map, which is level with the rooftops of these three rooms. Thus the term Court 34 refers to a courtyard that encompassed the rooftops of three rooms.

Granaries

Room 31. The interpretive problems for this room are compounded by the fact that its roof is the only one at Betatakin which was reconstructed by Judd (1930: 25-6). Only the primary beam is an original timber. The two dated secondary beams are obviously reused, for they are smoke-blackened while the walls and other beams are not. The cutting date of 1276 from the single original beam may record the construction of Room 31. This agrees with the date of 1276 for Room 27. Abutments show that Room 31 was built before either Room 29 or 100.

Room 33. The date from this room is not relevant because the beam from which it comes was placed across the room by Judd (1930: 26).

Room 100. Wall abutment patterns conclusively show that Room 100 was built after Rooms 27 and 31 but before Room 29. Furthermore, the conclusion that it was built partly of materials salvaged from older demolished structures is inescapable. A few of the stones in the masonry walls exhibit unmistakable traces of smudging by smoke, while all the others and the mortar are unsmudged. The smudged stones are randomly distributed throughout the walls, indicating that the blackening could not have been caused by leakage of smoke into the room from the outside. Three of the thirteen roof beams (two primaries and a secondary) are heavily smoke-blackened; the others are completely unsmudged. Thus, at least three of the beams are reused. From this it may be concluded that Room 100 is a late addition to Room Cluster 8 built partly with reused stones and beams. Therefore, the tree-ring dates are probably too early, an inference which is

strengthened by the fact that they are earlier than the date of 1276 for Room 27 which was built before Room 100.

Room Cluster 8 has a complex history. It was begun in 1276 with the construction of Rooms 27 and 31. A large enclosed courtyard was located to the northeast of Room 27. Access to the granary, Room 31, was achieved by way of this court. An additional granary, Room 33, was reached from Court 34 by way of the roof of Room 27. The next event in the history of this unit was the addition of another granary, Room 100, which was built adjacent to the northeast wall of Room 27 and took up part of the large courtyard. Next, the better part of the courtyard was converted into a dwelling, Room 29. This was accomplished by walling off and roofing the portion of the court beyond the northeast wall of Room 100. Possibly as a result of the drastic reduction of Court 28 by the construction of Room 29, Court 34 was extended to include the roofs of Rooms 27, 29, and 100, and became the new center around which Room Cluster 8 was oriented.

It is interesting to speculate on the possible social implications of the events which characterize the history of this room cluster. Among the modern Hopi the chief reason for the addition of rooms to the quarters occupied by a household is the marriage of a daughter or sister and the consequent addition of another husband to the household. It is possible that the marriage of a daughter of the family which occupied Room Cluster 8 caused the construction of Room 29 and thus created a larger household unit. At any rate, evidence from Room Cluster 8 supports the inferences that social units larger

than the nuclear family existed at Betatakin and that they grew by some sort of accretive process, most probably the marriage of female members of the social unit.

Room Cluster 9

Despite its location in an area of high room density and rather poor preservation, Room Cluster 9 is fairly easy to define. It consisted of a dwelling (Room 43), three granaries (Rooms 32, 44, and 51), and a storeroom (Room 48). Early in its history Court 36 probably served as the major courtyard for the cluster. Later a courtyard comprising the area designated Rooms 49 and 50 on the map may have been the primary courtyard.

Living Room

Room 43 is difficult to interpret both in terms of dates and evidence for structural modification. The difficulty with the dates derives from the fact that Judd (1930: 30) "propped a broken beam with a post, replaced two other beams, patched the roof edges with willows and cedar bark..." It is not now possible to determine which beams are original and which were replaced by Judd. Furthermore, Judd's description of the ceiling is curiously inaccurate in that he states that "there were no cross poles" between the five main beams and the Johnson grass closing materials. This room today possesses eight secondary beams laid on top of the primaries. All this may mean that Judd made more extensive repairs to the roof than he indicated or that subsequent, unrecorded restorative work was done on Room 43. As a result of this situation, only one beam can be confidently identified

as original. Beam 4, a cracked primary, is supported by an upright post and therefore must be the broken beam which Judd propped up. It is presently impossible to ascertain which two of the remaining four beams are the replacements put in by Judd. The absence of any timbers from the 1269 stockpile make it unlikely that this room is older than those rooms which contain a number of 1269 beams. The rooms with the most prolific use of 1269 beams are those associated with Room Clusters 5 and 4 which were built in 1275. Therefore, Room 43 should date no earlier than 1276, but could have been built at any time thereafter. The modifications that produced Room 48 suggest that 1276 is probably a good date for Room 43.

Evidence for the original form and subsequent modifications to Room 43 is also hard to interpret. The southwest wall of the room is of jacal construction with a doorway giving into Room 48, a very small storeroom or closet. Judd (1930: 32) infers that room 48 was created by partitioning off part of Room 43 with the jacal wall. The basis for this inference was that a single roof covered Room 43 and 48. Actually, this is not the case; the roof of Room 48 is a separate structure. Therefore, it is possible that Room 43 originally fronted to the southwest instead of the northeast. The doorway through the jacal southwest wall would have opened onto an inclined passageway in the space now occupied by Room 48 which led upward to the level of Court 36 and the entrance to the granary, Room 32. Apparently this area was later roofed over to produce Room 48 and a new doorway made in the northeast wall of Room 43. The absence of a formal sill and lintel in this doorway indicates that it may be a later addition to the room.

The sides of the new doorway would then have been ground down to produce the present smoothed appearance. The new doorway opened onto a probable courtyard located in the area occupied by "Rooms" 49 and 50 on the map. If this reconstructed history is correct, Room 43 underwent considerable modification after its original construction in 1276. The date from Room 48 suggests that this modification was undertaken only one year later in 1277.

Storeroom

Room 48 was probably created by roofing a small passageway, as indicated in the discussion of Room 43. The roof of this room is definitely not continuous with that of Room 43 as suggested by Cummings (Lindsay 1963a: 57) and Judd (1930: 32). The secondary beams in Room 43 do not extend beyond the jacal southwest wall into Room 48. The latter room has no primary beams. Instead, it has two closely spaced secondary timbers which are laid at right angles to the secondaries in Room 43. The single date of 1277 indicates that the conversion of the passageway into the storeroom took place in that year or later.

Granaries

Room 32. Neither date from this room bears upon its construction because both beams were placed in the room by Judd (1930: 26).

Room 44. The single non-cutting date from the room has little significance, except that it shows the wall in which it is embedded to have been built sometime after 1266. Beam 2 was placed in the room by Judd (1930: 31).

A grooved doorway opens through the southeast wall onto the roof of Room 51 and gives indirect access to both Courts 36 and 49-50. In the northeast wall a sealed doorway possesses neither grooves nor loops. The sealed doorway probably was the original entrance to the grinding room, Room 56. I would guess that this doorway was sealed when Room 44 was constructed adjacent to an already existing Room 56. Thus Room 44 was cut off from Room Cluster 11 of which Room 56 is a part.

Sometime after its construction, Room 44 burned. This is indicated by the presence of burned beam stubs and charred wooden door lintels, by the presence of a layer of charcoal and ash on the floor (Lindsay 1963a: 56) and by the heavily smoke-blackened walls. The fire may have taken place while the room was still in use, for Cummings found five "broken jars" inside. At any rate, the room was not used after the fire, since there is no evidence that the damage was repaired or the debris removed.

Room 51 was entered from Court 49-50. Because very little of this room survives, it is impossible to give it a date or to recognize any structural modifications. Wall abutments suggest that it was built after Rooms 43, 44, and 56.

Room Cluster 9 has a complicated history. It originated, probably in 1276, with Rooms 44 and 32, both oriented toward Court 36. At that time the doorway of Room 43 probably opened through the jacal southwest wall onto a narrow passageway which gave access to the higher floor level of Court 36. Apparently this arrangement was found to be

unsatisfactory, and a year later, in 1277, the passageway was converted into a small storage chamber, and a new doorway was made through the northeast wall of Room 43. This entrance gave onto Court 49-50 as did the doorways of Granaries 44 and 51, both of which may have been added to the cluster at this time. It is also possible that Room 44 burned and was abandoned before the remaining rooms of the cluster were deserted.

Room Cluster 10

Because of its somewhat isolated location and its enclosing walls, this is a particularly easy room cluster to identify. The dwelling faces the single granary across the walled courtyard. Access to the cluster must have been across the roof of Room 46, either from the rooms above and behind it or from the roof of Room 47.

Living Room

Room 35 was probably built sometime after 1280 as shown by the non-cutting date at that year from a primary beam. Wall abutments show it to be later than Court 37 to the southwest.

Granary

Room 46 is poorly dated with only a single non-cutting date from a stub in a wall. Wall abutments show that it was built about the same time as Room 35, and, therefore, postdates 1280.

The dating of this room cluster rests on only one date, but there is no evidence for not accepting it as valid. At 1280, Room Cluster 10 is the latest dated unit of its kind at Betatakin.

Room Cluster 11

Considerable deterioration has taken place in this part of the ruin since it was discovered in 1909. Fewkes (1911, Pl. 8) published a photograph, probably taken in 1910, which shows the walls of Room 60/61 standing to their full two-story height. By 1917 most of these walls had collapsed, leaving only remnants with a few beam holes to indicate the level of the floor of Room 60 (Judd 1930: 37, Pls. 16A, 17A). While Judd was working at the ruin, moisture from a snowstorm and vibrations from a clap of thunder caused these remnants to give way and tumble down the steeply pitched cave floor (Judd 1930: 37). The walls which now outline these rooms were laid in place by Judd after the originals had collapsed. Nevertheless, careful use of Cummings' field notes, Fewkes' photograph, Judd's descriptions and pictures, and the evidence still in situ renders this room cluster surprisingly easy to define.

It originally consisted of a dwelling (Room 60), two storage chambers (Rooms 59 and 61), two undefined units (Rooms 57 and 58), and the grinding room (Room 56).

Living Room

Room 60 was probably a second-story living room since it is the only chamber in this cluster which provides enough floor space for use as a dwelling. The floor level was approximately one-third

of the distance between the floor level of Room 59 and the base of the southeast wall of Room 60/61, as shown by the beam holes in the original walls and by a deep pecked groove in the cave floor which crosses the room at this level. Logically, entrance could have been gained in one or both of two ways: through a doorway in the southwest wall of Room 60 which gave onto the roof of Room 57; or through a doorway in the same wall at the level of Room 61 which would have opened inside Room 57. Cummings reports the presence of a sealed doorway in the southwest wall, but he does not say at which level it occurs (Lindsay 1963a: 58). Undoubtedly a hatchway in the floor connected Room 60 with 61. Wall abutments show that Room 60/61 was built at the same time as Room 59.

Storerooms

Room 59. Only one date from this room occurs in an architectural context. It comes from an upright post embedded in the masonry of the northeast wall. The date is early (1256) and probably comes from a reused timber, since it seems most plausible that Room Cluster 11 is late rather than early.

Room 61 is too small to have been anything but a storage chamber.

Grinding Room

Room 56 has no tree-ring dates and can be dated only relatively. The sealed doorway in the southwest wall suggests that the room was built before Room 44. Whether this also means that Room Cluster 11 predates Room Cluster 9 is problematical, since Room 44 is thought to

be a late addition to that cluster. Sometime after Room 56 was constructed a new doorway was made by knocking a hole through the northeast wall into Room 57. This was probably done at the same time that the original doorway in the southwest wall was sealed.

Rooms of Unknown Function

Room 57 was probably a storage chamber of some sort, since the walls are not smoke-blackened. Its rooftop probably served as the courtyard for this room cluster. It is unlikely that Room 57 was itself a courtyard because the amount of fill necessary to level the floor would have rendered the doorway between Rooms 56 and 57 completely impassable.

Room 58 is probably nothing more than a small platform that facilitated entry into Room 59 from the roof of Room 57.

Although it can be fairly confidently defined, Room Cluster 11 cannot be absolutely dated. The single date of 1256 from Room 59 probably has little relevance for the cluster. It seems very unlikely that rooms would have been built in this part of Betatakin until other, much more suitable areas were occupied. The rooms of this cluster are built upon bedrock that is pitched at nearly a 60 degree angle, a precarious situation. Abutments indicate that it was built at the same time or after the adjacent Room Cluster 12 and before Rooms 52, 53, 107, 108, and 109 which were erected directly below, atop the main east-west trail through Betatakin.

Room Cluster 12

This is a rather tenuously defined unit because all the rooms are badly destroyed. It consists of at least Rooms 63-65 and possibly also some of those located immediately to the east. Room 64 was undoubtedly the living room for this cluster. It is not now possible to identify a courtyard. There are no dates from this cluster.

Courtyard Complex 3

Room Clusters 11 and 12 are intimately associated and therefore are included in Courtyard Complex 3. Although it cannot be absolutely dated, Courtyard Complex 3 is inferred to have been built late in the history of Betatakin. The steeply sloping bedrock on which it is located is hardly the ideal site on which to build. Its builders were probably forced to locate here due to lack of suitable space elsewhere. For this reason Courtyard Complex 3 may postdate the latest dated cluster at Betatakin---Cluster 10 which was built after 1280.

The series of rooms located between Courtyard Complex 3 and the kiva, Room 55, may have constituted one or more additional room clusters. Since their existence is indicated only by footing grooves pecked into the rock floor of the cave, very little can be said about them. Those built astride the main trail are probably later than Courtyard Complex 3 and thus may also date in the 1280's.

Room Cluster 13

This cluster possesses two living rooms (Rooms 121 and 66), a grinding room (Room 117), and no recognizable storage chambers. It is

likely that the now completely destroyed Rooms 116, 118, and 119 served this function. Although there are no dates from the cluster, a series of architectural modifications and additions can be distinguished.

Originally the cluster possessed only one living room. This chamber, Room 121, opened onto a courtyard located in the area now occupied by Room 66. At some later time Room 66 was added to the cluster, necessitating modification and reorientation of Room 121. Since Room 66 was erected in a spot where there was not enough space for a full-sized living room, it was raised to a second-story height and its floor made level with the roof of Room 121 by filling the old courtyard with rubble up to that height. To accommodate these modifications the doorway in the east wall of Room 121 had to be sealed. A hatchway probably was cut through the roof at this time to serve as an entry. Since the doorway of Room 66 and the hypothetical new hatchway of Room 121 opened onto the roof of the latter chamber, I infer that this roof served as a new courtyard for the room cluster. If Room 117 corresponded to the Tsegi Phase pattern for grinding rooms and had no enclosing front wall, it would have looked out over this court.

Since Room Cluster 13 is located in a level spot suitable for construction, it is possible to infer that it was not built extremely late in the occupation of the site as were clusters in more inaccessible locations.

Room Cluster 14

This cluster of perhaps four rooms is extremely fragmentary and has no associated tree-ring dates. It is fairly clear from Judd's (1930: 50-1) description that Room 126 was the living room, since it contained a slab-lined firepit and had a jacal front wall and smoke-blackened walls. Room 125 may have been a courtyard or another dwelling, for the cave wall behind it is slightly smoke-stained, and Judd (1930: 50) infers a jacal front wall with a doorway. Rooms 124 and 127 were probably storage chambers, since neither is smoke-blackened. Judd (1930: 51) found a remnant of a jacal south wall in Room 127. The room cluster is located on the large artificially terraced and leveled courtyard-walkway, Court 99, along with Room Cluster 15. Because of its association with Cluster 15 it is thought to have been built early in the occupation of Betatakin.

Room Cluster 15

This cluster is easily defined, as it is completely isolated from all the others. All its rooms open onto Court 99.

Living Room

Room 79 is rather well dated. Although most of the beams in the room are not in situ, it is almost certain that they are original. Sometime after the abandonment of Betatakin a section of the cave roof fell and crushed the ceiling. Judd (1930: 42) removed the fallen rock but not the broken beams. At any rate, Room Cluster 15 is the only probable source for these logs; therefore, the dates are valid for

the cluster. Room 79 was probably built in 1268. Abutments suggest that all the rooms in the cluster were built at about the same time.

The only remodeling evident in Room 79 is a sealed doorway in the northwest wall. This "doorway" is more accurately described as a ragged hole knocked through the wall between Rooms 78 and 79. Its purpose is unknown. It was opened and sealed long before the rooms were abandoned.

Granary

Room 78 is the only positively identified granary. Its grooved doorway opens through the northwest wall onto Court 99.

Storage Chambers

Rooms 80 and 81 were undoubtedly used for storage purposes, but it cannot now be determined if they were granaries. Judd (1930: 42) says they both had jacal front walls. At present there is no evidence at all as to the nature of the front walls of either room. Of course, such evidence could easily have disappeared in the 50 years since Judd made his observations. Room 81 is probably the latest room in the cluster. Ax-grinding grooves on the bedrock floor of the room suggest that this area was once part of Court 99.

Courtyard Complex 4

Room Clusters 14 and 15 are united in their common use of Court 99; therefore, I have included them in Courtyard Complex 4. While Cluster 15 can be fairly securely dated at 1268, no absolute date can be assigned to Cluster 14. Their temporal placement relative

to one another may be inferred from their spatial relationship. Cluster 15 could not have been built until the retaining wall of Court 99 was completed. Cluster 14, on the other hand, was under no such restriction and quite possibly was built before the retaining wall and Room Cluster 15.

Room Cluster 16

By virtue of its spatial isolation from other rooms, Room Cluster 16 is one of the best defined units of its kind at Betatakin (Fig. 13 a). Indeed, it could serve as the "type example" for the room cluster concept. The living room opens onto Court 83. Directly across the courtyard are the two granaries.

Living Room

Room 82. The single cutting date of 1261 may date the construction of this room; however, the fact that Room Cluster 16 was built as a unit makes it probable that this date comes from a reused beam.

Granaries

Room 84. The single cutting date suggests that the ceiling was built in 1276 or later, probably later in view of the dates from Room 85. Beam 1 was probably stockpiled rather than reused.

Room 85. The two dates of 1278 probably record the year in which this chamber was built. Beam 2, which yielded a date of 1248, is highly weathered and discolored in sharp contrast to the fresh appearance of the other beams in this room---a very obvious reused

beam. In fact, it is weathered to such a degree that it looks as if it had lain out in the open for some time; perhaps this was a deadfall that was picked up off the ground and eventually incorporated into this roof.

Room Cluster 16 was undoubtedly built as a unit, probably in 1278. This is one of the later dated clusters, a fact which might be inferred even without the tree-ring dates, for it is perched rather precariously on a narrow, somewhat hard-to-reach ledge overlooking the spring. It is not likely that this location would have been chosen until other more suitable spots in the cave had been taken up with other rooms.

Room Cluster 17

Because of its exposed location outside the sheltering vault of the cave, this cluster is poorly preserved. It probably consists of a single dwelling (Room 95), perhaps as many as four storage chambers (Rooms 92, 93, 94, and 96), and Court 97. With the exception of Room 95 which has a doorway opening onto Court 97, it is impossible to determine the orientation of any of the rooms. Of course, no wood has survived in this area and there are no dates.

Room Cluster 18

Like Room Cluster 17, this cluster is exposed to the elements and is poorly preserved. It consists of one dwelling (Room 89), possibly five storage chambers (Rooms 86, 87, 88, 90, and 91), and Court 98. Rooms 89 and 87 face each other across Court 98, and Room

88 seems to have been entered through a roof hatch. The orientation of the other rooms cannot be determined. Once again there are no dates because of poor preservation. The only evidence for remodeling is a sealed doorway in the west wall of Room 89.

Although there are no tree-ring dates from either Cluster 17 or 18, a relative date may be assigned to them on the basis of their location. Situated as they are outside the cave proper, they were probably built after all available space in the cave had been occupied. Therefore, they are probably among the latest room clusters at Betatakin. On the basis of the dates from rooms inside the cave, it is probably safe to infer that Room Clusters 17 and 18 were built sometime in the decade following 1280. These two clusters, along with those represented by the rooms built on the main cross-cave trail, probably constitute the latest observable construction activity at the site. Figure 20 illustrates the sequence and dates of addition of room clusters at Betatakin.

DATE CLUSTER ANALYSIS

The second approach to the data ignores the exact provenience of the specimens, and considers all the dates together as a unit. The primary consideration in this type of analysis is the clustering of cutting dates. Assuming that the majority of trees were cut while still living, the date clusters record the years in which certain numbers of trees were cut for constructional purposes by the inhabitants of Betatakin. Theoretically, the periods of tree-cutting activity

should correspond fairly closely to the construction periods derived from the room-by-room analysis.

The distribution of cutting dates per year at Betatakin is graphed in Figure 21. There are a few scattered dates throughout the 1250's. The number of dates gradually increases and culminates in the first significant cluster at 1260. After 1260 the number of cutting dates per year falls off to a low of zero at 1265. Tree-cutting activity was renewed in 1266 and reached a plateau in 1267 and 1268. In 1269 more trees were cut than in any other single year during the life of Betatakin. A sharp drop occurs after 1269 until a new peak is reached in 1272. Following 1272 there is another two-year drop in the number of cutting dates followed by a sharp rise in 1275 and the second highest peak in 1276. After 1276 the number of dates per year drops off rapidly until the latest date is reached at 1286. Thus, trees for use in the construction of Betatakin were being cut from about 1250 until 1286, with five years in which tree-cutting activity reached peaks.

The correspondence between the date clusters and the dates of individual rooms is fairly good, although, as might be expected, there tends to be a slight lag in the room dates. Rooms built in 1267, 1268, 1275, 1276, and 1277 have been identified (Fig. 20). There are no rooms, however, which can be associated with the dates in the 1250's or with the cluster at 1260. The rooms which have beams dating in this range clearly were built much later. Room 6, which could have been built no earlier than 1276 but which has a wide range of early dates, is an excellent example of this. It looks as if the

Fig. 21. Number of cutting dates per year from Betatakin.

beams which date prior to 1267 were reused in the rooms in which they are now found. The structures in which these beams were originally used apparently have entirely disappeared. It may be that the earliest inhabitants of the cave lived in houses constructed of wood and other perishable materials. These perishable structures might later have been abandoned, torn down, and some of their components reused as building material in the later rooms. An alternative interpretation of these facts is that during the 1250's and early 1260's the occupation was sporadic, perhaps drawn to the cave by the spring. The cave may have served as a camping place or a seasonal abode for people who may have been affiliated with the group that later built Betatakin.

The greatest anomaly in the Betatakin data is the fact that although the greatest number of trees was cut in 1269, there is not a single room that can be dated in that year. In fact, it was not until 1275, six years later, that additional rooms were built. The question as to why so many trees were cut in 1269 and not used for six years or more cannot, of course, be answered with absolute certainty. Two possible explanations suggest themselves. First, the founders of Betatakin may have laid in a supply of building materials for use as new families were added to the village by the marriage of village women. This seems unlikely in view of the large number of trees cut and the small number of people inferred to be present at that time. The absence of any evidence for similar stockpiling at other Tsegi Phase villages also argues against this interpretation.

The second alternative is the more likely of the two, but remains a hypothesis. The best way to explain the tree-cutting activity in 1269 is that the people were expecting a forthcoming immigration to produce a rather immediate and fairly large addition to the population. Perhaps the 1267-68 settlers were only the advance guard of a group of people who were planning to move into Betatakin Cave. The cave had been used rather sporadically since about 1250, and, perhaps as a result of this familiarity, a particular group decided it might be a favorable place to establish a new village. A small vanguard might then have been sent out to establish residence in the cave and prepare it for habitation by the entire group. Undoubtedly, there were many things which would have had to be done to get the cave ready for occupation by a large community. For instance, large rocks which had fallen from the roof of the cave would have to be broken up and removed, and the trees and brush which probably grew in the cave then just as photographs show they did when the site was discovered in 1909 would have to be removed. Apparently the felling of a large number of trees for construction purposes was also one of the vanguard's duties.

None of the stockpiled timbers was used until 1275, which marked the beginning of an influx of population and a period of building activity that lasted through 1276 and 1277. Thus, for a seven-year period from 1268 to 1275 there were no new arrivals at Betatakin Cave. It would seem, considering that a stockpile of timbers was laid by in 1269, that the main group might have been expected sooner. If this is so, the main group may have been delayed for a couple of years. On the

other hand, it may be that a two- or three-year period was planned on to let the newly cut beams season for a time.

ABANDONMENT

The problem upon which the least light is shed by the tree-ring data is the date of the abandonment of Betatakin. Tree-ring dates are poor indicators of the end of anything; by their nature, if they date anything at all, they date the beginning of something. Trees were not likely to be felled by people who were planning to leave a village and move on. Conversely, the cutting of trees, as reflected in the tree-ring dates, indicates that in a year in which trees were felled, someone was planning to do a little building of one kind or another. If the village was not thriving, at least some of its inhabitants were not, in that year, anticipating a move. Therefore, the latest date from a site probably dates the end of construction, but may have little or no relationship to the abandonment of the site.

Another, entirely different type of problem plagues any attempt to date the abandonment of a cave site such as Betatakin. In a cave, even one as large as Betatakin Cave, there is a definite limit to the size of any village which might be built in it. There is only a certain amount of floor space, and after that is filled with rooms there is nowhere left to build but outside the cave. Therefore, construction may have ceased not because the population declined or because the village was abandoned, but because there was no room in which to build any additional structures. Room Clusters 17 and 18 may have been built where they were for this very reason. This is a

problem that generally is much less acute in open sites, where rooms usually may be added at will. Consequently, the potential for dating abandonment is greater for an open site than for a cave site. At Betatakin, this factor is probably of some importance.

The excellent preservation characteristic of dry caves works against obtaining a good estimate of the time of abandonment, in that repair timbers are less likely to be needed than in an open site where the effects of the weather are much more pronounced. Roofs which are in excellent shape after 700 years probably needed few repairs in the 30 to 50 years during which the site was occupied. Consequently, repair timbers, which might be expected to yield dates later than original beams, are nearly absent. At Kiet Siet there is considerable architectural and dendrochronological evidence for building, remodeling, destroying, and rebuilding. Betatakin exhibits less evidence for this kind of activity; it was apparently built and then left relatively unchanged until abandoned.

The latest date from Betatakin is 1286, which comes from a log which is not in situ. Nevertheless, this date indicates that in 1286 people were still living in Betatakin, and at least one person was in need of a beam with which to construct something new or to patch something old. Furthermore, the fact that a live tree was cut down suggests that all the rooms were occupied at that time. It is likely that, if parts of the village were abandoned, the prospective builder would have helped himself to a beam from an abandoned room rather than cutting down a living juniper tree with a stone ax. Consequently,

I infer that as late as 1286 Betatakin was a flourishing village, at or very close to the peak of its population.

If Betatakin was a vital, populous village as late as 1286, when then was it abandoned? It could have been as early as 1287 or considerably later. The tree-ring dates give no further clues; the rest must be reconstructed on the basis of architecture, ceramics, and inference. The lack of evidence for extensive rebuilding and alterations suggests a rather short occupation. Kiet Siel, which was occupied for approximately 50 years, has undergone much remodeling. Other Pueblo villages, both prehistoric and modern, characteristically give evidence of modification and rebuilding. Ceramics, too, show that Betatakin was occupied for only a short time. It is problematical as to how long a village is likely to exist with no tree-cutting going on at all. However, with due regard for the special conditions of cave living, 30 years is probably the maximum allowable limit. The traditional date of 1300 for the abandonment of the San Juan drainage and the end of Pueblo III is probably very nearly correct for the abandonment of Betatakin. Whether the abandonment was gradual or sudden cannot be determined. The discoverers of the site apparently found no evidence that it was abandoned suddenly; at least there are no comments to this effect.

NONCHRONOLOGICAL

POPULATION ESTIMATES

The order and time interval at which rooms and room clusters were added to Betatakin permit an estimate to be made as to the rate

and possible causes of population growth within the village. Three factors limit the extent to which generalizations on population may be made and prescribe the degree of confidence which may be placed on such generalizations. First, it is not possible to precisely define each and every room cluster at the site. In several areas preservation is so poor that distinctions have been obliterated. Second, the households undoubtedly varied in size; therefore, a population estimate must be based on an estimated average, thus introducing another possibility for error. Third, not all the room clusters can be precisely dated. If each room cluster could be defined and dated, population estimates would be easier; unfortunately, however, this is not the case. If the above limitations are kept in mind, an attempt can be made to estimate the rate and nature of the fluctuations in population at Betatakin. Such an estimate may be wrong in some details, but it should present a fairly accurate picture of general trends.

A word should be said about the methods used in estimating the number of people who inhabited the site. Ideally, it would be best to proceed on the basis of the room clusters, since those seem to be the basic units of residence. However, the room clusters vary in size; therefore, an estimated average number of people per room cluster would be meaningless and would probably yield inaccurate results. Consequently, the number of living rooms will be used as a basis for a population estimate. It is not known, of course, how many people constituted the average nuclear family at Betatakin, but Turner and Lofgren's (1966: 127) estimate of about five people per "household" in the period from 1200-1300 for northern Arizona is

probably as good an assessment as can be made. It agrees with other estimates based on different types of data. There are 22 identifiable living rooms plus an unknown number that has been destroyed by natural agencies since the site was abandoned. Probably there were no more than five living rooms that are no longer discernible. Thus, a final figure of about 25 living rooms is close enough for the rather gross estimates which can be made here. Using the figure of five people per living room, the maximum prehistoric population of Betatakin was probably about 125 persons.

The general trends of the population curve can be estimated on the basis of the dating of various room clusters (Fig. 20), but because not every cluster is dated, more specific estimates are impossible. During the 1250's and early 1260's the population of the cave was low and very likely transient. About 1267 the first permanent population increment was added to the cave when at least three households settled there. From 1275 through 1277 there was a sharp rise in population as at least ten new room clusters were built. After 1277 the population probably grew at a fairly steady rate; one room cluster was built in 1278, one in 1280 or shortly thereafter, and probably at the very least two more after 1280. The gradual increase continued until the peak of about 125 persons was reached in the mid-1280's. After 1286 there is no evidence bearing upon the nature of the population. Quite probably there was a rather gradual decline as families left the village one by one or in small groups until finally the last family or families pulled out and left the village deserted.

It may be, however, that the village was abandoned abruptly by its entire population which moved en masse to another area.

The Betatakin data permit the objective isolation of two different types of village growth. These two types may be inferred for any archaeological site or ethnographic village, but only rarely can they be recognized and delimited with such precision as is the case at Betatakin. These two types are: (1) growth by immigration, and (2) natural accretion resulting from the creation of new families by marriage. Immigration was responsible for the 1267-68 and 1275-77 population increments at Betatakin. The five or more room clusters added after 1277 may represent the households established by newly married couples. The new living rooms added to Room Clusters 2, 8, and 13 almost certainly represent this second type of accretion.

REUSE OF TIMBERS

Reuse of structural timbers is a practice which may be inferred for almost any site that was occupied for a long period of time. Indeed, the reuse of timbers often introduces a confusing factor into the interpretation of tree-ring dates (Bannister 1962: 509). At a site such as Betatakin with a relatively short span of occupation, reuse does not present as much of an interpretive problem as it does at sites such as Pueblo Bonito or Chetro Ketl, which were inhabited for much longer periods. Nevertheless, there is good evidence that during their short 30- to 50-year occupation of Betatakin Cave, the villagers found ample opportunity to salvage beams from old, abandoned structures and reuse them in their own rooms.

Beams which can be interpreted as reused are found in 14 of the dated rooms. Perhaps the best and most conclusive instance of the reuse of timbers is found in Room 6, which was built in 1276. Ten of the eleven dated beams were cut before 1276 with cutting dates ranging from 1246 to 1273. Four of these dates (Beams 6, 10, 14, and 16) fall at 1257-59 to form a weak cluster which has little significance for Room 6. Beam 4 was cut during the building activity in 1267-68, but whether it was reused from a structure built at that time cannot be determined. Beam 15 was probably part of the stockpile of timbers laid up in 1269 and is not a reused beam. Room 3 also presents good evidence of extensive reuse of timbers. This room, probably built in 1277, has beams with cutting dates ranging from 1255 to 1277 which show no clustering at all.

Almost all the reused beams were used originally in structures built in the 1250's and early 1260's. The small number of dated beams from this period indicates that early structures probably were never numerous. Apparently, the earlier structures were completely torn down, for there are now no rooms which can be dated in that time period; all the early beams are now included in rooms built much later. It is interesting that these beams apparently were not reused until the construction activity in the middle and late 1270's. Either the people who built in 1267-68 did not want to use the timbers from the earlier structures, or the latter were still being used and were not abandoned until the 1270's.

STOCKPILING OF TIMBERS

Stockpiling of timbers for future use is practiced by the modern Pueblo Indians, and may be inferred to have been practiced by the prehistoric Pueblos also. Prehistoric stockpiling of timbers at Chetro Ketl in Chaco Canyon has been demonstrated by Bannister (1965: 151). Surprisingly, even better evidence for this practice is found at Betatakin---a much smaller and shorter-lived site than Chetro Ketl.

Figure 21 shows that more trees were cut in 1269 than in any other year, but, as discussed in a preceding section, there is not a single room which can be dated in that year. In a like manner, none of the ten timbers cut in 1272 was used in that year. All the 1269 and 1272 beams were used during the major flurry of building activity in the mid-1270's. This situation is a rather clear-cut example of the stockpiling of timbers for use in future years. The exact nature of the stockpiling and the specific reasons behind it cannot be known today. However, the data do allow some deductions to be made. These were developed at length in a preceding section and need not be repeated here. Suffice it to say that the small vanguard of people which settled in the cave in 1267-68 had as one of its duties the cutting and stockpiling of timbers for use in rooms which were to be built by the rest of the villagers when they arrived.

The distribution throughout the ruin of beams cut in 1269 is very interesting. Four of the nineteen beams were not in an architectural context and may be eliminated from consideration. Eleven of the remaining fifteen come from only four rooms which belong to only two room clusters. Both clusters were built in 1275. Rooms 18 and 20

of Room Cluster 5 have primary beams dating in 1269, and Room 18 also has secondaries dating in that year. On the other hand, in Rooms 14 and 15 of Room Cluster 3 the only beams dated at 1269 are secondaries. Apparently beams of two sizes were cut in 1269: larger ones to be used as primary timbers and smaller ones to be used as secondaries. All the primary-sized beams must have been used in Room Cluster 5, leaving only secondary-sized ones for use in Cluster 3. The cutting of standardized beams may in part account for the strikingly uniform dimensions of these rooms; they were all built of a size to accommodate the pre-cut beams. Room 6, however, is much smaller, and the 1269 secondary projects far beyond the east wall of the room. Since one end of the remaining 1269 timber---a support post for a primary beam in Room 35---is buried in fill, its length cannot be estimated.

The distributional pattern of beams cut in 1272 parallels that of the 1269 beams. Seven of the 1272 timbers occur in Rooms 18 and 20 of Room Cluster 5. One of these is a primary, the other six are secondaries. A single secondary in Room 15 of Cluster 3 dates at 1272. A primary beam in Room 11 belongs to this stockpile as does a secondary-sized primary beam in Room 43. Both Room 11 and Room 43 were built in 1276.

The supply of beams cut in 1269 and 1272 was apparently exhausted during the major period of building activity of 1275 to 1277. With the exception of Post 2 in Room 35, no rooms built after 1277 contain any of the beams stockpiled in 1269 or 1272.

TREE-CUTTING ACTIVITIES

The time of year in which a tree was cut can be determined by the nature of the last increment of growth. If the terminal ring is complete, the tree died or was killed after it had completed its growth for that year. If the last ring is incomplete, the tree died sometime during its growing season. The data from Tables 10 and 11 on the nature of terminal rings are summarized in Table 12. These data are arranged according to species.

Table 12. Terminal Rings from Dated and Undated Tree-Ring Specimens from Betatakin

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	79	14	93
Juniper	43	29	72
Pinyon	7	20	27
Quaking aspen	23	7	30
Boxelder	4	3	7
Oak	1	0	1
Total	157	73	230

There are fewer than the total number of specimens because the terminal ring is not present on all specimens. The preponderance of complete over incomplete terminal rings is marked; there are 157 specimens with complete last rings and 73 with incomplete terminal rings, or 68% with complete final rings.

Unfortunately, there have been no studies of tree growth in the Tsegi, so the growing season for each species in this area is not known. Nevertheless, estimates may be made on the basis of general information and on data gathered from nearby areas which have been systematically investigated. The most comparable area which has been studied is the Mesa Verde, where the Laboratory of Tree-Ring Research has undertaken detailed physiological and climatological investigations.

Douglas-fir radial growth on Mesa Verde begins about May 1 and ends in June (Fritts, Smith, and Stokes 1965: 104-6, Fig. 3). Increment cores collected in the Tsegi in 1962 and 1963 show that Douglas-fir annual growth ceases by the middle of July at the latest; thus, the end of the growing period is probably comparable to that of Mesa Verde. Of the Douglas-fir trees from Betatakin 84% were cut after the cessation of growth, in other words, sometime between the end of June and the following May 1.

Of the aspen specimens 77% were cut after growth had ceased for the year. Unfortunately, no studies have been made of aspen growth in the Southwest, and there is no basis for assessing the time of year in which these trees were felled. The seven boxelder specimens present no conclusive evidence, and even if they did there have been no studies of boxelder growth in the Southwest.

Only 60% of the juniper trees were cut after the growing season had ended, a percentage significantly lower than those for Douglas-fir and aspen. No specific studies have been made of juniper growth; however, David G. Smith reports that the growing season of

this species is probably later than that of Douglas-fir, and probably takes place over a span of about three months during the summer. Thus, 60% of the juniper trees were cut late in the summer or during the following fall, winter, or spring; 40% were cut during the summer growing season.

Pinyon represents an even greater drop in the frequency of completed outer rings; nearly three-fourths of the specimens have incomplete final rings. Only 26% of the specimens were cut after the growing season, while 74% were cut during the growing season. On Mesa Verde pinyon growth "begins in early June and ends in late July or August" (Fritts, Smith, and Stokes 1965: 120). This growth period is considerably later than that for Douglas-fir; in fact, pinyon is just beginning to grow as Douglas-fir ceases growth for the year. Of the pinyon trees 74% were cut sometime during the period spanned by the months of June (last half), July, and August, while 26% were cut sometime between the end of August and the following June. A statistical analysis of the frequency distribution of complete and incomplete outer rings among the three datable coniferous species whose growth seasons are more or less well known is presented in Table 13. Expected frequencies (fe) are included in parentheses below the observed frequencies (fo).

Table 13. Chi Square Analysis of
Terminal Rings from Betatakin

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	79 (77.50)	14 (15.50)	93
Juniper	43 (54)	29 (18)	72
Pinyon	7 (20.25)	20 (6.75)	27
Total	129	63	192

Level of Measurement: Two nominal scales

Model: Independent random samples

Douglas-fir has a two-month growing season

Juniper has a three-month growing season

Pinyon has a three-month growing season

Hypothesis: The distribution represents a random sampling of
trees throughout the year.

Cell	fo	fe	fo ²	fo ² /fe
a	79	77.50	6241	82.00
b	14	15.50	196	12.64
c	43	54.00	1859	34.25
d	29	18.00	841	46.70
e	7	20.25	49	2.42
f	20	6.75	400	59.30
Total	192	192.00		237.31

$$\chi^2 = 237.31 - 192.00$$

$$\chi^2 = 45.31$$

$$P < .001 \text{ (p .001 = } \chi^2_{df=2} \text{ of 13.815)}$$

The hypothesis may be rejected at the .001 level of confidence.

The analysis tests the hypothesis that this particular frequency pattern could have been produced by chance under the assumption of random selection throughout the year. The expected frequencies were calculated on the basis of the known growing season for each species. For example, under the assumption of random sampling throughout the year, one-sixth of the total number of Douglas-fir specimens would be expected to exhibit incomplete outer rings, since the two-month growing season of this species comprises about one-sixth of the year. The expected frequencies for pinyon and juniper were computed on the basis of three-month or one-fourth year growing seasons. The Chi square value of 45.31 shows that there is far less than one chance in 1000 that this distribution could have been achieved by random sampling under the indicated assumptions. Thus, the hypothesis that the trees were cut at random over the whole year is convincingly rejected. Even the simpler hypothesis that the frequencies observed constitute independent random samples achieves a probability of less than one in 1000 ($\chi^2_{df=2} = 34.35$) and can also be rejected. This particular distribution cannot be due to chance and therefore must reflect some sort of patterned rather than random behavior on the part of those who felled the trees.

The significance of the above results can be tested further by using the dated specimens which exhibit clustering. This procedure is justified under the assumption that trees cut in the same year were cut at the same time. No single cluster has a large enough number of dates to permit an accurate statistical assessment of its significance. Therefore, the data on the completeness of the outer ring

for the eight major date clusters are lumped together. A "major" date cluster is arbitrarily defined as one with five or more dates. The clusters fall at 1260, 1267, 1268, 1269, 1272, 1275, 1276, and 1277. The expected frequencies are calculated on the basis of the percentages of complete and incomplete rings in the total sample. This analysis is presented in Table 14. The specific hypothesis to be tested is as follows: the observed frequencies of complete and incomplete rings among dated specimens belonging to the eight major clusters do not differ from the frequencies of the total sample. The calculated Chi square value of 2.51 indicates that such an observed distribution could be randomly drawn from the total population of all specimens about once in four attempts. Thus, the hypothesis cannot be rejected, and added significance is given to the pattern identified by analysis of all the specimens with a true outside.

The distributional pattern of complete and incomplete terminal rings may be used as a foundation for some inferences as to the time of year preferred by the Betatakin villagers for the cutting of trees. First of all, it is certain that, if there was a need, trees would be cut at any time of year. The fact that at least a few trees of each species were cut during the growing season bears this out. On the other hand, the tendency of dates to cluster at particular years indicates that on occasion a number of trees were felled in one operation. It is with reference to these trees that inferences as to the time of year tree-cutting activity took place are valid.

The data on the nature of the terminal rings, when correlated with the information on growing seasons, point insistently to the

Table 14. Chi Square Analysis of Terminal Rings
from Dated Specimens from Betatakin

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	40 (38)	5 (7)	45
Juniper	12 (14)	12 (10)	24
Pinyon	4 (4)	12 (12)	16
Total	56	29	85

Level of Measurement: Two nominal scales

Model: Independent random samples

Hypothesis: Observed frequencies among dated specimens do not
differ from frequencies of the total sample.

Cell	fo	fe	fo ²	fo ² /fe
a	40	38	1600	43.25
b	5	7	25	3.58
c	12	14	144	10.28
d	12	10	144	14.40
e	4	4	16	4.00
f	12	12	144	12.00
Total	85	85		87.51

$$\chi^2 = 87.51 - 85$$

$$\chi^2 = 2.51 \text{ (p. } 30 < 2.51 < \text{p. } 20)$$

The hypothesis cannot be rejected.

conclusion that the preferred time to cut building timbers was in the late summer, probably beginning in late July and continuing on perhaps into September. This is the only time the characteristic distribution of 84% complete Douglas-fir rings, 60% complete juniper rings, and 74% incomplete pinyon rings could have been produced as a result of large-scale tree-felling activities. In the agricultural round of the modern Hopi this activity would fall between the green corn harvest near the end of July and the major harvest of mature corn which begins about September 25 (Hack 1942: 20, Fig. 9). Since the Kayenta people seem to have lacked the Katsina cult and its associated behavioral patterns, it may be doubted that they were concerned with the harvest of green corn, which among the Hopi is intended for use in the Niman Katsina Ceremony. This period of about two and one-half months---late July, August, and September---while the corn was maturing might be expected to mark a lull in agricultural activity during which the men's attention could safely be turned away from the fields to other pursuits until time for the harvest near the end of September. Perhaps the women took a hand in looking after the fields during this period when little hard labor would be required. The months after the harvest might also have been used for the felling of trees; however, as discussed above, the data strongly favor the earlier date.

The foregoing inferences may be used as a basis for a further inference as to the time of year during which construction took place. Again, it must be said that if the need arose, building activity was probably undertaken at any time of year except during the harvest. Nevertheless, it is safe to infer that most of the

building took place late in the fall after the harvest and perhaps on into the winter. It is probable that from May through September most of the men's time was taken up with agricultural and tree-cutting activities, with little time left for actual construction work.

Several bits of evidence combine to suggest that much of the tree-cutting activity at Betatakin was of a communal rather than individual nature. The clustering of dates is a result of the cutting of a number of trees in one year and probably in one operation. It is unlikely that one man could have been responsible for all the trees which were felled in any one year, especially years such as 1269 and 1276 with a large number of dated beams. The use throughout the village of beams cut in one operation is further evidence that no single individual was involved. The practice of stockpiling itself suggests the work of more than one person. The 1269 stockpile is an exceptionally good case in point. Apparently these trees were cut by the men of the first households to settle in the cave and were not used until six years later by members of completely different households. It would thus seem likely that the large-scale felling of trees for construction beams was a communal project involving the cooperation of all or many of the men of the entire village rather than a household activity.

DIFFERENTIAL USE OF SPECIES

Another sort of cultural practice which may be recognized from the tree-ring data is the differential use of the various tree

species which are found at the site. The builders of Betatakin certainly were familiar with the materials with which they worked, and an intimate working knowledge of the structural strengths and weaknesses of the various tree species was undoubtedly theirs. Theoretically, this should be expressed in the use of certain species for particular jobs. In Table 15 the several species are plotted against the various uses to which structural timbers were put.

Table 15. Distribution of Species per Use-Category at Betatakin

Use-Category	Species						Total
	DF	JUN	PNN	Pop.	Bokm	Oak	
Roof beams	85	46	11	23	5	1	171
Jacal wall posts	0	3	7	1	0	0	11
Other posts	0	0	1	0	0	0	1
Horizontal beams supporting masonry walls	1	0	0	1	0	0	2
Total	86	49	19	25	5	1	185

This table includes only those beams which were in situ; therefore, there are fewer than the total number of specimens from the site.

Despite the unequal representation of the species and the preponderance of roof beams over any other category, a number of interesting inferences may be drawn from the relationships among the data.

Table 16 includes an analysis of the distribution of the four most common species relative to the two major categories of use.

Table 16. Chi Square Analysis of the Distribution of
Species per Use-Category at Betatakin

Use-Category	Species				Total
	Pop	DF	JUN	PNN	
Roof beams	23 (22.35)	85 (79.25)	46 (45.65)	11 (17.72)	165
Posts	1 (1.63)	0 (5.76)	3 (3.32)	8 (1.29)	12
Total	24	85	49	19	177

Level of Measurement: Two nominal scales

Model: Independent random samples

Hypothesis: Use categories and species are independent of
one another.

Cell	fo	fe	fo ²	fo ² /fe
a	23	22.35	529	23.68
b	85	79.25	7225	91.20
c	46	45.65	2116	46.40
d	11	17.72	121	6.84
e	1	1.63	1	0.65
f	0	5.76	0	0.00
g	3	3.32	9	2.72
h	8	1.29	64	49.60
Total	177	176.97		222.09

$$\chi^2 = 222.09 - 177$$

$$\chi^2 = 45.09 \text{ (p .001 = } \chi^2_{df=3} \text{ of 16.268)}$$

The hypothesis may be rejected at the .001 level of confidence.

Oak and boxelder are eliminated from this analysis because they are both too poorly represented in the collection to yield valid results. In a like manner, only the use categories of roofing beams and vertical posts possessed enough representative specimens to give good results. The roof beam category includes primary, secondary, and auxiliary beams. Vertical posts are found in jacal walls, as roof beam supports, and as integral members of masonry walls. The hypothesis to be tested is that there is no difference in use-category with respect to species. The Chi square value of 45.09 is well beyond that indicative of a probability of .001 ($\chi^2_{df=3} = 16.268$), and the hypothesis of "no difference" can be confidently rejected. There exists a strong pattern in the relationship between use and species.

It is obvious on close inspection of Table 16 that two cells are almost entirely responsible for the large Chi square value. These are cells b and h. In cell b the observed frequency of Douglas-fir roof beams exceeds the expected frequency by nearly six units. In cell h the observed frequency of pinyon posts exceeds the expected frequency by nearly seven units. Thus, Douglas-fir was preferred for roofing beams while pinyon found more use as vertical posts.

The reasons for this dichotomy between Douglas-fir and pinyon are not hard to find. The long, straight bole of the Douglas-fir lends itself to the construction of roofs in which relatively long distances must be spanned without sacrificing strength. Pinyon, in addition to producing shorter beams than Douglas-fir, probably has a serious structural weakness. It is a hard, rather dense wood, and I have observed in the sites that pinyon beams have a tendency to split

in a spiral which often runs the full length of the timber. This tendency was probably also known to the builders of Betatakin who saw to it that pinyon timbers were used most often to support a load parallel rather than perpendicular to their length; thus, their characteristic use as posts.

A similar analysis performed on the distribution of species relative to the two major classes of roof timber---primary and secondary beams---failed to reveal any significant departure from what would be expected by chance. Apparently there was no preference for any particular species to serve as primary or secondary beams.

Oak, although probably abundant in the 1200's as today, was not favored by the people of Betatakin, for it was used sparingly. This very hard wood no doubt was difficult to work with stone tools, and it may have been shunned for this reason. Similarly, boxelder was apparently not a preferred building species, although there may have been little of it around to be used.

Quaking aspen was used rather extensively, no doubt because of its abundance, accessibility, and probably also its softness which made it easy to work with stone tools. Aspen was used almost exclusively for roofing, probably because the long straight trunks fulfilled the requirements of roof building. Despite the number of aspen used, it is doubtful that the supply was anywhere nearly exhausted, if one can judge from the hundreds of easily accessible aspens now growing within a few hundred yards of the site. The fact that many more Douglas-firs than aspens were used is significant in that it shows a cultural preference for the former. If there were

not such a preference, the villagers would have exploited more fully the abundant supply of aspens before turning to the more inaccessible Douglas-firs which had to be transported from the top of one talus slope, across the canyon to the top of the opposite slope, and on up into the cave. Probably the greater strength and rigidity of the Douglas-firs were desirable qualities which made it worth while to expend no little extra effort to bypass the aspens in favor of Douglas-firs.

The specific uses to which the different species were put demonstrates that the builders of Betatakin had an intimate practical knowledge of the capabilities of the raw materials which they exploited. This, along with the frequent use in caves of types of masonry different from those used in open pueblos, gives some insight into the architectural concepts and practices of these prehistoric people. By analogy these characteristics can be transferred to other Kayenta Branch villages where the evidence is less well preserved.

PREHISTORIC ENVIRONMENT OF BETATAKIN

A comparison of the prehistoric assemblage of tree species as represented by the tree-ring collection from a site with the species present in the vicinity of the site today is a valuable indicator of certain types of environmental change which have taken place in the interval since the site was occupied. The tree species growing near Betatakin between 1250 and 1300 were Gambel oak, boxelder, quaking aspen, juniper, pinyon, and Douglas-fir. Ponderosa pine, so common elsewhere in the Anasazi area, is absent. An identical assemblage of

trees is found today at the head of Betatakin Canyon within half a mile of the site itself. Ponderosa pine is absent now as it was 700 years ago. Thus, the local environmental conditions at Betatakin are presently the same as they were in 1250. The climate was the same as today, and ground water conditions were undoubtedly similar to those of the present time.

This situation is in sharp contrast to the situation throughout the Tsegi where there is considerable evidence for significant environmental changes. The most well documented of these is the historic shift from alluviation to degradation in the 1880's which has completely altered the Tsegi Canyon environment. The sluggish stream and the many small ponds and swamps were destroyed by the arroyo cutting. The typical flora associated with the lakes and swamps---reeds, cattails, and ferns---was replaced by a sagebrush-juniper-pinyon flora typical of the Colorado plateaus region. Equally drastic changes during the prehistoric period probably accompanied the cutting of the Tsegi-Naha arroyo around 1300. That such changes did occur is indicated by the pronounced shift in tree species at Kiet Siel described in Chapter 8. Betatakin seems to have been immune to the factors which produced the many changes that have taken place throughout the canyon system since 1300. The local environment of Betatakin is probably identical to what it was when the first vanguard of villagers moved into the cave about 1267.

The reasons for the lack of change at the head of Betatakin Canyon lie not in differences of climate, for which there is no evidence, but in the local topography. The cycles of environmental

change which took place throughout the Tsegi were produced by fluctuations in the water table of the Recent alluvium. These fluctuations in turn are correlated with conditions of aggradation or degradation throughout the Laguna Creek system. The head of Betatakin Canyon was not affected by these changes in the level of the ground water because it constitutes a very small system of its own, completely unrelated to that of Laguna Creek. Here, well above the surface of the alluvium, the erosional base level is controlled by the Kayenta bench, which, being of solid rock, does not change in response to changes in base level throughout the rest of the Laguna Creek system. Therefore, because the ground water situation has remained stable, environmental conditions above the lip of the Kayenta bench have remained unchanged for centuries, while a series of marked, cyclical changes have taken place throughout the rest of Tsegi Canyon during the same period.

CONCLUSIONS

All relevant archaeological and dendrochronological evidence indicates that Betatakin is a "pure" Tsegi Phase site. Furthermore, it is clear that the total occupation of Betatakin Cave took place entirely within the Tsegi Phase. Unlike many other caves that contain Tsegi Phase pueblos, there was no earlier occupation. This makes Betatakin valuable from both an archaeological and a dendrochronological standpoint, since all archaeological material and all tree-ring dates from the site can be assigned to the phase without fear of contamination by earlier material. Thus, Betatakin will contribute much to the final characterization of the Tsegi Phase.

The first people to leave any evidence of their utilization of Betatakin Cave appeared on the scene sometime in the 1250's. They were probably drawn to the great empty cave by the shelter offered by its immense overhang and by the abundant supply of clear water afforded by the spring at the foot of the cave. They must have found Betatakin Canyon to be much as its upper reaches are today---choked with a dense growth of aspen, oak, boxelder, ferns and brush, all watered by a small stream and a high water table.

Whatever their reasons for coming, their stay left little imprint. A few trees were cut for use as timbers in structures which did not survive the subsequent occupation of the cave. These structures were probably located in the western part of the cave where more level space was available. The number of people was not great and their occupation of the cave may have been transient rather than permanent. The cave may have served as a seasonal camp for men who had penetrated into the Tsegi to plant fields at some distance from their home village. This early occupation apparently reached its peak about 1260 and remained stable or declined thereafter.

The village of Betatakin, as it is now known, was begun in 1267 when two or three households took up residence in the cave (Fig. 20). One household constructed Room Cluster 4 high up in the western part of the cave. Another cluster, since destroyed, was probably constructed in this area, and Room Cluster 14, situated high on a ledge in the extreme eastern part of the cave, may also have been built at this time. In 1268 Room Cluster 15 was added, bringing the total population to at least four households or about 20 people. The

structures built between 1250 and 1266 must still have been in use, for only one reused beam dating from this period occurs in the 1267-68 structures. Whether or not the earlier structures were actually occupied or merely "owned" cannot now be determined. In view of later events, I would hazard a guess that they were considered to belong to someone not actually in residence.

It is unlikely that the 1267-68 founders of Betatakin selected the site for their new home at random. Only under the most adverse of circumstances would the people of a sedentary community set off to establish a new village without some idea of where they were going. The evidence from Betatakin strongly belies any such interpretation of its founding and peopling. Undoubtedly they were familiar with the virtues of the cave before they set out to establish a new village there. This familiarity must have come through contact with the people who had made limited use of the cave since 1250. In fact, both the early utilizers of Betatakin Cave and the 1267-68 immigrants probably belonged to the same community. Such a community might have been a single village or two or more related villages which constituted a larger social community.

The 1267-68 immigrants were a vanguard, perhaps sent ahead to secure possession of the cave for a larger group of people. It is clear that they had the task of preparing Betatakin Cave for habitation by a larger group to follow. One facet of this job was the laying in of a substantial stockpile of construction beams for later use by other immigrants. This they accomplished in 1269 by felling a number of trees and cutting them to standard lengths. It must also

have involved removing the centuries-old accumulation of weathering detritus from the cave and clearing away the vegetation which must have grown along the many seepage zones in the cave floor.

The industry of the vanguard was not immediately rewarded. Perhaps the coming of additional households was imminent in 1272, for the stockpile of timbers was augmented in that year. Apparently it was a false alarm. Not until three years later and seven years after the arrival of the vanguard did additional construction take place at Betatakin (Fig. 20). In 1275 at least two new households (Room Clusters 5 and 3) took up residence in the cave. In 1276 at least four additional households arrived and built Room Clusters 2, 7, 8, and 9. The year 1277 saw the arrival of at least two more households who constructed Room Clusters 1 and 6.

The major immigration of people into Betatakin undoubtedly took place in this three-year period of 1275 to 1277. Many of the undated room clusters were probably added at this time as Betatakin became a major village sprawled across the floor of the great cave. The population was probably in excess of 75 people. The number of reused beams in the rooms built in 1275 and 1276 indicates that the pre-1267 structures had been torn down by this time and their materials redistributed. Perhaps this demolition had also been one of the duties of the 1267-68 vanguard.

Despite the fact that neither kiva yielded tree-ring dates, it may be inferred that at least one was in existence by 1277. The ceremonial needs of 75 people would require at least one kiva. How the vanguard satisfied their religious needs and obligations cannot be

known. They may or may not have had a kiva at Betatakin. They undoubtedly maintained close contacts with their home village and may have traveled to it to participate in religious observations. By 1277 the process may have been reversed with the hangers-on in the old village, if there were any, journeying to Betatakin for the major ceremonies.

After 1277 Betatakin grew at a slower pace. The accretion during this period was probably a result of both natural population growth and of immigration. Room Cluster 16 was added in 1278, and Cluster 10 sometime after 1280. Clusters 11, 12, 17, and 18 were probably also added in the early 1280's. The addition of complete room clusters to the village may have been a result of the sporadic arrival of households who had clung longer to the old village or who had come from different villages. On the other hand, some of this accretion was probably due to the creation of new households by the marriage of residents of Betatakin itself. The addition of new living rooms to the already existing Room Cluster 2, 8, and 13 points to the creation of new families by marriage. This accretion continued until at least as late as 1286, after which time all construction apparently ceased. Betatakin reached its population peak in the mid-1280's. Twenty or more households, comprised of a maximum 125 individuals, inhabited the village.

The demise of Betatakin is less clear than its growth. It was abandoned sometime after 1286. The reasons for its abandonment are undoubtedly the same as those for the abandonment of the entire Tsegi Canyon system which are discussed in Chapter 10. There is little

evidence to suggest in what manner the people left the village. Apparently there was no evidence for any sort of violent expulsion or hasty retreat. Betatakin could have been abandoned over a period of years as families slowly drifted away, or it could have been deserted relatively suddenly if the people left en masse. From the lack of evidence for an abrupt departure, and reasoning from the gradual nature of the immigration into Betatakin, it may be inferred that the abandonment proceeded at a leisurely pace. At any rate, it was probably completed by 1300 or a little later.

The implications of the dated history of Betatakin are far-reaching. They involve several aspects of culture, such as village and sub-village social organization and community leadership, as well as the processes involved in the founding and peopling of a large village. Furthermore, light is shed on the nature of the forces or events which motivate a "sedentary" agricultural people such as the Kayenta Anasazi to abandon one area for another.

One of the most significant inferences which can be drawn from the Betatakin data is that it was founded and settled by a group of people who already constituted a community. The community was not created by the association of a hitherto unrelated bunch of Indians who happened to come together and erect a village in Betatakin Cave. In other words, "Betatakin," as a social unit, existed somewhere else prior to the construction of the village presently known by that name. A number of lines of evidence point rather insistently to this conclusion. The history of the founding and populating of Betatakin strongly indicates that the people of an existing functioning social

community moved from one place to another in accordance to a well laid plan of action. This plan included the sending ahead of a small vanguard which established residence in the cave and prepared it for habitation by those who remained behind. The extreme regularity of constructional techniques and forms implies that the villagers possessed a well defined and uniform set of architectural standards. Such uniformity probably reflects a condition of cultural homogeneity produced by the prior existence of the social unit that constructed and inhabited Betatakin. It is unlikely that enough social control could be exerted over a heterogeneous assembly of families to produce the marked architectural homogeneity which characterizes Betatakin.

The history of the settlement of Betatakin provides the basis for consideration of a problem which is usually impossible to even identify in an archaeological context. This is the nature of the society which established and populated a site. It allows us to make inferences about the organization of the people who founded Betatakin even before the village was actually begun. Even though the site or sites which the villagers inhabited before moving to Betatakin are completely unknown, something of their nature may be glimpsed in the history of Betatakin. It has been inferred that the people of Betatakin constituted a single organized social unit before they moved into the cave, and much of the evidence cited in the following discussion supports this first conclusion as well.

The careful preparations undertaken before the bulk of the population arrived implies a leisurely and planned movement into the cave. The early transient use after the cave's discovery fostered an

awareness of its potential for habitation. Around 1267, in a location that remains unknown, a decision was made to exploit this potential, and a vanguard was sent ahead to occupy the cave and prepare it for use. The extensive preparations performed by the vanguard indicate that a much larger group of people was involved and that they knew where they were going well in advance of departure from their old place of residence. Some sort of group decision-making mechanisms must have been involved here, and the fact that the vanguard performed its assigned duties indicates that sanctions of some sort backed up the decision. In other words, the socio-cultural processes through which the entire social unit was integrated and organized were involved in this action. This integrative structure could have involved kinship, religious, or political organization. Probably they were so interwoven that aspects of all three entered into the picture. The apparent absence of a highly developed kinship structure in Tsegi Phase villages and the general weakness of purely political institutions among the modern Hopis support the argument that religious organization formed the foundation for these decisions and actions. The fact that the kiva is the only village integrative device that is perceptible in the archaeology of the Tsegi Phase reinforces this conclusion. However, it remains a hypothesis subject to testing. As among most societies at a fairly low level of socio-cultural integration, any decision to move probably involved some sort of consensus brought about by the operation of whatever decision-making processes were available.

The nature of the leadership structure that implemented the decision to move can only be speculated upon. It may have been of a

formal nature involving well defined status-roles; or it may have been less structured, involving leaders chosen and supported by consensus because of their demonstrated ability or popularity. There were probably no full-time political or religious leaders. At any rate, the deliberate carefully planned move into Betatakin Cave must have involved some sort of leadership in order to give it direction and cohesion. This situation implies a high degree of intra-village solidarity among the Kayenta Anasazi at about A.D. 1250. The fact that the social basis for this solidarity cannot be absolutely determined does not gainsay the evidence for the existence of such solidarity. This conclusion contradicts Jennings' (1966: 62-6) hypothesis that Kayenta villages were nothing but loose agglomerations of family "homesteads" with little or no over-all village organization or cohesion.

It is unlikely that sedentary agriculturalists would simply pack up and move from one place to another for no reason at all. Something must have caused the immigration into Betatakin Cave. The well planned and leisurely move implies that whatever the causes, they were not overwhelmingly compelling. The people picked their spot well in advance, sent out the vanguard, and took their time in finally making the move. This allows several possible causes to be eliminated from consideration. It is unlikely that this pattern of settlement could have been precipitated by conflict with any sort of "enemy people." It would have been sheer folly to have weakened the pre-Betatakin village by sending four families off into the depths of Tsegi Canyon while the home village was menaced by enemies. Furthermore, the four vanguard households, widely separated from one another

and isolated from the spring, could have put up no effective defense against attack.

The threat to the pre-Betatakin village must have been something which was recognized and anticipated by the villagers. It probably involved either the precarious balance between the farmers and the land they tilled or some sort of social pressure which cannot now be recognized. It was at this time that the Tsegi-Naha erosion cycle was approaching its climax. It is therefore possible that headward erosion of the lower reaches of some of the streams was slowly destroying fields and crops, thus necessitating a move further upstream. It is also possible that social or ceremonial obligations or relationships with people of another community finally led them to move into closer proximity to the other group. In this case, the "other group" could have been the people of Kiet Siel. In view of the history of Kiet Siel developed in Chapter 8, this possibility seems likely.

The dating of Betatakin also permits some inferences to be made about the nature of the social organization of the village itself. Actually this evidence reinforces inferences already made on the basis of the architecture. The dates strongly support the conclusion that the household, as represented by the room cluster, was the basic unit of organization. The dating clearly shows that the first recognizable settlement of Betatakin as it is now known took the form of three or four room clusters isolated from one another by considerable distances. Subsequently, the village grew by accretion of room clusters rather than by individual rooms or by larger units. Rooms added singly were

tacked on to already existing room clusters. The larger sub-village structural unit---the courtyard complex---was formed by the amalgamation, over a period of years, of two or more room clusters which, despite their association in a single courtyard complex, remained structurally distinct. This evidence supports the interpretation of the social significance of the room cluster and the courtyard complex based solely on architectural data.

CHRONOLOGICAL ANALYSIS OF TSEGI PHASE SITES
IN NORTHEASTERN ARIZONA

Volume 2

by

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A Dissertation Submitted to the Faculty of the
DEPARTMENT OF ANTHROPOLOGY
In Partial Fulfillment of the Requirements
For the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

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CHAPTER 8. KIET SIEL

NA-2519; Arizona D:3:1 (ASM)

HISTORY AND ENVIRONMENTAL SETTING

Kiet Siel has been called the largest cliff dwelling in Arizona. Indeed it may be the largest in the Southwest in number of rooms and courtyards. The crumbling ruins of this prehistoric village were first seen by whites in January of 1895. During the winter of 1894-95 Richard and Al Wetherill and Charlie Mason embarked on their first trip into the Marsh Pass region. In January they entered Tsegi Canyon for the first time and picked their way upstream, skirting the many waterfalls and ponds which barred their way. They chose to explore the "middle fork" of the Tsegi and so discovered Kiet Siel. They spent three or four days at the ruin, but apparently undertook no extensive digging (McNitt 1957: 79-84; J. Wetherill 1935, 1955a).

Richard Wetherill returned to Kiet Siel two years later as leader of an expedition financed by George Bowles, a student at Harvard, and his tutor C. E. Whitmore. The expedition was in the field from January to April, 1897 (McNitt 1957: 153). More extensive work was done this time and a substantial collection of material was amassed.

The next recorded visits to the ruin took place in 1908 when first a party of prospectors and later Edgar L. Hewitt made the arduous trip. In 1909 Cummings' University of Utah party did a small amount of work at the site and excavated two Tsegi Phase kivas in

Turkey Cave just upstream. That same year W. B. Douglass made a ground plan of the ruin. Fewkes, as part of his trip through "Navajo National Monument," visited Kiet Siel and made a few observations which he published in 1911. T. Mitchell Prudden also made the trip to Kiet Siel in 1910. After this a trickle of tourists visited the site every year (J. Wetherill 1935, 1955a). Kiet Siel was included within the original boundaries of Navajo National Monument, and when the protected area was reduced in 1912 it was one of the three major ruins preserved by the Monument.

After Cummings' limited work in 1909, Kiet Siel received little archaeological attention until the winter of 1933-34. At that time a Civil Works Administration crew directed by Irwin Hayden undertook the excavation and stabilization of Kiet Siel as part of a project designed to enhance the tourist appeal of Navajo National Monument. One facet of this program which has not survived the subsequent erosion of the canyon was the construction of a trail from Marsh Pass to Kiet Siel. Of this trail only isolated remnants perched on patches of uneroded baldrock remain. Their work at Kiet Siel has proved to be more permanent. This work involved the excavation of rooms which had not already been cleaned out and the digging of several stratigraphic trenches in the extensive trash deposits below the ruin. About 1200 artifacts were recovered during these excavations (J. Wetherill 1935). In addition, extensive stabilization work was performed on the ruin itself. This stabilization has in no small way helped maintain Kiet Siel as one of the best preserved ruins in the Southwest. A third important accomplishment of the CWA project

was the production of a detailed and accurate floor plan of the site.

Once again Kiet Siel underwent a long period of archaeological neglect, although visitor traffic grew slowly but steadily over the years. In 1958 the National Park Service performed additional stabilization work at the site, but undertook no excavation. Keith M. Anderson in 1964 conducted stratigraphic excavations in the trash deposits below the ruin (Anderson 1966a). The trash attained a maximum depth of four feet and revealed an unbroken series of pottery types extending from the Pueblo I period through Pueblo III.

Kiet Siel is even more poorly reported than Betatakin. No reports on excavations at the site have ever appeared. To be sure, the literature on Southwestern archaeology abounds with references to the site, but most of the information comes from oral tradition or personal observation. Richard Wetherill's field notes on his 1897 work apparently exist (McNitt 1957: 161), but they are of little use without the material which he collected. Fewkes' (1911: 16-17) comments on Kiet Siel are even less extensive than those he makes on Betatakin. The CWA work has not been published, although field notes are on file at the Museum of Northern Arizona. The 1933-34 collection of material from Kiet Siel constitutes part of Anderson's forthcoming study of Tsegi Phase technology.

Collections from Kiet Siel are more widely scattered than those from Betatakin. Richard Wetherill's 1895 collection is "the one major collection Richard made which has not been traced" (McNitt 1957: 84). John Wetherill (1955a: 18) implies by his statement that

no excavation was undertaken that there may not have been a very large collection in that year. The large collection Richard procured in 1897 for Bowles and Whitmore was bought by the Hyde brothers and given to the American Museum of Natural History where it now reposes (McNitt 1957: 163; J. Wetherill 1935: 490; 1955a: 20). The CWA collection of 1933-34 is at the Museum of Northern Arizona. The material recovered by Anderson in 1964 is housed at the headquarters of Navajo National Monument.

Kiet Siel is located in the head of a large rincon on the west side of Kiet Siel Canyon, about five miles upstream from the confluence of Kiet Siel and Laguna creeks and about two miles downstream from the head of the canyon. In this part of Kiet Siel Canyon the Wingate sandstone, the Moenave formation, and the Kayenta formation are not exposed. Here the walls of the canyon are comprised entirely of Navajo sandstone which forms a rounded scalloped rim (Fig. 22). In ascending the canyon one passes up over a series of three major cataracts formed by the various rock formations. As each cataract is crossed, another formation disappears beneath the alluvium until, above the last and highest cataract, only the Navajo sandstone remains. Steep cones of fine-grained talus derived from the Navajo sandstone descend from the cliffs to the canyon floor.

The canyon floor is filled with a deep deposit of alluvium which has been cut to bedrock by the present erosion cycle (Fig. 22). The arroyo has exposed sedimentary deposits that average 50 feet in depth near Kiet Siel. Most of these sediments undoubtedly belong to the Tsegi formation and were present when the village was occupied.

Fig. 22. The local environment of Kiet Siet. View downstream from the ruin. Note the broad alluvial flat and the deep arroyo.

There is little evidence of the Naha formation this far up the canyon.

Kiet Siel Creek, now flowing on bedrock in the bottom of the arroyo, is a permanent stream. It is fed by numerous springs and seeps along the contact between the alluvium and the bedrock and by a tremendous seepage zone in the Navajo sandstone at the head of the canyon. This contrasts sharply with the local situation at Betatakin where alluvium is absent and where the cycles of erosion and deposition of the Laguna Creek drainage have not operated.

The plant life in the vicinity of Kiet Siel also is quite different from that at Betatakin (Fig. 22). This is a reflection of differing ground water conditions. The flora of Kiet Siel is typical of the Tsegi system as a whole. The flat alluvial terrace is covered with sparse grass and sagebrush. Gambel oaks cling to the talus slopes and fringe their lower limits in the manner shown in the lower right of Figure 22. Pinyon and juniper trees are rare, but a few isolated ones grow at intervals on the talus. Scraggly Douglas-fir trees fringe the tops of the talus on both sides of the canyon. Sheltered coves and deep side canyons on the east side of the main channel offer more protection from the sun and harbor dense stands of large Douglas-firs. The deepest and best watered coves are cool and wet enough to support a number of white fir trees. Several boxelders grow under the lip of the overhang of Kiet Siel Cave where they are deluged by every rain. Aspens, so prominent at Betatakin, are nowhere to be seen throughout the entire length of Kiet Siel Canyon. Arroyo cutting has lowered the water table so far that

aspens cannot grow. About a mile downstream several large cottonwood trees grow in the bottom of the arroyo with their roots practically in the stream.

Good farmland extends for approximately one mile in either direction from Kiet Siel. The site is located near the middle of a long stretch of canyon which has a relatively wide alluvial floor. When Kiet Siel was occupied, before the cutting of the Tsegi-Naha arroyo, it must have been an ideal area in which to farm. Even if a running stream was not present at that time, discharge from the Navajo sandstone would continuously recharge the water table in the alluvium and provide plenty of ground water to support agriculture.

Kiet Siel sprawls across the floor of a large cave eroded from the Navajo sandstone cliff (Fig. 24). Although smaller and much less impressive than Betatakin Cave, Kiet Siel Cave affords a great deal more level floor area. The dimensions of the cave have not been determined. However, it is as wide as Betatakin Cave. The cave probably reaches upwards of 320 feet in width and perhaps over 100 feet in maximum depth. The lower ceiling affords more protection than Betatakin Cave, as witnessed by the better preservation at Kiet Siel. Indeed the ceiling of the cave is so low as to form the roofs of a number of rooms. Kiet Siel was built in a split-level cave which has two floors suitable for habitation, both of which show clearly in Figure 24. The lower floor is of alluvium deposited against the back wall of the east side of the cave. The second floor, cantilevered above the first, consists of solid bedrock. Formerly a spring issued from the sandstone just above the lower

floor in the east end of the cave. In recent years flow has been reduced to a trickle. In 1963 the spring dried up completely. In order to get water for mixing the mud mortar used in the stabilization work, the CWA crew in 1933-34 and the Ruins Stabilization Unit in 1958 had to dig sumps along the back wall of the lower floors to collect water from a seepage zone. That the prehistoric Indians had similar problems is demonstrated by Richert's discovery in 1958 of a prehistoric sump in the same place. The base of the cave lies approximately 6500 feet above sea level.

DESCRIPTION OF THE SITE

The ground plan of Kiet Siel used here (Fig. 23) is adapted from that made in 1934 by the CWA project. I have made several minor changes to better indicate wall abutments and doorways as recorded during the 1963 field season. The original CWA map did not show these features. The sections through various parts of the site are not to scale.

The room-numbering situation at Kiet Siel is even more confused than that at Betatakin. At least eight different systems involving at least four different maps are known to have existed. In addition to these are two apparently different series written on the walls of the rooms: one scratched in charcoal, the other stenciled in white paint.

Table 17 is an attempt to correlate seven of the ten sets of numbers. Wetherill's 1897 map has been lost (McNitt 1957: 161), and his system of room numbers is not known. Possibly the numbers written

in charcoal on the room walls belong to Richard Wetherill, for it was his habit to inscribe his name and the date with charcoal on the walls of ruins that he visited. Neither of the sets of numbers written on the room walls is included in Table 17, since they do not seem to relate to any extant map. The table is set up as follows.

Column 1. The numbers in this column correspond to those that appear in Figure 23. The numbers are based on Hayden's 1934 map (Column 2) and are similar. A few numbers have been changed to eliminate duplication, and new numbers have been added to indicate features not numbered on the Hayden map.

Column 2. These room numbers are those assigned by Irwin Hayden, director of the CWA project, 1933-34. His ground plan has been printed and widely distributed, at least throughout the Southwest. It was issued in April, 1934, by the Office of the Chief Engineer, National Park Service, in San Francisco and bears the designation
NM
 NA-4936.

Column 3. These room numbers appear on the official National Park Service map of Kiet Siel issued in 1962. According to correspondence in the Laboratory of Tree-Ring Research files, they represent those in use by the Wetherills prior to the mapping and renumbering by Hayden in 1934. Since the 1962 Park Service floor plan includes a correlation between this and Hayden's numbering system, use of either of these base maps is possible.

Column 4. In collecting tree-ring specimens for the Rainbow Bridge--Monument Valley Expedition in 1933, Lyndon L. Hargrave used a series of room numbers that cannot be related to any existing map.

Correspondence in the Tree-Ring Laboratory files states that Hargrave used the Wetherill numbering system that appears in Column 3. As can be seen from the table, this is not at all the case. The correlations between Hargrave's numbers and the others were derived from a comparison of his wood material with that collected from known proveniences in 1962 and 1963. The identification in Hargrave's collection of samples that duplicate specimens collected in 1962-63 makes it possible to correlate his room numbers with those of the 1962-63 duplicates. Since duplication is not always present, a number of Hargrave's numbers cannot be assigned to specific rooms. McGregor (1965: 87) lists a number of Kiet Siet dates under these room numbers.

Column 5. The numbers presented in this column are those assigned in 1909 by W. B. Douglass whose map is published in Fewkes (1911, Pl. 13).

Column 6. In 1927, A. E. Douglass made a sketch map to accompany the collection of wood specimens that he made. His numbers appear in this column. These numbers were used by Breternitz (1963: 86-7).

Table 17. Correlation of Kiet Siel Room Numbers

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
1	1	1		125 ^a	b
2	2	2		123	81
3	3	3		119	80
4	4	4		118	79
5	5	5		122	b
6	6	6		b	b
7	7	7		125 ^a	b
8	8	8		124	78
9	9	9		126	68
10	10	10		115	75
11	11	11		114	76
12	12	12		116	c
13	13	13		117	77
14	14	14		139	b
15	15	15		113	74
16	Bin Room	16		c	73
17	17	17		112	b
18	18	18		109	b
19	19	19		110	b
20	20	20		108	72
21	21	21		128	67 ⁱ
22	22	22		127	67 ⁱ

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
23	23	23		103	66
24	24	23A		c	c
25 ^d	25 ^d	23B, 34		c	c
26	26	24		102	65
27	27	25		100	64
28	28	26		99	b
29	29	27		104	69
30	30	28		106	71 ⁱ
31	31	29		107	71 ⁱ
32	32	30		105	70
33	c	31		101	63
34	34	31A		b	b
35	35	32		140	62
36	36	33		141	58
37	37	33A		c	61
38	38	35		97	60
39	39	c		98	b
40	40	36		c	59 ^d
41	41	37		c	59 ^d
42	42	38		95	59 ^d
43	43	c		b	59 ^d
44	44	47	7	b	57

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
45	45	48	8	84	58
46	46	49	15	131	42(4)
47	c	c		b 142 ^g	b
48	c	c		143	b
49	49	55		85	50
50	50	56		86	49
51	51	50		83	c
52	52	39		82	55 ⁱ
53	53	39A		81	55 ⁱ
54	54	41		79	b
55	55	40		80	b
56	56	42	6	78	54
57	57	43		c	b
58	58	43A		c	b
59	59	45		76	53 ⁱ
60	60	44		77 74 ^e	53 ⁱ
61	61	46		75	52
62	62	51		b	b
63	63	52		c	c
64	64	54		72	51 ⁱ

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
65	65	53		73	51 ⁱ
66	c	c		92	c
	66 ^e	63 ^e			
67	67	64		71	46 ^d
68	68	66		70	46 ^d
69	69	62		69	47
70	70	61		c	c
71	71	58		138	b
72	72	59		87	48
73	73	60		88	45
74	c	57		130	41
75	75	72		129	40(3)
76	76	73		90	39(2)
				135 ^g	
77	77	75		136	31
78	78	74		91	38(1)
				92 ^g	
79	79	70		c	c
80	80	68		67	43
81	81	67		68	b
82	82	69A		66	b
83	83	69		65	37

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
84	84	76		61	36
85	85	77		62	35 ^d
86	86	78		64	35 ^d
87	87	79		63	35 ^d
88	88	81		59	34 ⁱ
89	89	80		60	34 ⁱ
90	90	82		58	33
91	92 ^a	83		57	32
92	92 ^a	84	9	56	30
93	93	85		53	29
94	94	86		55	b
95	95	87		52	c
96	96	92		c	c
97	97	88		51	24
98	98	90		h	23 ⁱ
99	99	91		38	23 ⁱ
100	100	94		40	22
101	101	95		c	c
102	102	98		41	21
103	103	99		42	20
104	104	100		43	c
105	105	101		44	19

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
106	106	102		45	10 ^d
107	107	103		46	10 ^d
108	108	104		47	9
109	109	105		48	b
110	110	106		49	8
111	111	108		50	7
112	112	109		11	b
113	113	110		10	b
114	114	111		9	4
115	115	112		8	2
116	116	113		7	c
				5 ^g	
117	117	114		6	3
118	118	116		3	b
119	119	115		4	b
120	120	117		2	b
121	121	118		1	1
122	122	119		12	5
123	123	120		13	6
124	124	122		15	b
125	125	107		c	b
126	126	121		14	b

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
127	127	97		c	c
128	128	96		c	c
129	129	123		18	11
130	130	125		16	12 ⁱ
131	131	124		17	12 ⁱ
132	132	126A		21	13 ⁱ
133	133	126		22	13 ⁱ
134	134	129		24	14
135	135	127		20	c
136	136	128		23	15
137	137	143		25	c
138	138	131		27	18
139	139	130		26	16
140	140	133		28	25
141	141	132		29	26
142	142	135		30	27
143	143	134		31	28
144	144	137		33	b
145	145	136		34	b
146	146	139		35	b
147	147	138		36	b
148	148	140		37	b

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
149	149	93		32	b
150	150	141		93	b
151	151	142		94	b
152	152	71		89	44
153	74	89		b	b
154	c	c		b	

- a - Room number used twice on map.
- b - Room not indicated on map.
- c - Room indicated on map, but not numbered.
- d - Single number applied to a feature given two numbers on another map.
- e - Number assigned to a hypothetical second-story chamber which does not exist.
- f - Gap in the sequence of room numbers.
- g - Number applied to a feature which is not a room.
- h - Unnumbered second-story room.
- i - Single number applied to two-story chambers.

The numbers in parentheses in Column 6 are kiva numbers assigned by A. E. Douglass to kivas he had already given room numbers.

Table 17--Continued

Figure 23	Hayden 1934	Wetherill and NPS	Hargrave 1933	W.B. Douglass 1909	A.E. Douglass 1927
149	149	93		32	b
150	150	141		93	b
151	151	142		94	b
152	152	71		89	44
153	74	89		b	b
154	c	c		b	

a - Room number used twice on map.

b - Room not indicated on map.

c - Room indicated on map, but not numbered.

d - Single number applied to a feature given two numbers on another map.

e - Number assigned to a hypothetical second-story chamber which does not exist.

f - Gap in the sequence of room numbers.

g - Number applied to a feature which is not a room.

h - Unnumbered second-story room.

i - Single number applied to two-story chambers.

The numbers in parentheses in Column 6 are kiva numbers assigned by A. E. Douglass to kivas he had already given room numbers.

Kiet Siel, like Betatakin, has an arc-shaped ground plan produced by the natural curve of the cave wall (Fig. 23). The ruin also conforms to the configuration of the cave by being divided into two levels. The lower level occupies the surface formed by Tsegi formation alluvium, talus, and occupational debris in the lower part of the cave. Cultural material at this level consists of an extensive trash midden, which accumulated from at least Pueblo I through Pueblo III times, and a number of poorly preserved structures associated with the Tsegi Phase occupation of the cave. Much of this construction has been destroyed by the recent erosion. Photographs taken before the head of the present arroyo reached Kiet Siel suggest the presence of more extensive walls. The lower occupation surface shows clearly in Figure 24 a. In the lower right a remnant of a masonry wall and below that hundreds of building stones that have toppled into the arroyo may be seen. A large cone of trash is visible just at the foot of the ladder. Much of this is material thrown out of the upper part of the ruin. The few rooms and the kiva shown in Figure 23 are the only structures remaining. Stratigraphic tests were excavated into the trash by the CWA project and by Keith M. Anderson.

The main part of the ruin occupies a broad overhung bedrock ledge suspended in mid-air above the lower level occupation area (Fig. 24). This part of Kiet Siel contains 154 rooms, courts, and kivas arranged along three major streets. Much of the eastern half of the ruin is built on a man-made terrace created by banking artificial fill against a retaining wall. This required no little amount of fill, since the retaining wall is more than 180 feet long and, in spots,

a

b

Figure 24. General views of Kiet Siel. Note the upper and lower occupation levels. a, Kiet Siel from above; b, Kiet Siel from below.

more than ten feet high. Two groups of rooms face outward across two streets toward the front of the cave. At least three kivas are located in front of the roomblocks. In the southwestern third of the site two blocks of rooms face each other across a single street that parallels the cave wall. The outer double row of rooms faces inward toward the back of the cave and presents a blank wall to the front (Fig. 24). This contrasts with the front orientation that is characteristic of Anasazi site layout from earliest times (Reed 1956: 11).

Architecturally, Kiet Siel is much less homogeneous than Betatakin. This is true of both techniques and forms. An obvious expression of this difference is the greater regularity and rectangularity of Betatakin rooms evident in the ground plans (Figs. 16 and 23). The formal attributes of Kiet Siel rooms and the associations among rooms are less uniform than at Betatakin, and kiva architecture is more variable. These contrasts probably reflect the presence at Kiet Siel of a more heterogeneous population with less uniform standards and less rigid social controls.

Kiet Siel masonry is quite varied and generally inferior to that of Betatakin. It ranges from almost pure mud with hundreds of embedded spalls to large building blocks laid up with quantities of mud mortar. Regular coursing is rare. Building stones were usually shaped but not dressed. An exception to this is found in the walls of Room 68. The stones used in this wall are more massive than is usual at Kiet Siel and exhibit the "dimpling" produced by pecking that is so characteristic of Mesa Verde dressed masonry. Wall

construction in general appears to be rather sloppy, whatever the quality of the masonry. Corners are rounded and walls irregular.

Jacal construction is also variable, but conforms to the general pattern described in Chapter 5. Jacal walls were used in a number of different ways, in contrast to their regularity of occurrence at Betatakin. A number of living rooms have jacal front walls, as was the case at Betatakin. Here the similarity ends, however. Several rooms with two walls of jacal exist, and one enigmatic structure (Room 62) has three walls of jacal. Walls of this type were also used to screen courtyards from streets (Courts 63 and 114) and to subdivide work areas (Court 41-43).

Roof construction at Kiet Siel varies, but does not violate the general Tsegi Phase pattern outlined above. A common feature of roof construction at this site is the use of wood splints instead of small sticks as closing material. This habit is of some importance with reference to the dating. Only one auxiliary beam occurs at Kiet Siel.

The massive retaining wall is one of the outstanding features of Kiet Siel. Although much of it was restored by the CWA crew, enough of the original was present to permit an accurate reconstruction. It is one of the most impressive examples of artificial terracing in the Southwest. The wall is of typical Kayenta masonry. Many poles and logs, laid perpendicular to the wall and bedded solidly in the fill, reinforce the wall. This technique probably accounts for the ability of the wall to withstand the pressure exerted by the tons of fill behind it.

LIVING ROOMS

Kiet Siel dwellings exhibit considerable variation within the Tsegi Phase living room pattern. The entrybox complex is almost universal, but occurs in no standard form. Masonry entryboxes are especially common, platforms rare. The association of masonry deflectors and boxes with masonry walls and slab entryboxes with jacal walls is evident at Kiet Siel. However, these associations are far from consistent. As at Betatakin, metate bins are absent, perhaps as a result of deliberate destruction. Kiet Siel is unique in the Tsegi in its possession of a subterranean living room (Room 13). Architectural data on Kiet Siel living rooms are included in Table 18.

STORAGE CHAMBERS

Granaries and storerooms possess the characteristic Tsegi Phase features, and there is little to differentiate them from those at other sites. Exterior platforms below the doorways of granaries are more common here than elsewhere. There are more jacal-walled storerooms than at other Tsegi Phase sites. Cupboard-size "storerooms" built in nooks and crannies of the cave wall are common. As was the case at Betatakin, the largest room at Kiet Siel is a storage chamber (Room 89). Tables 19 and 20 include architectural data on the granaries and storerooms at Kiet Siel.

CEREMONIAL CHAMBERS

Kiva identification at Kiet Siel is less of a problem than at Betatakin. The architectural data on the Kiet Siel kivas and Room 74 are presented in Table 21. Although at one time or another almost

Table 18. Architectural Data for Living Rooms at Kiet Siet

Architectural Features	Living Rooms																							
	3	13	20	33	35	36	38	56	61	69	75	77	80	83	90	92	100	111	122 ^a	123 ^b	129	136	138	
1st Story	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Subterranean		x																						
Walls																								
1 Jacal				x	x											x			x					
2 Jacal																	x	x						
Inside plastered		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Inside smoke-blackened	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Floors																								
Modified bedrock	x	x		x				x	x	x					x	x		x	x	x			x	
Fill	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Plastered	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Roofs																								
Roof destroyed								x			x	x		x				x						
Posts	0	0	?	1	0	0	1	-	0	0	-	-	0	-	?	0	3	2	0	0	0	0	0	
Auxiliaries	0	0	0	0	0	0	0	-	0	0	-	-	0	-	0	0	0	0	0	0	0	0	0	
Primaries	2+	1	3	1	2+	2	0	-	2	3	-	-	0	-	7	2+	2	-	0	?	5	5	3	
Secondaries	0	8	?	7	3+	10	7	-	7	11	-	-	4	-	15	4+	8	-	7	7+	13	7	15	
Closing material sticks	0	x	?	x	0	0	?	-	x	x	-	-	x	-	?	0	0	-	x	0	x	x	x	
Closing material boards	x	0	?	x	0	x	?	-	0	0	-	-	0	-	?	0	0	-	0	0	0	0	0	
Juniper bark matting	x	x	?	x	0	x	?	-	x	x	-	-	0	-	?	0	x	-	x	0	x	x	x	
Grass matting	0	0	?	0	0	0	?	-	0	0	-	-	x	-	?	0	0	-	x	0	0	0	0	
Corn husk matting	0	0	?	0	0	0	?	-	0	0	-	-	x	-	?	0	0	-	0	0	0	0	0	
Reed matting	0	0	?	0	0	0	?	-	0	0	-	-	0	-	?	0	x	-	0	0	0	0	0	
Doorways			A,B				A,B																A,B	
Sealed			A				A	x													x		A	
Open			B	x	x	x	B		x	x			x	x	x	x	x	x	x				B	
Jacal wall				x	x												x	x	x	x				
Masonry wall			A,B				A,B	x	x	x			x	x	x						x		A,B	
Low sill			A,B	x	x	x	A,B	x	x	x			x	x	x	x	x	x	x		x		A,B	
Stone sill				x	x	x		x	x	x						x							B	
Wooden sill													x											
T-shaped								x		x					x						x		B	
Not original							B																B	
Roof hatches																								
Present		x	x			x				x											x	x	x	
Inferred								x												x				
Sealed										x									x					
Open		x	x																		x	x	x	
Slab coping		x																						
Converted to smoke hole						x				x											x			
Made later																						x		
Floor-level ventilators																								
Original construction		x										x				x				x			x	
Made later			x					x														x		
Smoke holes																								
Original construction				x			x		x				x		x		x					x		
Made later							x																	
Sealed																				x				

Table 18--Continued

Architectural Features	Living Rooms																							
	3	13	20	33	35	36	38	56	61	69	75	77	80	83	90	92	100	111	122 ^a	123 ^b	129	136	138	
Firepits																								
Present		x	x	x		x	x	x	x	x				x		x	x	x	x		x	x	x	
Inferred															x									
Inside doorway						x	x	x	x	x				x		x	x	x			x			
Against wall		x	x	x															x			x		
Jacal deflector				x																				
Entrybox complex																								
Closed right							x			x			x											
Closed left														x							x			
Closed both sides																		x						
Slab deflector																x						x		
Slab entrybox													x						x					
Masonry deflector						x			x	x									x					
Masonry entrybox									x	x				x							x			
Jacal entrybox							x																	
Entrance platform						x				x								x					x	
Shelves																								
Masonry	x						x			x				x										
Pole						x																		
Niches	x	x		x			x			x	x												x	
Wall pegs															x									
Holes in floor			x								x								x		x			
Benches																				x	x	x		
Designs scratched in wall plaster		x				x			x				x			x			x	x		x		
Doorways open onto																								
Court	?			x	x	x	x	x	x	x			x	x	x	x	x	x					x	
Another room				R16																				
Room burned					x			x						x			x	x						

A,B - designates multiple occurrence of the feature

a - ceremonial room converted to living room

b - ceremonial room converted to living room

? - possible presence of feature

- - evidence of this feature destroyed

Table 19. Architectural Data for Granaries at Kiet Siel

[illegible]

**Table 20. Architectural Data for Storerooms
at Kiet Siet**

Architectural Features	7	27	28	32	39	53	57 ^a	58 ^a	87	94	99 ^b	102	105	106	109	118	120	121	124	126	139	147
1st Story	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2nd Story	x					x	x									x						
Walls																						
1 Jacal																x						
2 Jacal											x											
Inside plastered		x																	x	x		
Inside smoke-blackened				x						x				x					x	x		
Floors																						
Fill										x	x	x	x						x			
Plastered											x								x			
Ceiling	x					x										x						
Unmodified bedrock		x	x		x				x	x	x		x		x		x	x			x	x
Roofs																						
Cave overhang	x		x		x	x			x			x	x	x	x	x	x	x				
Roof destroyed		x																				
Auxiliaries	-			0						0	0								0	0	0	0
Primaries	-			2						1	1								0	0	0	0
Secondaries	-			9						0	?								1	4	8	9
Closing material sticks	-			?						0	?								x	?	x	x
Juniper bark matting	-			?						0	?								x	?	0	0
Doorways																						
Sealed		A		A						A	A	A										
Open		B		B					x	B	B	B			x	x		x	x	x	x	x
Jacal wall												A,B										
Masonry wall		A,B		A,B					x	A,B	A,B			x	x		x	x	x	x	x	x
Stone sill				A,B					x	A	A,B			x	x		x	x	x	x	x	
Low sill				A,B					x	B	A,B	B										x
High sill		A,B								A		A		x	x		x	x	x	x	x	
Loops				A																		
Wall pegs														x			x					
Grinding grooves in bedrock floor											x											
Doorways open onto																						
Court		x	x	x	x				x	x	x	x			x		x		x	x	x	

A,B - designates multiple occurrence of the feature

a - rooms indicated only by unsnugged area on cave wall

b - living room converted to storeroom

? - possible presence of feature

- - evidence of this feature destroyed

Table 21. Architectural Data for Kivas and Room 74 at Kiet Siel

Architectural Features	Kiet Siel Kivas				Turkey Cave Kivas		Room
	46	76	78	155 ^a	1	2	74
1st Story							x
Subterranean			x	x	x	x	
Pseudo-subterranean	x	x					
Walls							
1 Jacal							x
Inside plastered	x	x	x		x		x
Inside smoke-blackened	x	x	x		x		x
Floors							
Modified bedrock	x						x
Fill	x	x	x		x		x
Plastered		x	x		x		
Slab	x						x
Roofs							
Roof destroyed	x	x	x		x	x	x
Posts	2	-	-		-	1	7
Auxiliaries	-	-	-		-	-	-
Primaries	1+	-	-		-	-	-
Secondaries	-	-	-		-	-	-
Closing material	-	-	-		-	-	-
Matting	-	-	-		-	-	-
Inferred roof hatches	x	x	x		x	x	
Ventilators	x		x		x	x	?
Firepits present	x		x		x	x	x
Slab deflector	x					?	x
Masonry deflector			x		x		
Magic pit?	x					x	
Niches	x	x	x		x		x
Holes in floor		x	x		x		x
Loom anchors	x		x		x	x	x
Benches			x		x		
Southern recesses	x						
Wall painting	x						
Wall dado		x					
Pilasters					x		
Poles	x		x				

a - interior features not observable

? - possible presence of feature

- - evidence of this feature destroyed

every structure with a rounded wall has been called a kiva (see W. B. Douglass' map in Fewkes 1911, Pl. 13), five unequivocal kivas can be recognized at Kiet Siel. Four of these are on the upper level, one on the lower. The two kivas in Turkey Cave just upstream undoubtedly belong with Kiet Siel, since there are no domestic structures associated with them. They have the same relationship to Kiet Siel as does the kiva NA-3533 to Betatakin. Thus, the site possesses at least seven recognizable kivas. In addition, there are two problematical structures that may be ceremonial in function and a probable rectangular kiva which was converted to domestic use before the site was abandoned. The details of these ten structures are presented on the site map (Fig. 23) and in Table 1. The variability of kiva architecture at Kiet Siel reflects that of Tsegi Phase religious architecture in general.

Kiva 46 exemplifies keyhole-shaped kivas found in Tsegi Phase sites (Fig. 25; Table 21). A southern recess, its floor raised above the level of the ventilator shaft, imparts this characteristic shape to an otherwise oval structure. The kiva is pseudo-subterranean, with the space between double outer walls filled with earth. The exterior of the recess is not sunk below ground at all. Entry must have been through a hatchway in the roof. The roof, which is now absent, was supported by a single large east-west beam that crossed the middle of the kiva. Rectangular wells for each end of the beam can be seen in Figure 25. Minimum height of the ceiling was about 71 inches.

Fig. 25. Kiva 46 at Kiet Siel.

Remnants of several coats of wall plaster remain on the interior of the kiva. The latest of these bears a white band, four inches wide, which apparently encircles the kiva 35 inches above the floor. A similar four-inch band of white, 12 inches above the first, is barely discernible on an earlier coat of plaster. Perhaps each coating had such a band. Two small wall niches occur in the northeast quadrant of the kiva. One of these is a foot above the floor. The other is 40 inches above the floor, its sill level with the top of the latest white band. Two charred posts stand at the interior corners of the southern recess. These, plus heavy smoke stains on the western wall, suggest that the kiva burned.

The floor features are typical of those usually associated with kivas (Table 21, Fig. 25). A rectangular ventilator opens beneath the floor of the recess. In front of the ventilator was a slab deflector flanked by two upright posts. The deflector slab is broken off flush with the floor and the two posts are charred. A circular firepit lies just inside the deflector. Beyond the firepit is a long rectangular hole lined with slabs. The depth of this pit is unknown. Its obvious similarity to the "magic pit" in Kiva 1 at NA-7498 on Cummings Mesa (Ambler, Lindsay, and Stein 1964: 60-1, Figs. 50 and 52), suggests a similar function. The authors of the Cummings Mesa report suggest that it may have been used to conceal a man who performed magical feats during ceremonies (Ambler, Lindsay, and Stein 1964: 60-1). If deep enough, the Kiva 46 pit could have concealed a man. On the other hand, it may have been covered with a plank and used as a foot drum. Two rows of four loom anchor holes

apiece are set into the floor at right angles to one another, forming an L on the north and west sides of the firepit. No hole that may be interpreted as a sipapu exists. Most of the floor is paved with slabs set into plaster over loose fill. A small arc along the north side consists of artificially leveled bedrock.

Kiva 46 is strikingly similar to those that occur in sites near Navajo Mountain (Cummings 1945; Ambler, Lindsay, and Stein 1964: 33-5, 59-61; Hobler 1964: 78-87). The keyhole shape and the arrangement of internal features are nearly identical. A major difference is the absence at Kiet Siel---and in the Tsegi---of the circular depressions and circular stone slabs commonly found in the floors and southern recesses of Navajo Mountain kivas. The significance of this difference is difficult to estimate. However, it constitutes a pronounced divergence in ceremonial architecture between these two focal centers of Kayenta Branch population. Closer to home, Kiva 46 is essentially identical to keyhole-shaped kivas at Scaffold House, Twin Caves Pueblo, and near Long House (Kidder and Guernsey 1919: 64-5, Fig. 25).

Room 75 was probably a kiva at one time. Prehistoric remodeling and more recent stabilization work obscure many of the original architectural details. In addition, the southern two-thirds of the structure is missing. Thus, little can be said about the size, ceiling height, mode of entry, or floor features. A rectangular niche, set into the northwest wall a good five feet above the floor, may represent the efforts of the CWA stabilization crew. Several layers of plaster cling to the lower walls. The earliest coat extends behind the northeast wall, while subsequent coats are applied to it.

Therefore, this wall is a later addition to the structure and may postdate its use as a kiva. The remnant of the floor consists of a thick layer of plaster, which exhibits no evidence of multiple coatings, laid on fill. The floor plaster is continuous with the latest layer of wall plaster and postdates the addition of the northeast wall. The only floor features remaining are two small circular holes of unknown function.

Kiva 76. Only a small remnant of this chamber remains. The southern three-fourths of the structure has crumbled away, leaving only a small arc of the northwestern wall and a patch of floor (Fig. 26 a). Much stabilization and reconstruction work has been done on this room. The large log-lined niche in the northwest wall was rebuilt by the CWA project. Photographs in the John Wetherill collection at the Arizona State Museum show no evidence for the log lining. No evidence for the roof, entry, or floor features remains. The reconstructed walls extend to a considerable height with no sign of roof beams. Several layers of original wall plaster adhere to the lower part of the walls. On one of the earlier layers of original plaster a light-colored dado, extending from the floor to a height of 30 inches, encircles the walls that remain. The floor is a thick coat of plaster over loose fill. The only floor feature is a small circular hole---perhaps a loom-anchor hole.

Kiva 78 (Fig. 26 b) is better preserved than either 75 or 76. Nevertheless, the southern recess---if there was one---and the ventilator are missing, along with any evidence for the roof. This kiva is rather oddly shaped; it resembles a triangle with curved sides.

a

b

Fig. 26. Kiet Siet kivas. a, Kiva 76; b, Kiva 78.

A small triangular bench occupies the northeast angle. The remnant of a ventilator shaft cut into bedrock can be seen at the break in the south wall. Just inside is a masonry deflector with a small niche hollowed out of the northwest side. Adjacent to the northwest side of the deflector is a circular firepit. A floor-level niche is located near the northwest angle. The floor is clay over fill. Three small round holes in the floor are all that remain of a series of loom-anchor holes. Wetherill collection photos show a row of five such holes, each with a looped stick in situ.

Kiva 155. The fifth clearly definable kiva at Kiet Siel is located on the lower level of the cave. Kiva 155 was excavated into the alluvial floor of the lower cave and thus is the only truly subterranean ceremonial structure at the site. This kiva was cleared in 1933-34 by the CWA project. As part of the stabilization work, the CWA crew reroofed the kiva to provide visitors with an example of kiva architecture. Unfortunately, this roof has collapsed and the kiva is now filled with broken beams and sand. It is, therefore, impossible to describe its features.

The two circular kivas in Turkey Cave are undoubtedly associated with Kiet Siel. Turkey Cave was not used as a habitation site during the Pueblo III period; therefore, the kivas can belong only to Kiet Siel. Both kivas were excavated by Byron Cummings in 1909 (Breternitz 1964: 3; Lindsay 1963a: 79-83). Both have since been partially filled with sand and other debris and their features are no longer discernible; therefore, neither kiva is illustrated in

this report. The descriptions used here are derived from Cummings' field notes and from personal observations.

Kiva 1, the northernmost of the two, is circular in plan and fully subterranean with a maximum standing wall height of 5 feet, 8 inches. No evidence for a roof remains. A narrow bench completely encircles the interior. The walls bear several layers of clay plaster, the latest of which is undecorated. Two niches occur in the walls: one on the east side, the other on the northeast side. The floor is of clay, presumably laid on fill. A masonry deflector stands between the circular firepit and the mouth of the ventilator tunnel that opens beneath the bench. In the floor between the deflector and the ventilator is a shallow rectangular depression. North of the firepit are the fragments of a human-hair loop set into the floor plaster, perhaps the lone remnant of a loom anchor.

Kiva 2 possesses a number of interesting and unusual features. It, too, is circular and fully subterranean. The maximum height of the remaining walls is 7 feet, 2 inches. This kiva is equipped with pilasters and recesses set on the encircling bench. The southeastern part of the kiva is poorly preserved so the exact number of pilasters cannot be determined. At present four are discernible. An upright juniper post set into the wall at the south side may represent a fifth pilaster. If so, this would indicate the presence of six recesses. The ventilator shaft opens through the southeast part of the kiva, its sill four inches above the floor. The opening is grooved to receive a stone slab cover. The deflector is missing, but Cummings believed it to have been a single, upright slab. A

rectangular firepit is located 3 feet, 9 inches inside the ventilator opening. One foot, three inches beyond the firepit is a rectangular, slab-lined box let into the floor to a depth of six inches. Its similarity in shape and position to the magic pit or foot drum in Kiva 46 is obvious. A wooden staple, perhaps part of a loom anchor, projects from the floor west of the firepit. The poorly preserved floor is clay plaster over fill.

Room 123. In addition to the seven indisputable kivas associated with Kiet Siel, there is another chamber which probably served as a kiva before being converted to other purposes. This is Room 123 located at the extreme south end of the ruin (Fig. 27 a; Table 21). Originally it was a huge room approximately 14 by 12 feet. Later, Rooms 124, 125, and 126 were constructed inside it, an event which probably heralded a change in function of the larger room. The bench that extends along the east wall of Room 123 ends beneath the south wall of Room 125. Probably it once extended across the full length of the room. The large ventilator, which now opens through the bench in the northeast corner of the room, would have been located very near the center of the older room. No floor features remain at present. If a deflector-firepit complex once existed, it was probably torn out during the remodeling of the room. The present floor is of plaster over modified bedrock. The structure is neither subterranean nor pseudo-subterranean. It was, however, entered by means of a roof hatch. Room 123 is the only rectangular ceremonial chamber associated with Kiet Siel.

a

b

Fig. 27. Ceremonial chambers at Kiet Siel. a, Room 123, a former kiva; b, Room 74, a ceremonial adjunct to Kiva 46.

Two additional rooms deserve inclusion in the ceremonial category. Although neither can be recognized as a kiva, both possess enough diagnostic features and associations to be differentiated from secular structures. Adams (1951: 64-5) points out the frequent association of jacal-walled rooms with kivas in Kayenta sites. He goes on to speculate that "they had a special function, perhaps comparable to the antechambers of eastern kivas" (Adams 1951: 65). Two rooms at Kiet Siel exhibit this pattern of association and confirm its existence as a cultural pattern among the Kayenta Anasazi.

Room 74 is a large D-shaped room adjacent to the southwest side of Kiva 46 (Fig. 27 b; Table 21). The arc of the D is a heavy masonry wall, the northeast side of which is tied into the southwest wall of Kiva 46. The upper part of the northwest wall is formed by a large, overhanging boulder, beneath which the masonry back wall reaches a height of $2\frac{1}{2}$ feet. An upright post in the middle of this wall apparently "supports" the boulder. A smoothly plastered niche is situated about six inches above the floor at the north corner. Another niche is located in the southwest wall. Two large upright posts embedded opposite each other in the northeast and southwest walls probably supported one of the primary ceiling beams. The masonry walls carry a thick coat of clay plaster. The straight front wall is of massive jacal construction characterized by the use of very large upright posts. Two especially large posts set at either end of the jacal wall probably supported a primary roof beam. Of two breaks in the jacal wall, one is obviously fortuitous. The other may represent a doorway, a ventilator, or a natural break. It is located

opposite the slab-lined rectangular firepit. A small broken slab deflector is situated between the second break and the firepit. The floor is partially paved with slabs and partially of modified bedrock. A circular slab set into the floor near the west corner may be analogous to those in Navajo Mountain kivas. A row of five loom-anchor holes, each with its loop still in place, parallels the back wall of the room almost directly below the position of the northwestern primary beam, to which the top of the loom was probably affixed. A small circular hole just off the north corner of the firepit may be a sipapu.

A number of features indicate a special function for this room. Its size, slab paving, loom anchors, and possible sipapu differentiate it from living rooms. The loom anchors, paving, and possible sipapu show an affinity to kiva architecture, although its shape and jacal wall differentiate it from true kivas. Furthermore, a nonsecular function is suggested by the fact that it cannot be included in a room cluster. Finally, its intimate association with Kiva 46 is undeniable, since they share a wall. Room 74 is probably a formal adjunct to the kiva and should be thought of as a ceremonial chamber of some sort.

Room 122. The second jacal-walled room of possible religious function is less certainly ceremonial than Room 74. In fact, it probably served as a domestic structure during the latter years of its use. The chief reason for assigning it to the ceremonial category is its relationship to Room 123, thought to have been a kiva, which is very similar to the relationship between Kiva 46 and Room 74. The

formal resemblance of Room 122 to Room 74 is obvious (Table 21). Like Room 123, Room 122 underwent a series of modifications at some time during its period of occupation. These modifications in both rooms probably took place simultaneously and probably marked the conversion of both chambers from ceremonial to secular use.

Like Room 74, Room 122 is a D-shaped structure that shares its north wall with a kiva. Again, the straight wall is of jacal construction. Originally the room was entered through a roof hatch located just above the present doorway. The walls are heavily plastered and blackened by smoke. The floor is of modified bedrock covered with plaster. A rectangular firepit is located adjacent to the jacal wall. Sometime after its original construction the hatchway was sealed and a doorway cut through the jacal wall. Thereafter it, along with Room 123, probably served as an ordinary living room. Although its ceremonial function is not as obvious as that of Room 74, Room 122 probably constitutes yet another example of a jacal-walled adjunct to a kiva.

GRINDING ROOMS

Three grinding rooms may be recognized at Kiet Siel: Rooms 16, 107, and 152. Each possesses at least two mealing bins set into the floor. As usual, the metates have been removed from the bins, presumably by the prehistoric inhabitants of Kiet Siel as part of their normal abandonment procedure. Two of these rooms---16 and 107---conform to the Tsegi Phase grinding-room pattern in their lack of an enclosing front wall. In addition, Room 16 apparently was not roofed.

Room 107 lacks a formal roof, but the low ceiling of the cave at this point serves as a ceiling for the room as well. Room 152 differs somewhat from the others. It was fully enclosed by four walls and a roof and was entered by means of a T-shaped doorway. In addition, two low benches are located on the northwest side of the room, cutting across the north and west corners. This room may have been a general work room rather than strictly a grinding room. However, two metate bins are present. The architectural data for these rooms are presented in Table 22.

As was the case at Betatakin, three mealing rooms can hardly have accommodated all the corn grinding that must have taken place. Much of this work must have occurred in the living rooms and courtyards of the households. Courts 63, 29, and 40-43 contain mealing bins, showing that grinding was indeed done in these areas.

None of the three grinding rooms is clearly associated with any one room cluster. Room 16 appears to have been shared by Room Clusters 2 and 4. Room 107 probably is part of Room Cluster 20. Room 152 probably belongs to Cluster 15, which is poorly defined. All seem to be strictly domestic structures, although there is a slight possibility that Room 152 is associated with one or more of the kivas.

COURTYARDS

Kiet Siet courtyards possess no unusual or unique features. They conform very well to the general Tsegi Phase pattern. Individual courtyard retaining walls are less common than at Betatakin, because of the flatter floor of the cave. Nearly every courtyard has a firepit

and several have mealing bins. Courtyard data are summarized in Table 23.

ROOM CLUSTERS

Room clusters at Kiet Siel are typical of the Tsegi Phase. A characteristic Kiet Siel room cluster, Cluster 2, may be seen in Figure 11 a. The chief distinguishing feature of a number of them is their large size which in general is due to a greater number of storage rooms than is usual at other sites. What this means is unknown. It may be that farming conditions near Kiet Siel were so good that larger crops could be grown. Twenty-five recognizable room clusters occupy the upper level of Kiet Siel Cave. How many there may have been on the lower level cannot be determined because of the poor preservation in this part of the cave. The composition of each one of the 25 recognizable room clusters at Kiet Siel is presented in Table 24 and in Figure 28.

COURTYARD COMPLEXES

Two or more room clusters joined by a common courtyard do not seem to occur at Kiet Siel. However, in several instances other types of evidence lead to the inference of a relationship between two room clusters. In such cases the associated clusters are designated courtyard complexes, even though a formal relationship to a common courtyard is not evident. There are only two such instances at Kiet Siel. Courtyard Complex 1 consists of Room Clusters 1, 2, and 4. Courtyard Complex 2 is comprised of Clusters 17 and 18. Both these units are discussed at greater length below.

Table 22. Architectural Data for Grinding Rooms and Rooms of Unknown Function at Kiet Siet

Architectural Features	Grinding Rooms				Rooms of Unknown Function	
	16	37	107	152	62	64 ^a
1st Story	x	x	x	x	x	
2nd Story						x
Walls						
3 Jacal					x	
Inside plastered						x
Inside smoke-blackened	x				x	x
One side open	x	x	x			
Floors						
Plaster over fill	x	x	x	x		
Ceiling						x
Roofs						
Originally unroofed	x		x			x
Roof destroyed					x	
Posts		2		0	4	
Auxiliaries		0		0	-	
Primaries		2		1	-	
Secondaries		9		?	-	
Closing material sticks		x		?	-	
Juniper bark matting		x		?	-	
Doorways					A,B	
Open				x	A,B	x
Jacal wall					A,B	
Masonry wall				x		x
Stone sill				x	A,B	
Low sill				x	A,B	x
T-shaped				x		?
Firepits present					x	
Metate bins	x	x	x	x		
Benches				x		
Doorways open onto						
Court					x	x
Room burned					x	

a - construction not completed

? - possible presence of feature

- - evidence of this feature destroyed

Table 23. Architectural Data for Courtyards at Kiet Siet

Architectural Features	Courtyards																											
	4	12	14	17	23	24	25	29	34	41-43	37	51	63	Roof R69	71	79	Roofs R80-81	85	Roof R92	95	96	104	110	114	135	137	149	154
1st Story	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x		x	x	x	x	x	x	x	x	x
2nd Story														x			x		x									
Walls																												
1 Jacal			x										x											x				
3 Jacal										x																		
Inside smoke-blackened	x																										x	
Floors																												
Modified bedrock	x			x				x				x	x											x				
Fill	x	x	x		x	x	x			x	x	x	x		x	x		x		x	x		x	x	x	x	x	x
Plastered	x		x		x	x	x													x			x	x	x	x		
Ceiling														x			x		x									
Originally unroofed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x
Doorways																												
Open	x																											
Masonry wall	x																											
Stone sill	x																											
Low sill	x																											
Firepits																												
Present	x	x	x		x		x	x	x	x	x	x	x				x		x					x				
Inferred																											x	
Metate bins								x		x			x															
Holes in floor																					x							
Retaining wall and artificial fill					x	x	x				x				x					x	x		x	x	x	x	x	x
Poles								x																				

Table 24. Composition of Room Clusters at Kiet Siet

Room Cluster	Structural Units						Total Number of Rooms
	Court-yards	Living Rooms	Granaries	Store-rooms	Grinding Rooms	Unknown	
	Room Numbers						
1	4	3	1,2,6	-	-	-	4
2	12,14,17	13	5,8,9,10,11,15,19,22	7	-	-	10
3	14,17	pre-15	?	?	-	-	?
4	23,24,29	20	18,21,26,31	-	16	-	6
5	25	38	-	27,28,39	37	-	5
6	34	33,35	30	32	-	-	4
7	41-43,47	36	44,45	-	-	-	3
8	51	56	52,54/55	53,57/58	-	62	8
9	63	61	59/60,65	-	-	64	5
10	Roof 69	69	67,68	-	-	-	3
11	Roofs 80-81	80	81	-	-	-	2
12	?	83	82	-	-	-	2
13	?	84	86	87	-	-	3
14	Area 79?	90	66,88,89,91	-	-	-	5
15	71,154	75	50,72,73	-	152	-	5
16	95,96	92	93,97	94	-	-	4

Table 24--Continued

Room Cluster	Structural Units						Total Number of Rooms
	Court-yards	Living Rooms	Granaries	Store-rooms	Grinding Rooms	Unknown	
	Room Numbers						
17	149	100	98	99,102	-	-	4
18	149	pre-144-146	142,143, 144,145, 146	147	-	-	5
19	137	138	103,140, 141	139	-	-	5
20	135	136	132,133, 134	105,106	107	-	7
21	-	129	131	inside 129	-	-	4
22	-	123	130	124,126	-	-	4
23	110	111	108	109	-	-	3
24	114	122	112,113, 115,116, 117,119	118,120, 121	-	-	10
25	-	151?	150	-	-	-	2?

LARGER HABITATION UNITS

A very tenuous grouping of room clusters with an associated kiva may be isolated at Kiet Siel. Recognition of this grouping requires no little imagination. Indeed the whole thing may be completely fortuitous. The grouping consists of Room Clusters 11, 12, 13, and 14 and Kiva 78 (Figs. 23 and 28). If not fortuitous, this grouping may represent the presence of a localized lineage or clan with its own kiva. Presumably this type of organization was on its way out at this time, so this may represent a holdover of some sort. Again, it must be cautioned that this barely recognizable grouping may be due entirely to chance. No other such unit can be recognized anywhere else in Kiet Siel.

The large "house blocks" defined by McGregor (1965: 329, Fig. 159) do not exist either as structural or historical units. Primarily they consist of groups of rooms united by their orientation toward a particular street or by gaps between rooms. In several instances rooms from a single room cluster are included in two different house blocks. Numerous internal divisions in each house block illustrate their lack of structural unit. For example, the definite separation between Room Clusters 14 and 16 (Fig. 28) is ignored and both are included in a single house block. Room Cluster 16 is oriented toward the southwest and separated by a high blank wall from Room Cluster 14 which is oriented toward the southeast. Even the upper street is blocked at this point.

TRAILS AND STREETS

A number of hand and toe hold trails pecked into bedrock are associated with Kiet Siel. Several of these are situated just beneath the large suspended log and provided access to the upper part of the cave. They are located in the same general area as the long ladder that may be seen in Figure 24. Another aboriginal hand and toe hold trail ascends the Navajo sandstone cliff opposite Kiet Siel Cave. This undoubtedly provided the people of the village with access to the top of Skeleton Mesa where game and firewood were probably more abundant than in the canyon. A well made hand and toe hold trail that begins at the summit of a large talus cone just south of Kiet Siel Cave is not aboriginal. According to Julian D. Hayden, it was made by members of the CWA project for purposes of gathering firewood on the mesa top.

Kiet Siel is nearly unique among all the Tsegi Phase cliff pueblos in possessing long relatively wide streets along which are strung the rooms of the pueblo. There are three such streets: two in the eastern part of the site and one in the southwestern part. The lower street in the east is formed by the surface of the artificial fill banked behind the front retaining wall (Fig. 29 a). It runs nearly the full length of the eastern half of the site, beginning at Room 77 and ending in Court 12. Although broad, it is not as wide as it looks, for the now destroyed southern parts of Kivas 75 and 76 would have projected out into it. The higher eastern street (Fig. 29 b) is shorter and narrower than the lower. It rests on bedrock and on artificial fill banked against the back walls of Rooms 71-73, 152, 49, and 50. The street runs from Court 79 to Court 41-43. It

a

b

Fig. 29. "Streets" at Kiet Siel. a, lower east street; b, upper east street. Note how this street was screened from adjacent courtyards by jacal walls.

is lined on the northwest side by room clusters whose courtyards were separated from it by a jacal screen and a low masonry wall. The third street runs the entire length of the southern part of the site beginning at Court 96 and ending at Rooms 118-119 (Fig. 23). It is formed by artificial fill except near the south end where bedrock rises to the surface. The street is unique in the Tsegi Phase in being flanked on both sides by rooms which face each other across it.

In addition to the three major streets, there are a few short narrow walkways. Like the walkways at Betatakin, these are extensions of courtyards.

ABRADING AREAS

While there are innumerable abrading grooves at Kiet Siel, there are no larger abrading areas such as those at Betatakin.

CERAMICS

Two sources of ceramic material are available for Kiet Siel: survey collections at the Museum of Northern Arizona and the Arizona State Museum and trash midden stratigraphic excavations performed by Keith M. Anderson in 1964. Pottery types in these collections are: Kana'a Gray, Coconino Gray, Medicine Gray, Honani Tooled, Tusayan Corrugated, Moencopi Corrugated, Kiet Siel Gray, Lino Black-on-gray, Kana'a Black-on-white, Black Mesa Black-on-white, Sosi Black-on-white, Dogoszhi Black-on-white, Flagstaff Black-on-white, Tusayan Black-on-white, Betatakin Black-on-white, Kayenta Black-on-white, Deadmans Black-on-red, Medicine Black-on-red, Tusayan Black-on-red, Kiet Siel Black-on-red, Citadel Polychrome, Cameron Polychrome, Tusayan

Polychrome, Kayenta Polychrome, Kiet Siel Polychrome, Tsegi Orange, Tsegi Black-on-orange, Tsegi Red-on-orange, Jeddito Black-on-orange, and Jeddito Polychrome. The temporal ranges of the more diagnostic of these pottery types are diagrammed in Figure 30.

The ceramic picture at Kiet Siel is obviously quite different from that at Betatakin where only Tsegi Phase types occur. Anderson (1966a) recognizes three distinct periods of occupation. The earliest of these took place in Pueblo I--early Pueblo II times between about A.D. 950 and 1000. The second occupation took place during the Pueblo II period probably in the late 1100's and early 1200's. Finally, a Pueblo III occupation lasting from about 1250 until the abandonment of the village is represented. On the basis of percentage distributions of various pottery types, Anderson divides the debris representing the last period into pre-1275 and post-1275 components. As will be seen, the tree-ring dates reflect this breakdown, although the last period is by far the most strongly represented.

It is quite clear that Kiet Siel, in contrast to Betatakin, is a multi-component site. The cave was occupied intermittently for at least 500 years. It is not unreasonable to suppose that Basketmaker II and III occupations also occurred. Milton A. Wetherill reports Basketmaker III pottery from deep trash deposits in an area of the cave not tested by Anderson. The Basketmaker II deposits in Turkey Cave (Breternitz 1964) indicate an intensive occupation which may well have spilled over into Kiet Siel Cave. The long occupation of Kiet Siel Cave might be expected to skew the tree-ring dates and thus limit

Fig. 30. Temporal ranges of pottery types from Kiet Siel. The dates are those assigned by Breternitz (1963). Vertical lines represent the total time spans of the types; heavy vertical bars indicate the periods of abundance.

the usefulness of the site for intra-phase comparison. Surprisingly, this is not at all the case.

TREE-RING DATA

Tree-ring specimens from Kiet Siel are included in all three institutional collections: the Douglass Collection (KSC- and KS-series), the Museum of Northern Arizona collection (F-series), and the Gila Pueblo collection (GP-series). Although there are 601 individual specimens, correction for duplication reveals the presence of samples from only 540 different trees. The species breakdown of the 540 specimens is as follows: 185 quaking aspen (34.3%), 101 Douglas-fir (18.7%), 82 juniper (15.2%), 71 pinyon (13.1%), 52 white fir (9.6%), 27 boxelder (5.0%), 14 oak (2.6%), 5 of unknown nonconiferous species (.9%), and 3 ponderosa pine (.6%).

Byron Cummings was the first to sample Kiet Siel for tree-ring material when he collected KSC-5, 6, and 7 in 1920. In 1927 A. E. Douglass collected KS-1 through KS-26A at the site. Lyndon L. Hargrave of the Rainbow Bridge--Monument Valley Expedition collected 53 of the 61 F-series specimens. The remaining eight F-series samples were collected at some later time, but the Museum of Northern Arizona catalogue book does not record the year or by whom the collection was made. GP-1586, a duplicate of F-3144, was sent by the Museum of Northern Arizona to Gila Pueblo in 1940. The two remaining GP-series specimens were collected by Deric O'Bryan in 1941. Roland R. Richert of the Ruins Stabilization Unit of the National Park Service collected KS-28 and KS-29 from a prehistoric sump or well. The majority of the

Douglass Collection specimens were collected during my field work in 1962 and 1963. KS-30 through KS-84 were collected in 1962, KS-85 through KS-489 were collected in 1963. Finally, KS-490 through KS-539 were recovered from Anderson's stratigraphic tests in the Kiet Siel trash midden in 1964.

The pertinent data on the 400 undated tree-ring specimens from Kiet Siel are presented in Tables 25 and 26. Table 26 contains fewer than 400 entries because 188 specimens did not have a true outside or the nature of the terminal ring could not be determined because of the tightness of the ring series.

Only 140 of the 540 tree-ring specimens from Kiet Siel yielded dates (Table 27). This is a rather poor 26%. Part of the reason for this lies in the preponderance of nonconiferous specimens, which comprise 42.8% of the sample. However, only 45.3% of the coniferous specimens were dated---a figure far below the 66.5% for Betatakin. This state of affairs is difficult to explain. At Kiet Siel, Douglas-fir and white fir growth tended to be relatively rapid and uniform year after year. Thus, trees cut for structural beams usually exhibit short and complacent ring series. Cores collected from living trees growing near Kiet Siel show that this type of growth remains typical of the area today. Pinyon and juniper specimens from Kiet Siel generally show more erratic ring series than is typical of those from Betatakin. Whatever the reasons, the Kiet Siel collection is less satisfactory for dendrochronological analysis than is the Betatakin collection.

Table 25. Use-Category and Species of Undated Tree-Ring Specimens from Kiet Siel

Use-Category	Species									Total
	DF	WF	JUN	PNN	PP	Pop	Box	Oak	Unknown	
Roof beams	14	12	20	3	1	161	14	6	0	231
Jacal wall posts	1	1	1	1	0	6	5	1	0	16
Roof beam support posts	0	1	0	0	0	0	2	0	0	3
Pole	0	0	0	0	0	0	0	1	0	1
Posts of undertermined use	0	0	3	0	0	0	0	0	0	3
Vertical and horizontal logs in masonry walls	2	0	0	0	0	4	3	1	0	10
Firepits	6	0	11	14	1	1	0	1	1	35
Loose logs in rooms	9	0	4	3	0	5	1	0	0	22
Door sill	0	0	0	1	0	0	0	0	0	1
Large log across entrance to village	0	1	0	0	0	0	0	0	0	1
Trash excavations	4	0	9	26	0	0	0	3	2	44
General and unknown	10	5	4	1	0	8	2	1	2	33
Total	46	20	52	49	2	185	27	14	5	400

Table 26. Complete and Incomplete Terminal Rings of
Undated Tree-Ring Specimens from Kiet Siel

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	12	4	16
White fir	12	1	13
Ponderosa pine	0	1	1
Juniper	17	6	23
Pinyon	0	3	3
Quaking aspen	77	55	132
Boxelder	17	5	22
Oak	2	0	2
Total	137	75	212

Table 27. Dated Tree-Ring Specimens from Kiet Siet

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 3</u>							
Primary Beam							
Beam 1	KS-33	DF	Core	C	X	1203p -- 1272L	
<u>Room 5</u>							
Primary Beam							
Beam 1	KS-88	JUN	Core	C	X	(1228 -- 1273rB)	Tentative date
Secondary Beams							
Beam 3	KS-89	JUN	Core	C	X	1226 -- 1277rB	
Beam 4	KS-90	WF	Core	C	X	1220p -- 1273rL	
<u>Room 9</u>							
Secondary Beam							
Beam 11	KS-95	JUN	Core	C	X	1179 -- 1262rB	
Post supporting E. end of Primary Beam, Beam 1							
	KS-92	PNN	Core			1067 -- 1216++vv	Ring count from 1200

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 13</u>							
Primary Beam							
Beam 9	KS-98	DF	Core			(814 -- 973vv)	Tentative; no sap- wood; poss. reused or deadfall
Floor	KS-99	PNN	Chcl. frag.			842 -- 945vv	
<u>Room 15</u>							
Primary Beams							
Beam 1	KS-31	WF	Core	C	X	1241p -- 1286rL	
Beam 2	KS-18* KS-32*	WF	1"core Core	C	X	1240p -- 1286rL	
Secondary Beam							
Beam 8	KS-104	JUN	Core	C	X	1178p -- 1271rB	
<u>Room 18</u>							
Secondary Beam							
Beam 3	KS-108*	DF	Core	C	X	1194p -- 1273rL	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 20</u>							
Primary Beams							
Beam 1	KS-46	DF	Core	C	X	1142 -- 1275r <u>G</u>	
Beam 3	KS-48	WF	Core	I	X	1248p -- 1283 <u>G</u>	
Secondary Beams							
	KS-111	JUN	Core	C	X	1210p -- 1278 <u>B</u>	
	KS-112	JUN	Core	C	X	1148 <u>p</u> -- 1280r <u>B</u>	Ring count from pith to 1180
<u>Court 23</u>							
Post, NW corner	KS-115	PNN	Core			1173 -- 1270++vv	Ring count from 1250
<u>Court 24</u>							
Loose Log	KS-13* KS-45* F-3111	WF	1"core Core 1"core			1219p -- 1284v	Very close to cutting date
<u>Court 25</u>							
Firepit	KS-117	PNN	Chcl. frags.	C		1135 -- 1226++B	Ring count from 1210

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Court 29</u>							
Post, SE corner	KS-119	JUN	Core	I		(1166 -- 1259++B)	Tentative; ring count from 1220
<u>Room 33</u>							
Primary Beam							
Beam 1	KS-38*	WF	Core	C	X	1196p -- 1272rB	
Secondary Beams							
Beam 2	KS-124	WF	Core	C	X	1129p -- 1272rB	
Beam 8	KS-125	DF	Core	C	X	1223p -- 1272rB	
Post 9, support- ing S. end, Beam 1	KS-126	WF	Core	C	X	1231p -- 1272rB	
<u>Room 35</u>							
Primary Beam							
Beam 1	KS-134	DF	Chd.wd. I frag.	I	X	1180 -- 1273rL	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 35 (cont.)</u>							
Secondary Beam							
Beam 3	KS-136	PP	Wood sec.	C	X	(1237p -- 1275cB)	Tentative date
<u>Room 36</u>							
Secondary Beams							
Beam 9	KS-146	WF	Core	C	X	1219p -- 1271r <u>LG</u>	
Beam 10	KS-147	DF	Core	C	X	1249 -- 1276r <u>L</u>	
Beam 11	KS-148	DF	Core	C	X	1225 -- 1273r <u>LGB</u>	
<u>Room 42</u>							
Jacal Wall Posts							
East Wall	KS-49	PNN	Chcl. sec.	I	X	1237p -- 1280c	
South Wall	KS-15*	WF	Wood frag.	C	X	1233p -- 1284rB	
	KS-173*		Core				
	KS-174*	PNN	Core			1140 -- 1279vv	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 42 (cont.)</u>							
Near E. Wall	KS-162	PNN	Chcl. frag.	I	X	(1206 -- 1261B)	
	KS-164	DF	Chcl. frag.			1132 -- 1284v	
Mealing Bin near E. Wall	KS-169	JUN	Chcl. frag.	C	X	1226 -- 1281r	
Loose Log	KS-74*	DF	Wood sec.	C	X	1083p -- 1279rB	
<u>Room 44</u>							
Primary Beams							
Beam 1	KS-24 KS-175 F-3118	WF	1"core Core 1"core	C	X	1232p -- 1274rL	
Beam 2	KS-176 F-3119	WF	Core 1"core	C	X	1242p -- 1273rL	
Beam 4	KS-178	DF	Core	C	X	1243p -- 1275rL	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 44 (cont.)</u>							
Primary Beams							
Beam 5	KS-23 KS-179 F-3117	DF	1"core Core 1"core	C	X	1232p -- 1275rL	
Secondary Beams							
Beam 7	KS-180*	DF	Core	I	X	1176p -- 1274rL	
Beam 8	KS-181	WF	Core	C	X	(1252p -- 1273rL)	Tentative date
Beam 9	KS-182	DF	Core	C	X	1225 -- 1275rL	
<u>Room 45</u>							
Primary Beams							
Beam 1	KS-184 F-3116	WF	Core	C	X	1235p -- 1275rL	
Beam 2	KS-185* F-3112*	WF	Core 1"core	C	X	1170 -- 1275rL	
Beam 3	KS-186 F-3114	WF	Core 1"core	C	X	1199p -- 1274rL	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 45 (cont.)</u>							
Primary Beams							
Beam 4	KS-187 F-3113	DF	Core 1"core	C	X	1232p -- 1275rL	
Secondary Beams							
Beam 10	KS-188	WF	Core	C	X	1249p -- 1275rL	
Beam 14	KS-190	DF	Core	C	X	1248p -- 1275rL	
Post supporting cracked Beam	KS-191	WF	Core			1855p -- 1900vv	Same as KS-272 and KS-275 from niche in Kiva 76
<u>Kiva 46</u>							
Post 1	KS-192 F-3137	WF	Core Wood frag.			1185p -- 1274v	
E. Post in Deflector	KS-195	JUN	Core	I	X	1197p -- 1271rLB	
Pole outside Banquette	KS-54	WF	Core			1234p -- 1275v	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Kiva 46 (cont.)</u>							
Pole outside Ventilator	KS-55	WF	Core			1249p -- 1275v	Probable cutting date
"Probable roof beam"	F-3138	DF	Wood sec.			1232p -- 1271v	
"Probable roof beam"	F-3153	PNN	Wood sec.	C	X	1240p -- 1272GB	
<u>Room 49</u>							
Loose Log	KS-197	DF	Wood sec.	C	X	(1251 -- 1273rL)	Tentative complacent
<u>Room 56</u>							
Beam 1	KS-205* F-3235	DF	Core Wood frag.	C	X	905p --- 950rL	A reused beam
Loose Log	F-3139*	DF	Wood sec.			1214p -- 1274v	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 56 (cont.)</u>							
Loose Log	F-3152	DF	Wood sec.			1234p -- 1270v	
<u>Room 60</u>							
Primary Beams							
Beam 1	KS-210	WF	Core	C	X	1216p -- 1273r <u>L</u>	
Beam 2	KS-211	WF	Core	C	X	1256p -- 1273r <u>L</u>	
<u>Room 61</u>							
Secondary Beam	KS-217	DF	Core	I	X	1223p -- 1267r <u>LG</u>	
<u>Court 63</u>							
Firepit	KS-223	DF	Chd.wd. frags.	C	X	1239 -- 1272rL	May not be fire- wood
	KS-226	PNN	Chcl. frag.			1207 -- 1261vv	
	KS-229	DF	Chcl. frag.			1210 -- 1244vv	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Upper East Street</u>								
Pole	KS-61	JUN	Core	C	X	1190	-- 1274rB	
<u>Room 65</u>								
Primary Beams								
Beam 1	KS-62	DF	Core	C	X	1244	-- 1275rL	
Beam 2	KS-63*	DF	Core	C	X	1198	-- 1275L	
Secondary Beams								
Beam 3	KS-238*	JUN	Core	C	X	1145 <u>p</u>	-- 1276rB	Count from pith to 1180
Beam 9	KS-65	JUN	Core	C	X	1161 <u>p</u>	-- 1273rB	Count from pith to 1200
Beam 14	KS-242*	JUN	Core	I	X	1200	-- 1279L	
<u>Room 68</u>								
Primary Beam								
Beam 1	KS-244*	PNN	Core	C	X	1157p	-- 1271rB	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 69</u>							
Primary Beams							
Beam 1	KS-66 F-3144 GP-1586	DF	Core Wood sec. Pie cut	C	X	1194p -- 1275rL	From same tree as Beams 3 and 6
Beam 2	KS-247 KSC-6	JUN	Core 1"core	C	X	1165 ₊ -- 1274rL	Count from center to 1200
Beam 3	KS-67 F-3135	DF	Core				Same as Beams 1 and 6
Secondary Beams							
Beam 4	KS-248	JUN	Core	C	X	1238 ₊ -- 1274rL	Count from center to 1242
Beam 6	KS-250	DF	Core				From same tree as Beams 1 and 3
Beam 7	KS-251	JUN	Core	C	X	1177 ₊ -- 1275rB	Count from center to 1200
Beam 9	KS-253	WF	Core	C	X	1223 -- 1273rL	
Beam 11	KS-255*	PNN	Core	C	X	1175 -- 1275L	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 69 (cont.)</u>							
Secondary Beams							
Beam 14	KS-258	JUN	Core	I	X	1139 -- 1274rL	
<u>Room 74</u>							
Jacal Front Wall							
Post 1	KS-56	DF	Core	C	X	1235p -- 1275rB	
Post 13	KS-270	DF	Core			1234 -- 1271vv	
Wood fragment in wall	KS-268	WF	Core	C	X	(1257 -- 1273rL)	Tentative; short and complacent
<u>Kiva 76</u>							
Niche							
Uprights 1 & 2	KS-272 KS-275	WF	Core Core				Same as KS-191 from Room 45
Loose Log	KS-60 F-3106	WF	Wood sec. Wood sec.	C	X	1210p -- 1273cLB	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Kiva 76 (cont.)</u>							
Loose Log	GP-4272		Wood sec.				
<u>Room 77</u>							
Beam 5	KS-281	DF	Core			1222p -- 1272v	Probable cutting date
<u>Kiva 78</u>							
Firepit	KS-44*	PNN	Chcl. frag.			848 -- 979vv	
<u>Room 80</u>							
Primary Beam							
Beam 2	KS-69	DF	Core	C	X	1213 -- 1279L	
Secondary Beams							
	KS-287	DF	Core	C	X	1232p -- 1276L	
	KS-294	WF	Core	C	X	1225 -- 1277rL	
<u>Room 83</u>							
Firepit	KS-297	DF	Chcl. frag.			1206 -- 1271+v	(1)

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Room 84</u>								
Secondary Beams								
Beam 2	KS-300	WF	Core	C	X	1243	-- 1280 <u>GB</u>	
Beam 3	KS-75	DF	Core	C	X	1226p	-- 1260 <u>L</u>	
Beam 5	KS-301*	WF	Core	C	X	1243p	-- 1283r <u>L</u>	
Beam 6	KS-302*	DF	Core	C	X	1242p	-- 1283r <u>L</u>	
<u>Room 90</u>								
Secondary Beams								
Beam 1	KS-80*	DF	Core	C	X	1188	-- 1273r <u>L</u>	
Beam 8	KS-310	DF	Core					Tentative; from same tree as Beam 11
Beam 11	KS-312	DF	Core	C	X	(1205p	-- 1267r <u>B</u>)	Tentative; from same tree as Beam 8
Beam 15	KS-315	DF	Core	C	X	(1216	-- 1266r <u>B</u>)	Tentative date

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 92</u>							
Horizontal log embedded in NW wall	KS-324 F-3109	DF	Core	C	X	1197p -- 1258r <u>L</u>	
Split log splints, closing material	F-3124-1* et al.	DF	Wood frags.			955 -- 1156v	Probable cutting date; RB-MV Exped. field notes not specific enough to make certain the placement of these specs. in this room. Pieces of this spec. are numbered F-3124, 3125, 3127, 3128, 3130, 3131, 3140, 3141, 3142, 3145, 3146, and 3149.
<u>Room 93</u>							
Secondary Beam							
Beam 4	KS-329	JUN	Core	I	X	1161 -- 1245 <u>L</u>	
<u>Room 97</u>							
Secondary Beam							
Beam 4	KS-81	JUN	Core	C	X	1142 -- 1274 <u>B</u>	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 97</u>							
Loose Log	KS-335	DF	Core			1184 -- 1239vv	
<u>Room 98</u>							
Primary Beam							
Beam 1	KS-337	DF	Core			1227 -- 1253vv	
<u>Room 100</u>							
Jacal Wall							
Post 1	KS-346	DF	Core	I	X	997 -- 1209 <u>G</u>	A reused beam
<u>Room 117</u>							
Secondary Beam							
Beam 7	KS-355	JUN	Core	I	X	1152p -- 1269rB	
<u>Room 126</u>							
Beam 1	KS-368*	JUN	Core	C	X	1192 -- 1286rB	
Beam 2	KS-369	JUN	Core	C	X	1134p -- 1276rB	

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 129</u>							
Small beam in doorway	KS-387	JUN	Core	I	X	1230p -- 1275 <u>L</u>	
<u>Room 132</u>							
Primary Beam							
Beam 1	KS-400*	JUN	Core	C	X	1115 -- 1274r <u>B</u>	
<u>Room 134</u>							
Secondary Beams							
Beam 2	KS-412	WF	Core	C	X	1249p -- 1273r <u>L</u>	
Beam 4	KS-414	WF	Core	C	X	1224p -- 1273r <u>B</u>	
<u>Room 136</u>							
Primary Beams							
Beam 1	KS-415	DF	Core	C	X	1250 -- 1277r <u>L</u>	
Beam 5	KS-419	JUN	Core	C	X	1102 <u>+</u> -- 1274 <u>L</u>	Count from center to 1120

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 138</u>							
Secondary Beams							
Beam 8	KS-428	PNN	Core	C	X	1193 -- 1269 <u>B</u>	
Beam 10	KS-430*	DF	Core	I	X	1218p -- 1277rB	
Beam 14	KS-432	PNN	Core	I		1180p -- 1274+rB	(1)
<u>Room 142</u>							
Primary Beam							
Beam 2	KS-449	WF	Core	C	X	1250p -- 1272rB	
<u>Room 143</u>							
Secondary Beam							
Beam 4	KS-454	JUN	Core	C	X	1115p -- 1256r <u>B</u>	
<u>Room 147</u>							
Secondary Beam							
Beam 6	KS-470	JUN	Core	C	X	1143 <u>+</u> -- 1249r <u>L</u>	Count from center to 1150

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 150</u>							
Secondary Beams							
Beam 7	KS-478	PNN	Core	I	X	1229p -- 1285r <u>LGB</u>	
Beam 8	KS-479	DF	Core	I	X	1199 -- 1255 <u>L</u>	
<u>MNA Collection</u> specimens from unidentifiable Rooms							
	F-3161*	JUN	Wood frag.			940 -- 1110vv	No sapwood; poss. from Room 92B; probably a deadfall
	F-3167	WF	Wood sec.	C	X	1253p -- 1278G	"Kiva in front and near center of cave"
	F-3183*	DF	Wood sec.			1194p -- 1274v	"Stone ax end from room in front row of houses (Kin Tiel) Room 3"
	F-3192		Pie cut				

Table 27--Continued

<u>Provenience</u>	<u>Catalogue Number</u>	<u>Species</u>	<u>Form</u>	<u>TR</u>	<u>CD</u>	<u>Dates</u>	<u>Remarks</u>
<u>Roof, Room 15</u>							
Loose Logs	KS-486*	WF	Core			1160p -- 1272vv	
	F-3108		Wood				
	F-3164		sec. Pie cut				
	KS-488	JUN	Core	C	X	1166+ -- 1274L	Count from first ring to 1200
<u>Sump or Well</u>							
	KS-28	DF	Wood			1242p -- 1273v	Close to cutting date
			sec.				
	KS-29*	DF	Wood			1212p -- 1274v	Probable cutting date
			sec.				
<u>General</u>							
	KS-4*	JUN	Wood			1115 -- 1256v	
			sec.				
	KS-6*	JUN	Wood			1109p -- 1273v	
			secs.				
	KS-9	JUN	Wood			1170 -- 1281vv	
			frag.				
<u>Trash Excavations, Anderson, 1964</u>							
	KS-495	PNN	Chcl.			916 -- 961vv	
			frag.				

Table 27--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates		Remarks
<u>Trash Excavations</u> (cont.)								
	KS-505	PNN	Chcl. frag.	C	X	1209	-- 1280rB	
	KS-507	PNN	Chcl. sec.			1226p	-- 1278vv	
	KS-520	PNN	Chcl. frag.			986	-- 1032vv	
	KS-522	PNN	Chcl. frag.			786	-- 861vv	
	KS-527	PNN	Chcl. frag.			714	-- 816vv	
"Stairway" at head of <u>NPS Ladder</u>	KS-482	WF	Core	C	X	1893p	-- 1933rB	Built by CWA project, 1933-34
<u>No Provenience</u>	F-4273*	PNN	Wood sec.	C	X	1199p	-- 1286cL	
	KS-16*	DF	Wood frag.			698	-- 1210++vv	Artifact collected by J. Wetherill in 1927; count from 1060

For key to headings and symbols, see Chapter 6.

CHRONOLOGICAL ANALYSES

ROOM CLUSTER ANALYSIS

Room Cluster 1

This cluster consists of Rooms 1, 2, 3, and possibly 6. It is centered on Court 4 which is formed partly of bedrock and partly of fill banked behind the large front retaining wall. A deep pecked groove in the bedrock extends eastward from the present end of the retaining wall for a distance of about ten feet. Thus the retaining wall probably extended the full width of the court.

Living Room

Room 3. The single cutting date from this room indicates that it was built in 1272 or later. Since it probably was built after Room 5 (1277), this date may represent a reused or stockpiled timber.

Granaries

Room 1 is a small granary with a roof hatch entry. There are no tree-ring dates. Abutments show that it was built after Room 2.

Room 2 is also a small storage chamber that lacks tree-ring dates.

Room 6 is a tiny granary in a crevice in the cliff above Room 5. Pecked steps on the bedrock ledge in front of the doorway lead toward the roof of Room 3, suggesting that Room 6 belongs to Room Cluster 1.

Room Cluster 1 is poorly dated, but must have been built sometime after 1277, the year in which Room 5 was built. Indeed Cluster 1 may be an adjunct to the earlier Room Cluster 2.

Room Cluster 2

This particularly large cluster has two living rooms, eight storage chambers, two or three courtyards, and an associated grinding room. Figure 11 a illustrates part of this cluster. Throughout the cluster there is a bewildering abundance of evidence for building, destroying, rebuilding, and remodeling which makes the architecture and dates difficult to interpret. The tremendous amount of alteration is reflected in the tree-ring dates, which cluster poorly.

Courtyards

Court 12 is the major focus of this cluster. Two dwellings and four storage chambers open directly onto the court. In addition, two other storage chambers open onto the roofs of rooms which front on the court. A large central firepit served the court.

Court 14 is a small courtyard which probably was screened from the "street" by a jacal wall indicated by the dashed line on the floor plan (Fig. 23). A small rectangular firepit is located just inside this wall. The only room presently connected with this court is Room 15, a large granary.

Court 17 may once have served a different function. However, there is no evidence that it ever was roofed. It has no firepit, nor are its walls smoke-blackened, which suggests that it never served the domestic functions characteristic of most courtyards.

Living Rooms

Room 9 is a large but poorly dated chamber. The cutting date of 1262 probably reflects the time of its construction, although it may have come from a reused timber. Abutments show it to be later than the adjoining Rooms 8 and 10 and earlier than Room 7.

Sometime after its construction and use as a dwelling, Room 9 was converted into a granary. This is most clearly shown by alterations to the doorway. Figure 31 a shows that the lower half of the original T-shaped doorway was plugged with masonry topped by a large slab sill. The high doorway thus produced was grooved to receive a stone slab door. The application of a coat of fresh unsmudged plaster over the heavily smoke-blackened walls inside the room undoubtedly accompanied the modifications to the doorway as part of the conversion procedure.

Room 13 is unique in Tsegi Phase cliff pueblos---a subterranean living room (Fig. 31 b). While pithouses are common in late Pueblo III sites near Navajo Mountain (Hobler 1964), they have not yet been identified as part of the Tsegi Phase settlement pattern. Although this may be due to a lack of excavated Tsegi Phase open sites, the same cannot be said for the cliff dwellings. Actually, Room 13 is not a true pithouse. It is a normal Tsegi Phase living room sunk into the artificial fill behind the great retaining wall. It contains features typical of roof-entered dwellings.

The two tree-ring dates do not help date the room. Beam 9 is either a reused timber or a fragment removed from a long-dead tree. The firepit date obviously comes from either a long-dead tree or a construction timber cut during an earlier occupation of the cave.

a

b

Fig. 31. Architectural details of Room Cluster 2 at Kiet Siel. a, partially sealed doorway of Room 9; b, Room 13, the only known Tsegi Phase subterranean living room. The roof hatch gives access to both Courts 4 and 12.

Room 13 is probably a late addition to Cluster 2; it postdates both Court 4 and the retaining wall and is therefore post-1272. There is no evidence for remodeling.

Granaries

Room 5. The three dates from this room can be interpreted in two ways: (1) the room was built in 1273 and the roof repaired in 1277; (2) the room was built in 1277 using at least two timbers cut in 1273. The lack of any evidence for modification of the room favors the second alternative. Wall abutments show that Room 5 was built after Room 8.

Room 8 has no tree-ring dates. In line with a hypothesis developed below, the presence of nothing but quaking aspen in the roof should indicate an early date, perhaps pre-1270. Abutments show that Room 8 is older than Rooms 5 (1277), 7, and 9 (1262). There is no evidence that Room 8 was ever modified.

Room 10 also lacks tree-ring dates because of the exclusive use of aspen in the roof. Again, this fact may indicate an early date. Abutment patterns indicate that Room 10 was built before Rooms 9 (1262), 15 (1286), and 11. There is no evidence for modification of the room.

Room 11 has no associated tree-ring dates. It was built before Room 15 (1286) and after Room 10. A remnant of an older wall lies beneath the south wall of the room. Once again, no evidence for remodeling is apparent.

Room 15 is a large granary with a number of interesting features. A fresh coat of plaster covers heavy smoke stains on the north and west

walls. The east wall bears a slightly smoke-smudged coating of plaster. The south wall is also freshly plastered but over unsmudged stones and mortar. The two large primary beams are clean, while many of the secondaries are heavily sooted. From the exterior it is clear that the part of the west wall below the level of the secondary beams is part of an older structure. The south wall was erected on a low irregular remnant of an older wall that extends unbroken along the north side of Court 17. The east wall is formed by the back walls of Rooms 10 and 11. The north wall also forms the south wall of Rooms 9 and 21. A sealed dwelling-type doorway is located in the north wall opposite the southeast corner of Room 21. The west primary beam of Room 15 is seated in the upper east corner of this sealed doorway, suggesting that its sealing accompanied the construction of Room 15.

It is clear that Room 15 was built on the partially destroyed foundations of an older chamber. The smoke-blackening of the walls and the nature of the sealed doorway in the north wall indicate that this older structure was a dwelling. Room 15 is well dated at 1286. Thus, the former living room must have been built, used, and abandoned sometime before 1286. The smoke-stained secondary beams may be timbers reused from the earlier structure. If so, it may have been erected in 1271 as indicated by the date from Beam 8. This allows 15 years for its use, abandonment, and the building of Room 15 in its place---a not impossible span of time. The pre-Room 15 dwelling was probably associated with a different room cluster.

Because it was built on the foundations of an older room, abutment patterns are a poor indication of Room 15's relationships

to adjacent structures. The older living room was apparently built after Room 10, at the same time as Court 17, and before Room 22/21. Its temporal relationship to Rooms 9 (1262), 11, and 16 is unknown. The relationships of the present Room 15 are clearer. It was built after Rooms 9, 10, 11, 16, and Courts 14 and 17. It probably post-dates Room 22/21 also. There is no evidence for modification of the room after it was erected in 1286. Room 15 is one of the latest dated chambers at Kiet Siel.

Room 19 has no tree-ring dates. Abutments show it to be later than Rooms 17 and 20 and earlier than or contemporaneous with Room 18. A doorway in the south wall is sealed, probably in response to the accumulation of trash behind the retaining wall. At present the sealed doorway lies below the level of the fill against the south wall. Thus, Room 19 must have been in place before the retaining wall was built, and therefore predates 1272.

Room 22 is an unusual granary in that it has two doorways, both grooved to receive slab doors. The eastern doorway opens onto the roof of Room 9; the southern, onto the roof of Room 15. Again there are no tree-ring dates because of a lack of datable species in the roof. Room 22 was built after the old living room which was located in the area now occupied by Room 15. Its south wall is built around a remnant of the west wall of pre-Room 15. Room 22 is probably earlier than the present Room 15, dated at 1286.

Storage Room

Room 7 is a small chamber built of masonry and upright slabs located on the roofs of Rooms 8 and 9. It is impossible to identify this chamber as a storeroom or a granary, because the entrance has been destroyed. It obviously was built after Rooms 8 and 9.

Room Cluster 2 displays evidence of a very complex history. Unfortunately, the few dates contribute little to the interpretation of the cluster. In this case, wall abutments are more significant than tree-ring dates. Several alternative interpretations are possible. The one that best fits all the data follows.

The granaries associated with the cluster when it was first built are relatively easy to define. These are Rooms 8, 10, and 11. Room 9 was probably the living room. The cluster may have originated in 1262, if that date is accepted for Room 9. The original cluster centered on Court 12 and continued to grow around it. Room 5, a granary, was probably added in 1277. The addition of Room 13 to the cluster and the conversion of Room 9 into a granary cannot be dated either absolutely or relatively. The two events may or may not be related. Certainly Room 13 could not have been built before the retaining wall was finished between 1272 and 1275.

The relationship between the core area of Room Cluster 2, which is focused on Court 12, and the peripheral rooms is not clear. Granary 19, Courts 14 and 17, and pre-Room 15 were probably originally part of Room Cluster 3. Room 15 was built in 1286 on remnants of the

former living room that belonged to Cluster 3. Room 19 and Courts 14 and 17 may have been added to Cluster 2 in 1286 or they may have been annexed earlier.

Room Cluster 3

This cluster is difficult to define because it was partially destroyed and built over in prehistoric times. It may have consisted of the living room that preceded Granary 15, plus Courts 14 and 17, and Room 19. The dwelling had at least one doorway which opened to the north into the area now occupied by Rooms 22/21. It probably also had a second doorway which opened onto Court 14. Unfortunately, not enough of the old south wall remains to permit the identification of a doorway. This hypothetical doorway may have been constructed after the north doorway was sealed, or both may have been open at the same time. Room 19 may have been entered by way of the now sealed doorway in its south wall.

Despite the fact that Room Cluster 2 seems to have annexed the rooms belonging to Cluster 3, some evidence suggests that the inhabitants of the latter were more closely associated with the people of Room Cluster 4. The north doorway in the living room probably opened onto a passageway connecting with Courts 23 and 29, and Living Room 20. Furthermore, Room 17 was probably related to a large living room located in the space now occupied by Rooms 16 and 20. This room in turn communicated with Court 23 by way of a doorway in its north wall. All this indicates a great deal of interchange between the people of Room Clusters 3 and 4.

It is difficult to estimate when Room Cluster 3 was occupied. If the smoke-smudged secondary Beam 8 in Room 15 is a timber reused from the original dwelling, the cluster was probably in existence by 1271. Certainly it was abandoned by 1286 when Room 15 was built on the remnants of the living room. This allows a period of at least 15 years for the construction, use, abandonment, and partial destruction of the living room. This is much too short a time for natural agents to have accomplished the task, since most rooms at Kiet Siet still stand after 700 years, let alone 15. Barring collapse of part of the cave roof---a not too unlikely occurrence---the partial demolition of the living room and Room 17 must have been performed by the people of Kiet Siet. The stones and perhaps some of the roof beams were probably salvaged and used in some other structure. This process could have taken only a short time. A minimum span of 15 years for this cluster is not at all out of line. At any rate, Room Cluster 3 was constructed, occupied, and abandoned well within the total time span of Kiet Siet itself. That the village was prospering after Room Cluster 3 was abandoned is shown by the continued use of its granaries and the construction of a new granary in place of its living room.

Room Cluster 4

Room Cluster 4 is somewhat less dispersed than Cluster 2, and therefore is more easily isolated. Nevertheless, it, too, underwent a complex series of modifications. In its present form it consists of one dwelling, two courtyards, four granaries, and a grinding room.

Courtyards

Court 23 presently lies atop $2\frac{1}{2}$ feet of artificial fill packed between the cliff face and the front wall. The fill is covered with a layer of grass and reeds which is covered with a thick clay floor. Court 23 is connected by Walkway 24 to Court 25 and by a few pecked steps to Court 29. In its original form, Court 23 was probably a bedrock-floored passageway connecting the pre-Room 15 and pre-Room 20 dwellings with Court 29 and points west. The sealed doorway that opened from pre-Room 20 into pre-Court 23 now lies almost completely below the surface of the court. Sometime subsequent to its use as a passageway, the following modifications were undertaken. Rooms 22/21 were constructed in the eastern end of the passage. Since pre-Room 15 was now effectively cut off from this area, its northern doorway was sealed. The doorway of pre-Room 20 was sealed and the confined space behind it filled with trash and floored, forming the present Court 23. If the pole at the southwest corner of the court was erected when the present court was built, these modifications must have taken place several years after 1270. The present Court 23 took form after Rooms pre-15, 16, 20, 21, 26, and Court 29 was built.

Court 24 is a narrow passageway that connects Courts 23 and 25, each of which belongs to a different room cluster. Apparently its plaster floor was continuous with those of the courts on either side. Remnants of the plaster cling to the lower walls of Room 27, indicating that the latter was built before the court was floored. This floor is now almost entirely destroyed. Pecked into the bedrock beneath the floor are a number of wall-seating grooves which give

evidence that structures were formerly located here. Whether these structures were occupied before or during the Tsegi Phase cannot be determined. These structures, whatever they were, must have been demolished before the present rooms and courtyards were built in the area.

Court 29. The bedrock floor of this courtyard is sunken below that of Court 23 to which it is joined by three pecked steps. Three steps gouged out of the west wall at the southwest corner give access to the roof of Room 32 and thence to the lower east street. The tentative noncutting date from this courtyard is of little help in dating it. The low north walls were added after the construction of Rooms 20 and 33 (1272). The temporal relationship of the court to Rooms 30/31 and 32, which enclose its south side, are not apparent.

Living Room

Room 20 passed through at least three distinct phases of construction. Figure 32 includes a series of maps designed to clarify the discussion of this and Room 16. Originally Room 20 was a large dwelling located in the space now occupied by Rooms 16 and 20. This is indicated by heavy smoke-staining on the north, south, and east walls of Room 16. The early large dwelling opened northward into the passageway that preceded Court 23. The passageway joined this room with the pre-Room 15 dwelling which may indicate some sort of a relationship between the two. A high doorway in the south wall opened onto Court 17. The date of this early living room is not known. Abutments suggest that it preceded pre-Room 15 and therefore may have been built

Fig. 32. Sequence of alterations to Room Cluster 4 at Kiet Siel. a, original large dwelling built before 1270; b, large dwelling divided into three smaller rooms, about 1275; c, final modifications, about 1283.

before 1271. It may date in the 1260's and be more or less contemporaneous with the early chambers in Room Cluster 2. Room 26 may have been the granary associated with this large dwelling.

A number of modifications marked the beginning of the second phase of construction. The doorway in the north wall was sealed, and that in the south wall may have been closed also. A north-south wall was erected across the room, creating the present Rooms 16 and 20. These modifications may have been connected with the construction of Rooms 22/21 and Court 23. Certainly the courtyard could not have been filled until the north doorway was sealed. This, of course, would also have required the sealing of the north doorway of pre-Room 15, and may mark a definite shift in orientation of this chamber.

The uses to which the newly created Room 16 were put during this second phase of construction are not known. It may have been a grinding room or a passageway. Certainly it contained no fireplace, for the west wall and the seal in the north doorway are completely unblackened, in contrast to the other walls. It is impossible to determine if Room 16 was roofed at this time.

The newly created Room 20 was divided into two chambers by an east-west wall. Since at present all living room features occur to the south of the east-west wall remnant, I infer that the southern chamber was a small dwelling and the northern room a granary or store-room. Each of these rooms was connected to Room 16 by a doorway through the east wall.

It is difficult to estimate the date of the second period of construction. The post-1270 date of Court 23 may logically be applied

to the remodelings which created the present Rooms 16 and 20, since all these events seem to be related. The date of 1275 from the roof of the present Room 20 may date these modifications. Apparently it was sometime after the beginning of the second phase of Room 20 that pre-Room 15 was abandoned and the dismantling of its south and west walls and the north wall of Court 17 began. The effects of this demolition may be seen in Room 16. By the third phase pre-Room 15 was certainly abandoned.

A new series of modifications marked the beginning of the third and final phase of construction, which produced the form now exhibited by Rooms 16 and 20. By this time the demolition of the north wall of Court 17 had probably proceeded far enough to expose the interior of Room 16. The destruction of the east wall of Room 16 had probably also been accomplished to such an extent that the room could no longer be roofed---if it ever had been. During the third phase Room 16 was definitely a grinding room. The most extensive alterations, however, were performed on the other two rooms. First, the roof was removed. This is inferred from the fact that the present roof was built to cover a single chamber and not two. Next, the dividing wall was torn out, leaving only a stub in the east wall and a remnant on the floor. The southern doorway in the east wall was partially sealed to form a floor-level ventilator; the northern doorway was left open to give access to Room 16. The newly created single room was then roofed, leaving a hatch near the northwest corner. The final modifications to Room 20 probably took place in 1283---the latest date from the ceiling---or sometime thereafter.

Granaries

Room 18 was probably built in 1273, since there is no evidence for reuse of beams or alterations to the room after it was finished. Room 18 is perhaps the second granary to become part of this cluster. Apparently it was added during the first construction period of Room 20 but after the cluster had been in existence for a time.

Room 21 has no dates but predates Court 23, if only by a few days. It probably was built at the same time as Court 23 which is inferentially dated at about 1275. If so, Room 21 is the third granary added to the cluster.

Room 26 is probably the granary that was associated with the first stage of construction of the living room. It is built on a rock shelf which would have stood above the pre-Court 23 passageway. The fill and unbroken plaster floor of Court 23 lap up against the base of Room 26, indicating that the room was built before the courtyard.

Room 31. The bedrock floor of this room is sunk about 36 inches below that of the adjoining Court 29 to which it is connected by a grooved doorway. Again there are no tree-ring dates. Abutments show the room to have been built after Room 20, before Room 32, and perhaps simultaneously with Room 19. It may have been associated with the first phase of Room 20.

Grinding Room

Room 16 was used for grinding corn, for it contains at least three metate bins. As usual, the metates have been ripped out.

However, their impressions remain in the plaster in the bins. Room 16 in its final form had no roof and a front (south) wall only half the height of the other walls. A well defined sill in the south wall suggests a relationship with the rooms of Room Cluster 2. It is possible that women of both households availed themselves of this grinding room.

Since there is no roof, there are no tree-ring dates. The constructional history of this room was presented in the discussion of Room 20.

Room Cluster 4, like Clusters 2 and 3, underwent a long series of alterations (Fig. 32). It began, possibly as early as the 1260's, as a large dwelling, perhaps two granaries (Rooms 26 and 32), a passageway which ran along the north side, and a large courtyard (Court 29). In 1273 Room 18, a granary, was added to the cluster. Subsequently, perhaps about 1275, the dwelling was divided into three rooms---a dwelling, a storage chamber, and a grinding room or passageway---and the northern passageway was filled and floored to create Court 23. In 1283, or sometime thereafter, the living room was enlarged by removing the dividing wall to form the present Room 20. At that time also, Room 16 definitely became a grinding room if it had not already been one.

Courtyard Complex 1

Some evidence suggests that Room Clusters 1, 2, and 4 were related. The observable relationships between Clusters 1 and 2 are primarily structural. Figure 31 b illustrates these relationships. The wall that separates Court 12 from Court 4 is pierced by a

connecting doorway. Furthermore, the roof hatch in Room 13 is positioned so as to provide equal access to either cluster. The dividing wall ends at the north edge of the hatchway and never extended any farther (Fig. 31 b), thus providing direct passage into Court 4 from the hatch of Room 13. Nevertheless, the existence of the dividing wall shows that they are indeed separate clusters.

The relationships between Room Clusters 2 and 4 are both structural and historical. As pointed out previously, architectural evidence suggests that the people of these two clusters may have shared the grinding room. In addition, their reconstructed histories are closely linked through their mutual relationships to Room Cluster 3. Although early in its history Cluster 3 was more closely associated with Cluster 4, its buildings were later taken over by the people of Room Cluster 2.

The foregoing evidence is strong enough to identify Courtyard Complex 1 as consisting of Room Clusters 1, 2, and 4. Nevertheless, the evidence is not unequivocal. The three clusters are not joined by a single courtyard, and the possibility remains that the evidence cited resulted entirely from contiguity and not any formal relationship.

Room Cluster 5

In refreshing contrast to the first four clusters, Room Cluster 5 is compact and therefore easily recognized. It consists of a living room, three storage chambers, and a possible workroom grouped around two sides of Court 25.

Living Room

Room 38 is the only dwelling associated with this room cluster. It cannot be absolutely dated because every beam and post is either aspen or boxelder. However, the very presence of this many non-coniferous beams suggests that the room is early, probably pre-1270. During its occupancy it underwent only a few alterations. A living room-type doorway that once opened through the east wall now is sealed and plastered. The present doorway appears to have been knocked out of a formerly solid wall. It is apparent that sometime after its construction the entrance, and undoubtedly the firepit and entrybox complex with it, were moved from the east to the southeast side of the room. The reasons for this are not obvious. Abutments show Room 38 to have been built before Rooms 37 and 39.

Storage Chambers

Room 27 is probably a granary, but since the doorway has been almost entirely destroyed it is impossible to be certain about this. That it was the granary originally associated with Room 38 is indicated by the position of its doorway directly opposite the old doorway of the living room. Room 27 was built on the foundations of an older structure whose walls were footed in a groove pecked in the bedrock. It cannot be determined whether the older room was a Tsegi Phase structure or dates to an earlier occupation of the cave. The roof of Room 27 is missing and there are no dates. Abutments show it to be older than Room 26, which is inferred to predate 1270 on the basis of its

association with Room 20. This relationship strengthens the argument of an early date for Room Cluster 5.

Room 28 is a small closet-like room made by walling up the angle that the west wall of Room 27 forms with the back wall of the cave. Its doorway is missing and it cannot be positively identified as a granary. Room 28 postdates Room 27.

Room 39 is similar in size and shape to Room 28. It was created by walling up the angle between the east wall of Room 28 and the cave wall. At present it consists only of one course of stones. It not only postdates Room 38, but was built after the eastern doorway had been sealed, as Figure 23 clearly shows.

Workroom ?

Room 37 is a U-shaped structure facing Court 25 adjacent to the doorway of Room 38. It is doubtful that this room ever had a front wall. It is really an extension of Court 25, and it was probably used as a sheltered work area. The CWA map shows a mealing bin against the north wall of this room. Although there is now no sign of this bin, there is no reason to doubt its former presence. Room 37 may be nothing but a grinding room; its lack of a front wall is a characteristic grinding room trait. Abutments show it to be later than Room 38 and earlier than Room 36.

The lack of associated tree-ring dates makes it difficult to estimate when Room Cluster 5 was built and occupied. However, the overwhelming preponderance of aspen beams in Room 38 suggests an

early date. Its location at the rear of the cave, well back from the retaining wall, also supports this inference. Room Cluster 5 was probably built in the 1260's, or possibly even earlier.

Room Cluster 6

This cluster is compact and easily recognized. It consists of two living rooms, one granary, and one storeroom grouped around three sides of Court 34.

Living Rooms

Room 33 is a large D-shaped chamber with a front wall of jacal construction. With every date a cutting date at 1272, there can be little doubt that this chamber was built in that year. Abutments show the room to have been built before Room 35, which is dated at 1275, and probably after Room 32. There is no evidence for alterations of any kind.

Room 35. The jacal front wall of this room has burned off to a row of stubs in the ground. The roof has also burned, leaving only stubs of beams embedded in the walls. The dates of 1273 and 1275 are ambiguous; however, the room was probably built in 1275, utilizing a stockpiled beam. This constitutes the addition of a living room to a cluster at least three years after the cluster was begun. It may represent the marriage of a daughter and the addition of a new nuclear family to the household. Abutments show Room 35 to be later than Rooms 37 and 33 (1272) and earlier than Room 36 (1276). There is no evidence that the room was modified after its construction. It was

not reoccupied after it burned---an event which could have caused or occurred after its abandonment.

Granary

Room 30 opens directly onto the roof of Room 32 which overlooks Court 34. There are no tree-ring dates. The room must have been built after Room 31 and possibly before Room 18 (1273). There is no evidence for remodeling.

Storeroom

Room 32 opens directly onto Court 34. There are no dates. Abutments show that it was built after Room 31 and possibly before Room 33 (1272). In the north wall is a sealed doorway that once opened onto Court 29. Whether this indicates a former relationship to Room Cluster 4 is conjectural. The sealing of this entry evidently stopped leakage of smoke into Room 32, for the seal itself is completely unsmudged, while the walls are slightly smoke-blackened.

Room Cluster 6 originated in 1272 as Rooms 30, 33, Court 34, and possibly Room 32. Three years later a second dwelling, Room 35, was added to the cluster, bringing it to its final form. Subsequently the roof and jacal wall of Room 35 burned. This may have marked the end of occupation of that room or it may have occurred after the cluster, or even the site, was abandoned. It is noteworthy that this fire did not ignite the jacal wall or roof of the adjacent Room 33.

Room Cluster 7

Room Cluster 7 is rather complex and dispersed but still fairly easily identified. It consists of one dwelling, two large granaries, a possible courtyard, and a large courtyard-work area.

Courtyards

Court 47. A firepit located just outside the northeast angle of Kiva 46 indicates that this small area served as a courtyard for Room 36 of Cluster 7. Its limited extent was probably responsible for the use of Court 41-43 by the people of this cluster.

Court 41-43. The features numbered 41 through 43 are not really rooms. Rather they are small areas separated by a number of jacal walls. These walls probably served as windbreaks or as dividers that delineated functionally different segments of a larger unit. All three numbered features constitute a single work area. The areas numbered 41 and 42 each contain a mealing bin. Area 43 at present exhibits no features except the enclosing jacal wall. A firepit is located on the lip of a bedrock ledge adjacent to the north edge of the roof of Room 44. The association of this work area with Cluster 7 is shown by the fact that it is separated from the rooms to the west by a high wall and by the location of the firepit toward Room 36.

The features in this work area were erected on the partially destroyed foundations of an older D-shaped masonry chamber. It appears that the walls of this older structure were razed to ground level. A wall six feet high was erected on the foundations along the western side of the work area. This perhaps served as a windbreak and as a

device to separate this area from Court 51 immediately to the west. The ground plan (Fig. 23) shows that a gap left at the southwest corner served as a continuation of the upper street.

A number of dates from this work area gave a fairly clear picture of its placement in time. Three of these come from in situ jacal wall posts, and thus help date the construction of the wind-breaks. A single noncutting date of 1279 (KS-174) from a post just inside the southern end of the high masonry west wall indicates that the destruction of the earlier room must have been accomplished no later than that year. The construction of the jacal wall separating "Rooms" 41 and 42 must have occurred in 1280 or sometime thereafter, as shown by KS-49. The cutting date of 1284 (KS-15) from an in situ post probably records the year in which the short east-west screen just north of the firepit was built. The work area came into existence about 1280 and construction continued at least as late as 1284. The area probably remained in use until Kiet Siet was abandoned. There is no evidence bearing on the construction date of the demolished room in which Court 41-43 was built. It must have been built, used, abandoned, and razed by 1280 at the latest. How long this might have taken is conjectural, but the room may date back into the 1260's.

Living Room

Room 36 was probably built in 1276. Although there is considerable evidence for modification of the roof, Beam 10 appears to have been part of the original roof structure; therefore, its date

should apply to the construction of the room. Abutments show this room to postdate Rooms 35 and 44, both of which are dated at 1275.

Room 36 has a number of interesting features, some of which are the result of alterations to the original structure. Most of these are to be found on the roof which is illustrated in Figure 33 a. The sequence of events suggested by these features is as follows. The room was originally entered by means of a roof hatch. This hatch gave easy access to the upper level where Court 41-43 was later to be located. Later this hatch was sealed and a doorway in the west wall became the only entry. It is not clear if this doorway was part of the original equipment of the room, or if it was knocked through the wall at the time the hatch was sealed. The hatch was converted into the smoke hole seen in Figure 33 a. The alterations to the roof hatch are responsible for the absence of plaster on the western part of the roof. There is evidence that the hatch was not immediately converted into a smoke hole. The front (west) wall of the room is heavily smoke-stained, as if smoke had poured out the door. It is possible that the smoke hole was added to eliminate this effect. Apparently some method of preventing smoke from coming out the doorway was found. The upper two feet of the west wall, which constitute the unusual parapet seen in Figure 33 a, are not blackened by smoke. This parapet must have been added after the smoke problem was solved. Abrading grooves in the stones of the parapet indicate that the roof was used as a work area after the parapet was built.

a

b

Fig. 33. Architectural details of Room Cluster 7 at Kiet Siet.
a, roof of Room 36; b, front wall of Rooms 44 and 45.

Granaries

Room 44 was erected in 1275. This conclusion is strengthened by the fact that Beams 2 and 8, both of which date at 1273, exhibit more weathering than do the other beams in the roof. These two beams were probably stockpiled for two years, during which time the weathering took place. The two dated at 1274 may also be stockpiled timbers, although they exhibit no differential weathering. Abutments show Room 44 to predate Room 36 (1276) and to be contemporaneous with Room 45 (1275). There is no evidence for subsequent modifications to the room.

Room 45 was also built in 1275. The post supporting a cracked beam is obviously a product of very recent repair work. Other timbers from the same tree as this one show up in Kiva 76 as part of the log-lined niche which was built by the CWA crew.

Rooms 44 and 45 were obviously constructed simultaneously as a matched pair of granaries. Figure 33 b clearly shows that the front wall of both is continuous. The canting of the doorways is due to settling of the middle of the wall. Originally, the entries were probably symmetrically placed. The outer wall bears several layers of plaster, including a CWA coat which obscures much of the aboriginal work. Nevertheless, it is possible to make out a faint band of white paint that crosses the front of both rooms at the level of the door lintels (Fig. 33 b). This band was painted on one of the earlier layers of plaster and was covered with several subsequent coatings in prehistoric times. The protruding ends of the primary beams of both rooms are burned. The burning must have occurred while they were in place, but there is no evidence for the fire on the walls of the room.

Room Cluster 7 is well dated. The two granaries, Rooms 44 and 45, were built in 1275 and the dwelling, Room 36, a year later. Sometime after 1280 Court 41-43 was constructed on the ruins of an older room. The small size of Court 47 may have been responsible for the utilization of Court 41-43, which is not centrally located. The whole cluster probably postdates the retaining wall and Kiva 46 (1275).

Some sort of special relationship may have existed between Room Cluster 7 and Kiva 46, both of which were begun in 1275. Wing walls connect the kiva to the south corner of Room 36. Rooms 44 and 45 could be entered only by crossing the roof of the kiva, and neither could have been built before the back wall of Kiva 46 had been erected. The white band across the fronts of Rooms 44 and 45 may be symbolically related to the white band around the inside of the kiva. The social aspects of this tentatively identified structural relationship are not apparent. Perhaps Room Cluster 7 was occupied by the head of a lineage, clan, or ceremonial association that had some sort of proprietary right over the kiva or ceremonies connected with it. In spite of this possible ceremonial function for Room Cluster 7, there is abundant evidence for domestic activities indicative of nonreligious household functions. Whatever the ceremonial obligations or rights, if any, of the people of the household, they did not supersede the nonsecular aspects of household life.

Kiva 46 and Room 74

These two structures are considered together because they are obviously related. Kiva 46 was probably built in 1275. Both the 1275

dates come from poles set in the fill between the inner and outer faces of the double wall just south of the southern recess. The only cutting date from a roof timber (F-3153) falls at 1272. It may be that the kiva was roofed in 1272 and the outer shell and fill added in 1275. However, the noncutting date of 1274 from Post 1 inside the kiva argues that the whole structure was not completed until 1275. It could not have been built any later, for it definitely predates Rooms 44 and 45, both solidly dated at 1275. The construction of Kiva 46 probably came after the retaining wall had been finished. There is no evidence for remodeling of the structure once it was completed.

Room 74 is less well dated than Kiva 46. However, the single cutting date of 1275 from one of the jacal wall posts, along with its intimate relationship to Kiva 46, supports the inference that it was built in 1276. Since the northeast wall is bonded to that of Kiva 46, it is hard to see how they could have been built separately. No alterations to the original structure are apparent.

Room 153, which appears to be an antechamber attached to Room 74, is very poorly preserved and cannot be absolutely identified as to function. It was probably built in 1275, along with Room 74 and Kiva 46.

Room Cluster 8

This is one of seven room clusters ranged along the northwest side of the upper street. It is easily recognized, consisting of one dwelling, two granaries, one storeroom, three storage chambers that cannot be subclassified, and one very unusual structure of unknown use. These rooms occupy three sides of Court 51 (Fig. 34 a). A low masonry

a

b

Fig. 34. Architectural details of Room Cluster 8 at Kiet Siel.
a, general view of the cluster; b, doorway converted to a ventilator in Room 56.

wall separates the southeast side of Court 51 from the upper street. A row of abrading grooves and a large hole occupy a small area of exposed bedrock just inside the south wall.

Living Room

Room 56 is poorly dated, since the roof is completely missing. The beam stub dating at 950 (KS-205) obviously represents a timber reused from an earlier occupation of Kiet Siet Cave. The two dates in the 1270's come from loose logs and probably are not relevant to the room. The wall abutments of this room are complex and hard to interpret. There is some evidence that the present structure was built on the foundations of an older room. At the east corner, the northwest wall of Room 53 rests atop several courses of the southeast wall of Room 56. Above this point, however, the southeast wall of Room 56 abuts the southwest wall of Room 53. Either the lower courses of Room 56 represent the foundations of an earlier structure, or Rooms 53 and 56 were built together with alternating abutment patterns. Rooms 54/55 were built after the walls of Room 56 were completed but before the roof was put on. Figure 34 a clearly shows that Room 54 was above the roof line of Room 56 and that the roof must have been built around Rooms 54/55. The remnant of a higher extension of the southwest wall of Room 56 protrudes from the south corner of Rooms 59/60, indicating that Room 56 is the earlier (Fig. 35 b). Room 56 clearly precedes Room 61, which is inferred to date at 1267.

Originally, Room 56 was entered by means of a large doorway in the southeast wall. This doorway was later partially sealed and

converted into a ventilator, as is shown in Figure 34 b. This alteration was dictated by the accumulation of trash in front of the doorway. Figure 34 a shows that the present level of Court 51 is well above the top of the ventilator orifice whose sill is at the sill level of the original doorway. This represents an accumulation of more than two feet. The doorway must have been superseded by a hatchway for which there is now no evidence. A step pecked into the southeast wall probably gave access to the roof and the hatch.

The ruined condition of Room 56 is not compatible with its location far back under the protective overhang of the cave. It seems probable that the ceiling and part of the walls of this room were demolished by the prehistoric inhabitants of Kiet Siel, perhaps for reuse elsewhere. Many of the stones in the wall have been broken as if the wall had been intentionally torn apart. Figure 35 b shows this effect, both in the wall stub protruding from Rooms 59/60 and in the left foreground. This suggests that Room 56 was abandoned before the village itself was deserted and probably while construction activity still was in progress. Reasoning from the date and history of Rooms 59/60, I infer that Room 56 was still occupied in 1273 and that its abandonment and demolition took place sometime thereafter. Since it was occupied long enough for more than two feet of household refuse to build up outside the doorway, it may be inferred that it was begun in the 1260's, an inference that is supported by the dating of the adjacent Room 61.

Granaries

Room 52 has no associated dates. Abutments show that it was built before or at the same time as Room 56, and before Room 53.

Rooms 54/55. These two rooms are considered together because they were obviously built as a unit (Fig. 34 a). They were built before the roof was put on Room 56, but after the walls had been finished. There are no tree-ring dates.

Storage Chambers

Room 53 is almost entirely destroyed. Its former outline is shown by an unblackened section of cliff that formed its northeast wall and ceiling (Fig. 34 a). Like Room 56, this chamber was probably intentionally razed. Figure 34 a shows the manner in which the stones in the remnant of the southeast wall have been broken off flush with the abutment of the southwest wall of Court 41-43. Obviously, the latter was in place before the destruction of Room 53 began. Therefore, the demolition of Room 53, and probably also of Room 56, must have occurred sometime after 1280.

Rooms 57/58 are indicated only by an unsmudged section of cave wall in the northwest angle of Room 56. They could have been constructed before or after Room 56.

Structure of Unknown Function

Room 62. This enigmatic structure (Fig. 34 a, left foreground; Table 22) is constructed entirely of jacal except for the northwest wall. A jacal cross wall divides the structure into two chambers of equal size. The dividing wall does not extend all the

way across but stops short of a small firepit against the southwest wall. Each chamber has a stone-silled doorway giving onto Court 51. The function of this room is unknown. The two chambers are too small to have served even as sleeping places, much less living rooms. The firepit and low-silled doorways argue against use for storage. Perhaps it was an enclosed and heated work space. In form it somewhat resembles the jacal enclosure numbered 43 in Court 41-43. The date of its construction cannot be determined, although abutments show it to be younger than Rooms 56 and 61. Like many other jacal structures at Kiet Siel, Room 62 was destroyed by fire. Apparently, it was not reused after its destruction.

Room Cluster 8 probably dates fairly early in the Tsegi Phase occupation of Kiet Siel. Although there are no tree-ring dates, it may be inferred that it was built before 1267 on the basis of the date from Room 61. In original form it probably consisted of the dwelling (Room 56), as many as six storage chambers of assorted subtypes (Rooms 53/52, 54/55, and 57/58), and Court 51. In 1273 two new storage chambers, Rooms 59/60, were added, indicating that the cluster was still occupied. Later it was abandoned and many of its roof beams and wall stones were removed, presumably for use in other structures being built elsewhere. The intentional destruction of Room 53, at least, did not begin until sometime after 1280. Therefore, the Room Cluster 8 materials were probably reused during the final construction period at Kiet Siel, which took place in the mid-1280's.

Room Cluster 9

At present this cluster consists of one dwelling, three granaries, and a chamber of unknown function. These rooms are ranged along the northwest side of Court 63 which possesses a firepit and a mealing bin (Fig. 35 a). Court 63 was screened from the upper street by a jacal wall, of which only a row of posts remains. Like so many others, this cluster has a complex history of building and rebuilding.

Living Rooms

Room 61 was undoubtedly the original dwelling for this cluster. The single date of 1267 may apply to the construction of this chamber. On the other hand, it may represent a reused beam. There is little evidence to suggest which alternative is correct; however, I favor the date of 1267 for reasons that will become obvious as the discussion of this cluster proceeds. Abutments show that Room 61 was built after Room 56 and before Rooms 64/65 and 59/60.

At present the roof of Room 61 is in a collapsed condition, as can be seen in Figure 35 a. There is considerable evidence to suggest that this collapse took place while the room was occupied. Most of this evidence is to be found inside Room 65. The holes left in the wall between Rooms 61 and 65 when the beams were jerked from their sockets by their fall have been repaired. The hole left by the removal of the butt of Beam 2 (Room 61) was plugged with a block of wood and clay plaster. The butt of Beam 1 (Room 61) was not pulled free of the wall, but it is tilted at a sharp angle. Inside Room 65

a

b

Fig. 35. Architectural details of Room Cluster 9 at Kiet Siel.
a, general view of the cluster; b, Rooms 59/60.

a block of wood has been wedged between the uptilted end of Beam 1 and the wall. This, too, is covered with plaster. The clay used to seal the holes is quite different from the clay normally used in Kiet Siel. It is gray rather than reddish tan. It is also different from the clay used by the CWA project which is easily distinguished from the original clay by its brighter red color. In addition, these particular repairs are not of the type that were undertaken by the CWA. The wood block and clay seals were probably added when Room 65 was reconverted to storage use in 1279. Judging from the history of Room 65, it seems likely that the roof of Room 61 collapsed in 1275. Obviously the room was never reoccupied.

Room 65 was used as a dwelling for a period of time. However, since its first and last use was as a granary, it is discussed under that category.

Granaries

Rooms 59/60 were built in 1273 as shown by the dates from the primary beams in the ceiling of Room 60. Both rooms show evidence of a great deal of rebuilding (Fig. 35 b). Both were originally part of Room Cluster 8. Room 60 has two sealed doorways, both of which gave access to Cluster 8. The northeast doorway may have been sealed when Rooms 57/58 were built, since they would have blocked entry from this direction. The southeast doorway opened onto the roof of Room 56. When it was sealed and when the doorway in the southwest wall was made is not known. It may have been before or after the abandonment of Room Cluster 8 and before or after the collapse of Room 61's

ceiling. The collapsed roof does not greatly hinder access to Rooms 59/60. Room 59 also has a sealed doorway in its southeast wall. It was probably closed at the same time as that of Room 60. Both these rooms were last associated with Room Cluster 9, access to them being by way of the roof of Room 61.

Room 65 has a complex history. It began as a large granary associated with Room 61 and was probably built in the same year (1267?) as that chamber. Room 65 was erected over remnants of two older rooms, one of which must have been almost completely demolished. Of the latter only a fragmentary wall remains, against which was butted the southeast wall of Room 65. The older wall is much thicker than most later walls; consequently, it shows clearly in Figure 35 a just behind and to the right of the mealing bin. This remnant formed the southeastern half of the southwest wall of Room 65. The northwestern half of this wall was formed by the northeast wall of Room 67, which is probably contemporaneous with the remnant. These relationships are indicated on the ground plan, Figure 23.

At some later date Room 65 was converted into a living room. This alteration is most clearly shown by the doorway. Figure 35 a plainly shows that an original, grooved, high-silled, granary-type doorway was converted into a living room-type entry by knocking out several courses of stone to lower the sill. The interior of the chamber is heavily smoke-blackened, indicating the former presence of a firepit. It is likely that the conversion of this room to a dwelling was necessitated by the collapse of the roof of Room 61. For reasons discussed more fully with reference to Room 64, I infer

that a new roof was put on Room 65 at this time. Therefore, the collapse of the roof of Room 61 and the conversion of Room 65 to a dwelling probably took place in 1275 as indicated by the two dated primary beams.

The career of Room 65 was not yet ended, however. After being used as a dwelling for a time, it was converted back into a granary or storeroom. Evidence for this conversion can be found in the absence of a firepit and in the condition of the ceiling. A large broken area in the plaster floor shows where the firepit and entrybox were ripped out. The testimony of the ceiling is even more interesting. Only the two large primary beams are smoke-blackened; the rest of the roof structure is unsmudged. Thus, the roof was altered once again, this time by the removal and replacement of everything but the primary beams. A thin unblackened coating of clay covers the underside of each primary, added no doubt to protect the contents of the room from soot flaking off the beams. The clay used to seal the holes left in the northeast wall by the collapse of Room 61's roof is also unsmudged, indicating that it was added at this time. Granaries, unlike dwellings, had to be sealed up tight.

The tree-ring dates beautifully reflect this sequence of events. Both primaries date at 1275, while dates from the secondaries range from 1273 to 1279. The incomplete terminal ring on Beam 14 indicates that the ceiling was replaced in the spring of 1279. If this reconstruction is correct, Room 65 was used as a dwelling for only four years before being reconverted back to its original function.

Room of Unknown Function

Room 64 is an unfinished second-story chamber built above Room 65. Its walls were never finished any higher than that shown in Figure 35 a. No roof structure is evident and the walls do not reach the roof of the cave. The doorway is unfinished, but may have been intended to be T-shaped. The exact function of the room is not apparent, primarily because it is unfinished. However, nothing about it suggests a storage function. It probably was intended as a living room to replace Room 61. Its builders lived in the converted granary below while it was being built. If this is so, it presents one reason for completely replacing the roof of Room 65 in 1275. A roof built for a granary probably was not strong enough to support the domestic activities associated with a dwelling. Therefore, the first step in the construction of Room 64 may have been the laying of a new and stronger roof on Room 65 to serve as the floor for the upper chamber. If the walls of Room 64 were erected between 1275 and 1279 it explains why the primaries of Room 65 were not removed when it was reconverted into a granary. Taking out the primaries would require the razing of the walls of Room 64, a task beyond the ambition of the people who rebuilt the roof. Replacing the secondaries presented no such problem. They are loosely socketed in only one wall---the south-east one. Room 64 was probably begun sometime between 1275 and 1279. It was never completed and probably never used.

Room Cluster 9 is rather poorly dated, but does present much evidence of modification. This evidence is somewhat equivocal, and

may be interpreted in more than one way. The interpretation that seems to fit the evidence best is as follows. The cluster was begun, perhaps in 1267, as a dwelling (Room 61) and a large granary (Room 65) fronting on Court 63. In 1275 the roof of the dwelling collapsed into the room. In the face of this emergency, temporary residence was taken up in the granary. At that time plans were laid to construct a new living room over Room 65. Therefore, the original roof of Room 65 was removed and a stronger one built. Rooms 59/60 may have been transferred from Cluster 8 at this time to replace Room 65. Cluster 8 may already have been abandoned, or its inhabitants may have come to the aid of a neighbor in distress. Sometime after 1275 a new dwelling, Room 64, was begun. It was never finished, and it seems likely that the members of the household became discouraged and departed, either to another part of Kiet Siel or to a different village. The cluster was probably abandoned by 1279, when Room 65 was changed back into a storage chamber. I would guess that this final conversion was the work of an entirely different household which found itself in need of more storage space.

An alternative interpretation of all this is that the roof of Room 61 collapsed long after the site was abandoned and that the modifications to Room 65 were caused by the addition of a new family to the household. This, however, fails to account for the apparently prehistoric repairs to the wall of Room 65 that was damaged by the fall of Room 61's roof.

If the first interpretation is accepted, it means that the entire occupation of Room Cluster 9, and all the building, alteration,

and rebuilding associated with it, lasted only about 12 years. Indeed, the multiple conversions of Room 65 from granary to dwelling to storage chamber required only 4 of those 12 years. These are very short periods of time from an archaeological standpoint, but perhaps not so short in the life of a Pueblo household.

Room Cluster 10

This is a fairly clear-cut cluster consisting of one dwelling, two granaries, and a rooftop courtyard.

Courtyard

The court associated with this cluster is situated on the roof of Room 69 (Fig. 11 b). The floor is a thick layer of plaster laid over the roof below. A firepit is located against the southwest wall of Room 64. As can be seen in Figure 11 b its use left smoke stains on the wall above it. The high wall of Room 64 on the northeast and the wing wall on the southwest probably served as windbreaks. In addition, the latter may have separated this courtyard from the one on the roof of Room 80 next door.

Living Room

Room 69. The builders of this room used the remnants of an older chamber as a foundation for some of the walls. The northeast wall is built around the same old wall which was discussed under Room 65 (Fig. 35 a). The narrow bench which parallels the southeast wall northeast of the doorway is probably a remnant of the older room also. The back (northwest) wall of Room 69 is formed by the front wall of

Room 67 which is the older of the two. It is clear, however, that Room 69 itself was built as a single unit.

The overwhelming weight of evidence indicates that Room 69 was built in 1275. Three of the seven dates fall at 1275, three at 1274, and one at 1273. The dating is confirmed by the interesting fact that three of the roof beams---two primaries (Beams 1 and 3) and a secondary (Beam 6)---were cut from the same tree. Since these beams were cut to fit Room 69, it is obvious that the tree from which they came was felled specifically for the construction of this room. Abutments show it to be later than the old room remnant in the northeast and southeast walls, Room 67, and Room 80. The abutment patterns indicated on the ground plan (Fig. 23) seem to indicate that it is earlier than Room 65, which is inferentially dated in the 1260's. However, Room 65 abuts the remnant wall of the older room and not the wall of Room 69 itself.

Only two alterations were made to Room 69. A hatchway was partially sealed and converted to a smoke hole (Fig. 11 b). The lower two feet of the T-shaped doorway in the southeast wall was walled up with masonry in defense against accumulating trash in the street outside (Fig. 36 a). A sealed doorway in the northeast wall is located in the old wall remnant and was probably closed when Room 65 was built or earlier. A doorway in the southeast wall of Room 67 was probably plugged when Room 69 was built, for two of the latter's primary beams (Beams 2 and 3) are socketed in the masonry plug.

a

b

Fig. 36. Architectural details of Room Cluster 10 at Kiet Siet.
a, T-shaped doorway of Room 69 partially walled up to prevent trash from
spilling into the room; b, Room 68 showing the dressed-block masonry
walls reminiscent of Mesa Verde architecture.

Granaries

Room 67 is an old chamber that was reused by the people of Room Cluster 10. The position of the doorway in its southeast wall relative to that of the doorway in the old wall remnant (Fig. 23) suggests that the two rooms were related and therefore approximately contemporary. Room 67 was probably built before Rooms 65 (1267) and 69. In addition, it must predate Room 68 which is built on top of it. The southeast wall of Room 67 is continuous with that of Room 82 to the southwest, indicating that these two chambers are contemporaneous. The presence of only nonconiferous beams in the roof of Room 67 supports the early dating, but does not permit an absolute date to be derived.

Room 68 is unusual for a number of reasons. Not the least of these is its masonry, which resembles the typical Mesa Verde type more than the Kayenta type (Fig. 36 b). The large block-like stones are carefully dressed, giving a dimpled effect to their faces. The stones were laid so as to produce an exceptionally smooth wall face, and the mortar was applied in such a way as to enhance this effect. Chinking stones were used sparingly. The east corner of the room was carefully squared. A wing wall extending southeastward from the south corner is of the same construction. Even more unusual is the fact that the massive northeast wall of this room lies directly on the roof of Room 67, which, as a result, exhibits a pronounced sag. The significance of all this is conjectural. Does it signify some sort of Mesa Verde influence, perhaps the immigration of a family? Or did a local Kayentan attempt to imitate a masonry style that impressed

him on a trip to some Mesa Verdean village? Neither Mesa Verde nor Kayenta masons normally built stone walls across wooden roofs.

The single date of 1271 may apply to the construction of this room. However, since Room 69 was not built until 1275 it seems likely that this represents a reused or stockpiled beam. Room 68 could have been built before Room 69, for it rests on the walls and roof of Room 67---a much older chamber. If it was built in 1271 it is hard to see what its associations would have been.

The present Room Cluster 10 came into existence in 1275 with the construction of the dwelling, Room 69. Earlier structures located in this area served as a nucleus around which the cluster took form. Old wall remnants were incorporated in the walls of Room 69, and an older structure, Room 67, was used as a granary. Room 68 may have been built before, at the same time, or after Room 69. The old structures represented by the wall remnant and Room 67 cannot be dated, although they predate Room 65 which was probably erected in the 1260's. The demolished condition of the old remnant walls may indicate that they predate the Tsegi Phase occupation of the cave.

Room Cluster 11

This cluster consists of only two rooms---a dwelling and a granary---and a rooftop courtyard.

Courtyard

The court for this cluster is located on the roofs of Rooms 80 and 81. A firepit, which may be seen in the lower left corner of

Figure 11 b, abuts the southeast end of the free-standing wall that divides this courtyard from that of Room Cluster 10.

Living Room

Room 80 was probably built in 1279 as indicated by the date from the primary, Beam 2. The secondary beams dated at 1276 and 1277 were probably stockpiled timbers. Wall abutments show that Room 80 post-dates Room 69 (1275) and Room 83 (inferentially dated in the 1250's or 1260's). No alterations to Room 80 are evident.

Granary

Room 81 lacks tree-ring dates, but is probably contemporaneous with its associated dwelling, Room 80. Abutments show it to postdate Rooms 69, 82, and 83.

Room Cluster 11 clearly is a late unit constructed in a small space between Clusters 10 and 12. It was built in 1279 or later.

Room Cluster 12

Like Cluster 11, this room cluster consists of two rooms, a dwelling and a granary. It may have had a rooftop courtyard, for there is no space for one in front of Room 83. However, the roof of Room 83 is missing and it is impossible to determine the presence of a courtyard.

Living Room

Room 83 (Fig. 9 a) lacks associated tree-ring dates and can only be placed relative to nearby structures. Abutments show that it

postdates Rooms 82 and 86 and predates Rooms 80 (1279), 81, and 84 (1283). Therefore, it must have been built before 1279. I would place it even earlier for three reasons. First, it is associated with Room 82 which is contemporaneous with Room 67 which may predate the Tsegi Phase occupation. Second, the construction beams associated with this room are aspen or boxelder. Third, its position along the back wall of the cave is compatible with an early date. It may have been built in the 1250's or 1260's.

At some point in time the roof of Room 83 burned, leaving only charred beam stubs in the wall. This probably happened while Kiet Siel was still occupied, for subsequently the front wall was partially dismantled, probably for building stones to be used in other structures. This is another example of a fire that destroyed a room without damaging those adjacent to it. This fire may have led to the construction of Room 84 next door. If so, Room 83 must have burned in 1283. The noncutting date from the firepit indicates that it was used in 1271 or later. However, the firepit could have been used after the roof had burned. Apparently Room 83 was not reoccupied after the fire, although it may have been cleaned out and used as a courtyard.

Granary

Room 82. The ceiling of this room was formed by the overhanging cave roof, and there are no dates. Nevertheless, the room is inferred to be early on the basis of its contemporaneity with Room 67; in fact, it may be pre-Tsegi Phase. It is probably an older room

incorporated into Room Cluster 12. The only evidence for remodeling is a doorway opening into Room 83 which is now partially sealed. A second very poorly preserved doorway that opens over the wall between Rooms 83 and 80, was probably made when the other entrance was sealed.

Rooms 85, 86, and 87 may originally have been associated with Room 83. At present, however, this is impossible to ascertain. Therefore, they are discussed under Room Cluster 13.

Room Cluster 12 is probably one of the earlier such units in the east end of Kiet Siet and may be pre-1260. It consists of at least Rooms 83 and 82 and possibly also Rooms 85, 86, and 87. Room 83 burned in aboriginal times and was not reoccupied thereafter. If Room 84 was built to accommodate the dispossessed occupants of Room 83, the latter must have been abandoned in 1283.

Room Cluster 13

This cluster consists of one dwelling, a granary, and a store-room. There is no obvious courtyard. The unroofed area numbered 85 may have served some of the functions of a courtyard, but there is no evidence for a firepit. As intimated in the discussion of Cluster 12, there is a possibility that Cluster 13 is actually a part of 12. At present this cannot be demonstrated, so this group of rooms is treated as a separate cluster.

Living Room

Room 84 was built in 1283 as indicated by the dates from Beams 5 and 6. Beam 2, dated at 1280, probably represents a stockpiled

timber. If Room 84 was built as a result of the burning of Room 83, Beam 3 (1260) may be a timber salvaged from the latter; therefore, Room 83 may have been built around 1260. On the other hand, there may be no relationship between the two rooms. In that case, Beam 3 would be a reused beam salvaged from an unknown source. Abutments show Room 84 to postdate Rooms 83 and 90, the latter dated at 1273.

Sometime after its construction, Room 84 was converted into a storage chamber. The heavily blackened walls and ceiling beams were coated with yellow plaster. The firepit and entrybox were torn out, leaving a ragged hole in the plaster floor. Only the smooth front edge of the firepit remains outlined in clay. A peephole in the front wall was sealed from the inside and two shelves were added in the east corner. The outside wall was plastered and hundreds of chinking stones pressed into the moist clay. The lower 18 inches of the dwelling-type doorway were walled up, the remaining orifice deeply grooved, and with the loops set into the wall on either side. The heavily blackened interior of the room indicates that this conversion took place after some years' use as a dwelling. The alteration of Room 84 may be the latest recognizable construction work at the site, even though it cannot be precisely dated. Since no new dwelling was added to this cluster, and since Room 83 was not reoccupied, it seems likely that we have another instance of people of one household converting the abandoned dwelling of another into a granary.

Granary

Room 86 has no dates and can be dated only relatively. Wall abutments show it to predate Rooms 83 and 87. It may be part of an older complex of rooms, perhaps related to Rooms 67 and 82. This room may have belonged with Room 83 in Room Cluster 12 before its inclusion in Cluster 13.

Storeroom

Room 87 also lacks dates because its ceiling is formed by the roof of the cave. It was constructed after Rooms 86 and 89 (1267).

Room Cluster 13 may actually be part of Cluster 12, but is given separate treatment here because there is no objective basis for combining them. It is a late cluster that came into existence in 1283 with the construction of the dwelling, Room 84. Rooms 85, 86, and 87 were probably older structures incorporated into this cluster in 1283.

Room Cluster 14

Room Cluster 14 consists of one living room and four granaries. No courtyard is apparent, but one may have existed in the area numbered 79.

Living Room

Room 90 was probably built in 1273. Tree-ring and architectural evidence combine to suggest that an older smaller version of this room formerly existed in its place. The roof of Room 90 is

curiously constructed. Twelve of its fifteen secondary beams rest on primary beams that are the secondary beams of Room 87 which protrude several feet into the outer chamber, Room 90. Beams 11 and 15, dated at 1267 and 1266 respectively, rest on these primary beams. Beam 1, dated at 1273, lies beyond the ends of the primaries and spans the entire length of the room. Figure 37 clearly indicates the presence of a smaller roof area that was enlarged to cover the present Room 90. It looks, therefore, as if a smaller Room 90 was built perhaps as early as 1267 and that it was added to in 1273 to create the present Room 90. According to the wall abutments, Room 90 was built after Room 89 and before Rooms 91, 66, and 84 (1283).

Granaries

Room 88, a second-story chamber, obviously was built after Room 89 below it. The total absence of wood from this room makes it impossible to estimate how long after.

Room 89 has only aspen timbers and therefore should be early. Wall abutments show it to predate Room 90. Therefore, it must have been built before 1267.

There is some evidence that Room 89 was used as a living room for a short time. The walls are slightly smudged by smoke, and a sealed smoke hole in the ceiling is located just inside the doorway, above the spot where a firepit would be expected. It seems likely that Room 89 was used temporarily as a dwelling, either while the first Room 90 was being built or while it was being enlarged. The

Fig. 37. Roof of Room 90, Room Cluster 14 at Kiet Siel. The roof plaster clearly indicates the modifications that were made on the room in 1273.

alternative seems the more likely, since Room 89 was built as a granary.

Rooms 66 and 91 are largely destroyed and have no associated wood specimens. They were built together sometime after the alterations to Room 90 were performed in 1273.

Room Cluster 14 was begun about 1266 with the construction of Rooms 89, 90, and perhaps 88, probably in 1267. A courtyard with at least a firepit probably existed in front of Room 90. In 1273 Room 90 was enlarged to its present dimensions. While the alterations were being performed, the household moved into the granary, Room 89. Sometime later two new granaries, Rooms 91 and 66 were added, completing the cluster as it now stands. There is no way of estimating when the cluster was finally abandoned.

Kiva 78

Previous mention has been made of a tentative architectural relationship between the Room Clusters 11, 12, 13, and 14 and Kiva 78. Superficially these structures seem to form some sort of structural unit. The individual histories of the room clusters argue against the existence of such a unit. These rooms certainly were not constructed as a unit. Clusters 12 and 14 were built early in the history of Kiet Siet. Clusters 11 and 13 were later additions to the village, being built in 1279 and 1283 respectively. Both these clusters were sandwiched into small spaces between the previously existing clusters as if there were no other building sites left in

the cave. With the possible exception of Clusters 12 and 13, the histories of these four units do not seem to be related in any way.

Unfortunately, Kiva 78 cannot be dated, since nothing of the roof remains. Therefore, its history cannot be correlated with those of the various units that make up this group of room clusters. My feeling is that there is no special relationship and that the seeming structural unity of this group of chambers is merely fortuitous.

The early date from the firepit of Kiva 78 obviously comes from a piece of dead wood or from a beam dating to an earlier occupation of the cave. Since the walls of the kiva do not directly abut those of any other rooms, it cannot be relatively dated. It could have been built before the retaining wall; therefore, it may predate 1270.

Room Cluster 15

This cluster is difficult to define because several of its rooms are poorly preserved. It probably consisted of one living room, three granaries, and a grinding room.

Courtyard

No courtyard obviously associated with this cluster is preserved. It is quite possible that it occupied the roof of the dwelling, Room 75, plus the small Courts 71 and 154. Court 154 at present is a narrow walkway linking Rooms 72, 73, and 152. Court 71 is a small area, raised about two feet above Court 154, that links Rooms 50 and 72.

Living Room

Room 75 is probably the dwelling associated with this cluster. Originally it was probably a kiva later remodeled and used as a living room. There are no dates associated with either stage of this chamber. The original kiva probably postdates Kiva 76. Its relationship to other rooms is unclear. The kiva and the later living room could only have been erected in this spot after the construction of the front retaining wall. Therefore, they probably postdate 1272.

Granaries

Room 50 is almost entirely gone and has no dates. Its wall abutments show that it postdates the wall that connects Rooms 72 and 45 and serves as a retaining wall for the fill of the upper street. Therefore, Room 50 must postdate Room 45 which was built in 1275. The date of 1274 from KS-61, a vertical pole set just inside this retaining wall just behind the north corner of Room 50, agrees well with the dates of 1275 from Room 45. The retaining wall was probably built in 1275 or later, the pole being a timber stockpiled in 1274.

Rooms 72 and 73 have no dates. Abutments show that they were built together as a unit (Fig. 23). They predate the upper street retaining wall which was built sometime after 1275. Interlocking abutments at the west corner of Room 73 indicate that Rooms 72, 73, and 152 are contemporaneous. These three rooms may have been associated with the kiva which originally occupied Room 75's spot. The relationship between Rooms 72 and 73 and the kiva is similar to that between Rooms 44 and 45 and Kiva 46. Thus, the construction of Rooms 72, 73,

and 152 may predate the room cluster itself which came into being with the construction of Dwelling 75 in the place of an earlier abandoned kiva.

Grinding Room

Room 152 cannot be absolutely dated. Abutments show it to be a contemporary of Rooms 72 and 73. CWA repair work obscures the relationship between this room and Kiva 76. Nevertheless, it probably postdates the kiva. Since Kiva 76 could not have been built before the big retaining wall, it and Rooms 152, 72, and 73 are probably post-1272.

Room Cluster 15 has no associated tree-ring dates and cannot be absolutely placed in time. It probably originated as two granaries and a grinding room associated with a kiva located where Room 75 now stands. This complex of rooms must have been built after 1272, since the presence of the retaining wall was necessary for the existence of Kiva 75 and of Kiva 76 which predates the granaries and grinding room. The relationship of Rooms 72 and 73 to the upper street retaining wall indicates that they may have been built before 1275. Thus, the kiva complex probably was built between 1272 and 1275. After an unknown period of time Kiva 75 fell into disuse, was partially dismantled, and a living room constructed in its place. This marked the beginning of the room cluster as a domestic unit. Room 50, a granary, and Court 71 were added sometime after the construction of Rooms 72, 73, and 152.

Kiva 76

The dates from this kiva come from timbers that are not in place and therefore probably have no significance for the chamber. The dates of 1900 from two of the uprights in the timber-lined niche clearly ascribe that feature to modern restoration work. It is significant that even if no records of the repair existed, it would still have been possible to detect the later repair work and to date it to the historic period on the basis of the archaeological and dendrochronological evidence. These two upright beams were cut from the same tree as a post supporting a cracked beam in Room 45. Although not absolutely dated, Kiva 76 is later than the retaining wall, and therefore postdates 1272.

Room 77

Room 77 is a chamber of unknown function, although its smoke-blackened walls and floor-level (?) ventilator suggest that it once served as a dwelling (Fig. 38). What, if any, other rooms were associated with this chamber are unknown. The date of this room is unknown, but it certainly could not have been constructed before the retaining wall. Since this wall is inferred to postdate 1272, so must Room 77. The noncutting date of 1272 from a floor-level beam near the east end of the room may mean that the room was built after that year. This beam reinforces the retaining wall and may not be directly associated with Room 77. The beam's association with the retaining wall itself is not certain, for the CWA performed extensive repair work throughout the entire length of the wall.

Fig. 38. Room 77 at Kiet Siel.

Room 77 is of interest chiefly as the seat of one end of the massive white fir log which is suspended across the front of Kiet Siet. What function this log served is not evident. Rope burns on it have produced the inference that it was used by the Indians as a pulley to haul heavy objects up into the village. The inference as to function is correct; unfortunately, the inference as to time is not. Julian D. Hayden informs me that the rope burns were put on the log by the CWA crew who used it as a pulley to haul buckets of water and mud mortar up into the ruin. Thus, its original function remains a mystery. It was no mean feat to transport this gigantic log---2½ feet in diameter at the butt---to the site, raise it up to the level of the cave, and emplace each end in walls opposite each other across a gap of some 36 feet. Unfortunately, the log cannot be dated because it possesses a fast-growing complacent ring series; despite its size, it was only 46 years old when cut. The timber was emplaced after Rooms 77 and 146 had been built, as shown by the abutments in Room 77 and the hole knocked in the northeast wall of Room 146 to accommodate the tip of the log. Therefore, it postdates the construction of the retaining wall which is inferentially dated at post-1272.

Room Cluster 16

Room Cluster 16 is quite clear-cut. It consists of one living room, two granaries, one storeroom, and possibly two courtyards.

Courtyards

A courtyard probably occupied the roof of Room 92 and a small area to the north that is level with the roof. Since the roof has

burned, all that remains of this courtyard is a firepit against the southwest wall of Room 89 and a small remnant of plaster floor between the firepit and the wall of Room 92.

Court 95 is a small area of artificially leveled bedrock covered with a plaster floor. The southeast half of the floor was laid on fill banked behind the low front retaining wall. There is no evidence for a firepit, but two large holes ground into the bedrock lie just outside and below the front wall. Court 95 was probably a small work area. Abrading grooves in the bedrock may be seen where the plaster floor has been destroyed. These grooves were made either prior to the laying of the floor or after it had been partially destroyed.

Court 96 is an area leveled with artificial fill behind a retaining wall. This wall was built by the CWA and may have had no aboriginal counterpart. If a firepit for Room Cluster 16 ever existed here, there is no sign of it now. It may lie buried under the fill.

Living Room

Room 92 may have been built in 1258 as indicated by the date from the log embedded in the northwest wall. It is hardly likely that it was built earlier and the log incorporated in the wall later. On the other hand, it may have been built at a later date with a reused timber incorporated in the wall. Since there is no evidence to support this latter alternative, 1258 is probably a good date for the room. Thus, Room 92 is one of the oldest at Kiet Siel. This conclusion is compatible with its location against the back wall of the cliff. The

date of 1156 comes from a number of wood splints that probably were used as closing material in the ceiling. Unfortunately, Hargrave's field notes are not clear enough to establish the provenience of these specimens with certainty. They probably represent the use of dead wood rather than the reuse of older structural timbers. Wall abutments indicate that Room 92 was built before Rooms 93 and 94 and before the low walls associated with Court 95. Subsequently, the roof of Room 92 burned.

Storeroom

Room 94 cannot be dated absolutely, but it was built after Room 92. A doorway originally opened through the southeast wall onto the roof of Room 92. This was later sealed and a new doorway was knocked through the northeast wall. The newer doorway opens onto the level area behind Room 92 and may have been made after the roof of the latter burned.

Granaries

Room 93. The date of 1245 probably comes from a reused beam or a deadwood log, for Room 93 was built after Room 92 which is dated no earlier than 1258.

Room 97 was built in 1274 or sometime thereafter. There is no evidence of any kind to suggest modification of the room or that Beam 4 is a repair timber. Since it predates the retaining wall of Court 95, the latter must have been leveled and floored after 1274. Room 97 was built before Rooms 98/99 which lie adjacent to the southwest.

Room Cluster 16 is one of the earliest dated clusters in Kiet Siel. It may have been built as early as 1258. Originally it probably consisted of Rooms 92 (a living room), 93 (a storeroom), and 94 (a granary) focused on a courtyard on the roof of Room 92. In 1274 or later another granary, Room 97, was added to the cluster. Sometime after 1274, Court 95 was built. The cluster may have been abandoned when the roof of Room 92 burned; at least there is no evidence that the room was reoccupied.

Room Cluster 17

At present this cluster consists of one dwelling, two storerooms, and at least one granary (Fig. 39). The group of storage chambers designated Room Cluster 18 may also have been associated with this cluster.

Courtyard

Court 149 probably served this cluster as well as Cluster 18, although perhaps not simultaneously.

Living Room

Room 100 is unique at Kiet Siel: a dwelling constructed almost completely a jacal. Unfortunately, only one of the many beams sampled could be dated; most of the rest were nonconiferous. However, the room must have been built sometime after 1274, for it is later than Room 99 which in turn is later than Room 97 which could not have been built before 1274. Therefore, Post 1, which dates at 1209, must be a

Fig. 39. Room Cluster 17 at Kiet Siet.

reused timber. Room 100 also postdates Room 102 as shown by the abutment patterns. There is no evidence to suggest that the room was altered.

Storerooms

Room 99 was originally a living room, as shown by its heavily blackened interior. Its original doorway opened through the southwest wall near the west corner (Fig. 23). This door has been sealed, perhaps when Room 100 was built. When it was converted to a storeroom all interior features were removed and, as Figure 39 shows, a new doorway was made in the southwest wall near the south corner. The positions of the two doorways suggest that the conversion of Room 99 to a storage chamber took place when Room 100 was constructed, probably as a replacement for Room 99. Room 99 can be dated as post-1274 on the basis of its relationship with Room 97. It was built before Rooms 98 and 100.

Room 102, like Room 100, is of jacal construction. Again like Room 100, it has no tree-ring dates. It was built before Room 100. A doorway through the jacal northeast wall has been sealed with a block of masonry---a rather curious piece of work. This doorway, like that in Room 99, was probably sealed when Room 100 was built in the space between the two earlier rooms. The open doorway in the southeast wall looks as if it had been let into a previously unbroken wall (Fig. 39).

Granary

Room 98 was probably built at the same time as Room 99, since there are no breaks in the wall (Fig. 39). Therefore, it is probably

earlier than Room 100. Since all these structures appear to be later than 1274, Beam 1, dated at 1253, must be reused.

Room Cluster 17 probably consisted originally of Room 99 (a living room), Room 98 (a granary), and Room 102 (a storeroom). These rooms faced each other across a small courtyard located where Room 100 now stands. Room 100 was added to the cluster later, probably incorporating the courtyard firepit. At the same time, Room 99 was converted to a storeroom. All these events in the history of Room Cluster 17 must have taken place after 1274, as shown by the relationship of its rooms to Room 97. The position of this cluster, nearly blocking the main western street, supports a relatively late date. It was built after most of the space in this part of Kiet Siel had already been utilized. There is a good possibility that this cluster is related to Cluster 18 across the street. The storage chambers of the latter may have been used by the people of the former.

Room Cluster 18

This cluster is difficult to define because of the density of the rooms in this area. At present it consists only of storage chambers, all of which open onto Court 149 (Fig. 40 a). There are five granaries and one storeroom. There is evidence of a former second-story living room.

Courtyard

Court 149. The present floor of this courtyard lies four feet below the level of the southwestern street. This is probably due to the

a

b

Fig. 40. Architectural details of Room Cluster 18 at Kiet Siet. a, general view of the storage chambers and the sunken Court 149; b, sketch plan of the interior features of Rooms 144 and 146.

construction of the street behind the court's northwest retaining wall. At present no interior features are discernible. However, the heavily smoke-blackened enclosing walls witness the former presence of a firepit. The northwest retaining wall was built after Rooms 138 and 147. The courtyard itself need not postdate these rooms, however, since the retaining wall could have been erected years after the court was in use.

Living Room

The dwelling originally associated with this cluster was located where Rooms 144 and 146 now stand. This was the only second-story living room at Kiet Siel. Figure 40 b presents a floor plan of these two rooms which illustrates the evidence upon which this interpretation is made. The walls of both rooms are heavily smoke-blackened, except for the dividing wall, which is a late addition to the room. A floor-level hole in the southeast wall near the south corner of Room 146 was originally a ventilator for the living room. A feature in the northwest wall which may be a sealed doorway can be perceived from the interior of Room 146. Unfortunately, the roof of Room 146 is missing and it cannot be determined whether or not it was continuous with that of Room 144. The date of this room is not known. However, it was probably early, perhaps dating in the 1250's. Its relationship to Room 142 shows that it predates 1272. Upon its conversion to storage purposes, its firepit and other interior features were removed and it was divided into two granaries.

Storeroom

Room 147. The single date of 1249 from Beam 6, a secondary, may or may not date the actual construction of the room. Certainly it is early, since it and Rooms 143 and 145 were built as a unit. The date from Room 143 indicates that this group is no earlier than 1256. It was built before the northwest retaining wall of Court 149.

Granaries

Room 142 is a late addition to this cluster. Abutments show it to postdate Rooms 143, 144, and 146. This is further witnessed by the fact that the northwest wall of Room 142 is less heavily smoke-blackened than that of Room 143 directly below it. Smoke from fires in Court 149 did not affect it for so long a time as Room 143. Thus the date of 1272 may very well apply to the construction of this chamber, since the lower rooms in this cluster are inferred to date much earlier.

Room 143 may have been built in 1256 as indicated by the date from Beam 4. The room is probably early, since it was built at the same time as Rooms 145 and 147, the latter having a date of 1249. Room 143 was probably not built before 1256, for there is no evidence for remodeling. Smoke-staining on the outside wall indicates that it was built before Room 142 directly above. Its relationship to Room 141 is not clear, but it is either contemporaneous with or later than that chamber.

Room 144 cannot be absolutely dated. As mentioned above, its construction is thought to be fairly early. When the present Room 144

was created by dividing the older room is also unknown. Abutments show Room 144 to be later than Rooms 143, 145, 147, contemporaneous with Room 146, and earlier than Room 142 (1272). Like Room 142, its northwest wall is less blackened than that of the room below. Thus, Room 144 may postdate Room 145 by a number of years.

Room 145 was built at the same time as Rooms 143 and 147. Therefore, it was probably built in 1256 or later. It predates Room 144.

Room 146 is the second granary created by the division of the old living room. Since the roof is missing, there are no dates. This room was abandoned by the time the large fir log was placed across the front of the village, for a large hole was knocked in its northeast wall to receive the tip of the log.

Room Cluster 18 is one of the older such units at Kiet Siel, perhaps originating in the 1250's. Rooms 143, 145, and 147---all storage chambers---were built as a unit before any other rooms were added to the cluster. If there was a dwelling associated with these three rooms, it is not now identifiable. Later, a second-story dwelling was built over Rooms 145 and 147. Subsequently, this living room was converted into two granaries. Room 142, the last addition to this cluster, was built in 1272 or later. After the conversion of the dwelling, the six storage chambers of this cluster probably were used by the people of Cluster 17.

Courtyard Complex 2

Room Clusters 17 and 18 are related both structurally and historically. Both clusters used Court 149, although Cluster 18 may have been abandoned before the people of Cluster 17 made use of its rooms. It is clear that some use was made of Cluster 18's rooms after its dwelling was abandoned. Room Cluster 17, by virtue of its location and late date, is the most likely candidate for this later use of the storage rooms of Cluster 18. It is quite possible that Cluster 17 was begun by the same people who moved out of the second-story living room in the earlier cluster. Room Clusters 17 and 18 are, therefore, included together in Courtyard Complex 2.

Room 148

Room 148 appears to have been built during the course of recent stabilization work, and is not aboriginal. Its main function is to provide added support for one end of the large fir log. Probably it was built by the CWA project, as indicated by its relationship to the retaining wall of Court 96.

Room Cluster 19

Rooms belonging to this cluster occur on both sides of the southwestern street. Those on the northwest side are less certainly associated with this cluster than those on the southeast side. Presently, Room Cluster 19 consists of one dwelling, three granaries, a storeroom, and a sunken walkway.

Courtyard

At present no identifiable courtyard is associated with this cluster. "Room" 104 may have served this function, although it now exhibits no domestic features. The former presence of a courtyard in this area is attested by a firepit sealed under the plaster floor of Room 103. A former fairly large courtyard may have been altered and obscured by the construction of the street and the building of rooms such as Room 103 in it.

Passage

"Room" 137 is actually a passageway that gives access to the doorways of Rooms 138 and 139. Its floor is about four feet below the level of the street. A retaining wall, built after Rooms 136 and 138 were in place, keeps the trash fill from cascading into the passage. The sunken nature of the passage is a result of the accumulation of trash in the street.

Living Room

Room 138. The dates from this chamber are difficult to interpret. The most likely interpretation is that the room was built in 1277, reusing some timbers from earlier structures. An alternative is that it was built at an earlier date and repaired in 1277. A third interpretation is that an old room was reroofed in 1277. Since there is no architectural evidence for alterations to the roof, the first interpretation is the most likely. In view of the early dates ascribed to nearby rooms, 1277 would seem to be too late a date for Room

Cluster 19's living room. Perhaps Room 138 replaced an earlier dwelling belonging to this cluster. Abutments show Room 138 to have been built after Rooms 139, 140, and 141, and before the retaining walls of Passage 137 and Court 149.

The only evidence of remodeling in Room 138 is a sealed doorway of the living room type in the northwest wall. This doorway was closed in response to the deposition of trash in the street, whose surface is a good two feet above the sill of the sealed entry. This may indicate that the street was built after 1277. However, the possibility that this wall was actually built much earlier than 1277 cannot be ruled out. To replace the old entry, a large doorway was knocked through the southwest wall of the room near the west corner. Perhaps at the same time a hatchway was cut through the finished roof above the new doorway.

Storeroom

Room 139 was built before Room 138, but it cannot be absolutely dated. It was also built before Room 141 which predates Rooms 143, 145, and 147 which are inferred to date in the 1250's.

Granaries

Room 103 cannot be dated. It was built before Room 102 which probably postdates 1274. The firepit sealed beneath the floor indicates that Room 103 is a late addition to Room Cluster 19.

Room 140 postdates Rooms 139 and 141, but predates Rooms 138 and 148. Its relationship with Room 142 suggests that it was built before 1272.

Room 141 was built before Rooms 143, 145, and 147, all of which may date in the 1250's. It also predates Rooms 138 and 140. It was built after Room 139.

Room Cluster 19 presents a number of dating problems. Its storage chambers, at least those on the southeast side of the street, may be as early as the 1250's. The living room, however, cannot realistically be dated earlier than 1277. Two explanations for this anomalous situation come to mind. First, there may have been an older living room that was partially or wholly torn out and replaced by Room 138. Second, Room 138 may be the original dwelling that was completely reroofed in 1277. This dating situation plus the presence of a former courtyard partially underlying Room 103 suggests that Room Cluster 19 existed originally in a form substantially different from that it now exhibits. The present form may be a result of the construction of the street.

Room Cluster 20

Rooms of this cluster are found on both sides of the street. As in the case of Room Cluster 19, the rooms on the southeast side of the street are more clearly associated with the cluster than are those on the northwest.

Courtyard

Like the previous cluster, Room Cluster 20 has no courtyard. In this case it is likely that a courtyard was obliterated by the construction of the street through it. Heavy smoke-staining of the

cave roof in Rooms 105, 106, and 107 shows that fires had burned in this area before the construction of the rooms.

Passage

"Room" 135 is a passageway identical to that associated with Room Cluster 19. It, too, was built after the rooms on either side of it.

Living Room

Room 136 probably was built in 1277, as indicated by the date from Beam 1, a primary. This is consistent with the date of 1273 for Room 134 which predates Room 136. The fact that the construction of the street necessitated no alterations of the northwest wall of the room supports the late dating. Wall abutments show Room 136 to postdate Rooms 134 and 139 and to predate the retaining walls of Passages 135 and 137. No alterations of Room 136 were undertaken.

Storerooms

Rooms 105 and 106 have no tree-ring dates. Room 105 was built before Room 106. Rooms 106 and 107 may have been built at the same time.

Granaries

Room 132 was probably built in 1274, as indicated by Beam 1, a primary. Abutments show that it was built after Rooms 130, 131, 133, and 134 and before Room 136. Thus the 1274 date is consistent with the 1273 date of Room 134 and the 1277 date of Room 136.

Room 133 was built before 1274, as shown by its relationship to Room 132. The wall abutments are not discernible, but it may be contemporaneous with Room 134 dated at 1273. It was built after Rooms 129 and 131.

Room 134 is securely dated at 1273. Abutments show it to predate Rooms 132 and 136, dated at 1273 and 1277 respectively. It is probably contemporaneous with Room 133. Its relationship to Room 139 is unclear, but Room 134 is probably considerably the later of the two.

Grinding Room

Room 107 cannot be dated. It is probably contemporaneous with Room 106 and is later than Room 108. As in so many grinding rooms, the front wall of Room 107 stood only a few courses high, leaving it enclosed on only three sides.

Room Cluster 20 is a relatively late addition to this part of Kiet Siel. It was sandwiched between two previously existing units, Room Clusters 19 and 21. The storage chambers associated with this cluster were under construction in 1273 and 1274. The living room was not begun before 1277. During this four-year hiatus the builders of this cluster must have lived somewhere other than in Room 136.

Room Cluster 21

This cluster now consists of one dwelling, one granary, and a small storeroom. There is no courtyard associated with the cluster,

but one probably existed just outside Room 129 in the space now occupied by the street.

Living Room

Room 129 is a large chamber with a number of unusual features. A small storeroom---a room within a room---occupies the north corner. It is butted against a massive masonry entrybox located just inside an old doorway. A floor-level vent opens through the deflector. Southwest of the deflector a low bedrock bench occupies the west corner of the room. Two pecked steps adjacent to the deflector connect the bench with the main floor level.

In Room 129, 17 of the 18 roof beams are aspen; the remaining one is boxelder. Needless to say, there are no tree-ring dates. Nevertheless, the preponderance of aspen suggests an early date. This is confirmed by the wall abutments that show Room 129 to predate Rooms 123, 124, 125, 126, and 130 and to be contemporaneous with Room 131.

Originally this room was entered by way of a large T-shaped doorway in the middle of the northwest wall. This doorway was sealed with a large block of masonry set just outside the entrance itself. A vent was left near the base of this block. A small rectangular piece was then removed from the edge of the roof above the doorway to produce a hatchway in place of the old lateral entry. A small stick incorporated into the masonry door seal dates at 1275. This is probably a good date for the remodeling, for there is no evidence that the seal was ever altered. This is one more instance of the modification

of a feature adjacent to the street to prevent the street fill from spilling into the feature. At present the surface of the fill is three feet higher than the sill of the old doorway.

Storeroom

The small storage chamber inside Room 129 is the only example from the Tsegi Phase of a room built inside another room. It was constructed after the masonry entrybox had been built, since it abuts the wing wall.

Granaries

Room 130 was probably originally associated with the cluster. The sealed doorway in its northeast wall was probably closed when Room 132 was built adjacent to it. This, along with the abutment patterns, shows Room Cluster 21 to be earlier than Room Cluster 20. Room 130 was built sometime before 1274 at the latest.

Room 131, like Rooms 129 and 130, has only nonconiferous roof beams. Abutments show it to be earlier than Rooms 123, 124, 125, 126, 130, 133, and contemporaneous with Room 129.

Room Cluster 21 is one of the earlier clusters at Kiet Siel. It is probably pre-1270, and perhaps even pre-1260, although there are no tree-ring dates to affirm this dating. Originally it probably consisted of a living room (Room 129) and two granaries (Rooms 130 and 131). At this time there was probably a courtyard located in front of Room 129. The court was later obliterated by the construction of the

street, which also caused the closing of the doorway of Room 129 in 1275.

Room Cluster 22

Room Cluster 22 consists of three rooms, all of which were constructed by erecting dividing walls inside a larger structure. In its present form there is one living room, one granary, and two store-rooms. "Room" 125 is merely an open space that provides access to the doorways of Rooms 124 and 126.

Living Room

Room 123 is a living room made from the southern two-thirds of a larger chamber. This earlier room was probably a kiva and has been discussed in detail previously. It is illustrated in Figure 27 a. That the present Room 123 was used as a dwelling is shown by the smoke-blackening of the south side of the dividing wall. The roof has burned, leaving only stubs in the walls. Since all these stubs are nonconiferous, the construction date of the room cannot be determined directly. However, its relationship to Room 126 indicates that it was built in 1286 or later. There is no evidence that Room 123 was re-occupied after it burned.

The construction date of the original kiva is not known. The original roof was removed when Rooms 123-126 were built inside it. This is shown by the fact that traces of individual roofs remain in Rooms 123, 124, and 126.

Storerooms

Room 124 cannot be directly dated. There is little doubt, however, that it was built at the same time as Room 126; that is, in 1286.

Room 126 was probably built and roofed in 1286. Beam 2, dated at 1276, is probably a reused or stockpiled timber.

Granary

Room 130, as shown by wall abutments, predates all the other rooms in this cluster. Originally it probably belonged to Room Cluster 21; therefore, it may predate 1260. It must have become associated with Room Cluster 22 sometime after 1286, although there is a slight possibility that it was previously associated with the early kiva.

Room Cluster 22 as a domestic unit, dated at 1286, is one of the latest clusters at Kiet Siel. Abutments show that the old kiva, the shell of which is occupied by this cluster, was built after Room Cluster 21.

Room Cluster 23

The rooms of this cluster are poorly preserved and therefore difficult to classify. Insofar as the rooms can be classified, the cluster consists of one living room, one granary, and a tiny "cup-board." These rooms occupy three sides of Court 110, the bedrock floor of which lies above the level of the street.

Living Room

Room 111 is constructed largely of jacal. As in many other structures of this type at Kiet Siel, the jacal walls have been partly destroyed by fire. Most of the timbers in this structure are non-coniferous, and the coniferous ones do not date. Therefore, Room 111 cannot be absolutely placed in time. It was built before the low retaining wall of Court 110. There is no evidence that Room 111 was reused after it burned.

Storeroom

"Room" 109 is really a tiny cupboard with a "doorway" barely big enough to admit an arm. It was built after Room 108.

Granary

Room 108 was built before Rooms 107 and 109.

There is no way of dating Room Cluster 23, either absolutely or relatively. It could be very early or very late. On the basis of a very subjective judgment, I would guess it to be rather more early than late.

Room Cluster 24

This is a large cluster in terms of the number of rooms. It consists of one living room, six granaries, two storerooms, and two very small storage chambers which cannot be subclassified. All but three of the storage chambers open onto Court 114. This large

courtyard is the focal point of the cluster, even though the living room is somewhat isolated from it.

Living Room

Room 122 cannot be dated, since every structural beam and post is aspen. This room probably originally served as a ceremonial adjunct to the early kiva next door. Abutments show that both rooms were constructed at the same time. The ceremonial aspects of Room 122 have already been discussed. Attention here is focused on its use for domestic purposes. The room exhibits some evidence of alteration. A roof hatch was sealed and a doorway opened through a previously unbroken jacal wall. It is quite likely that these modifications accompanied its change in function. Perhaps Room 122 was converted to secular use at the time that Room 123 underwent the same transformation. If so, the modifications to Room 122 may have occurred in 1286. Its former ceremonial function probably explains its seeming isolation from its associated storage rooms and courtyard.

Granaries

Rooms 112 and 113 can be dated only relative to each other and Room 111. Room 112 was built after Room 113 and before Room 111.

Room 115 was built over the ruins of an earlier chamber, as indicated by a low wall fragment underlying its north wall. The earlier room is too fragmentary to be classified. It may predate the Tsegi Phase occupation of Kiet Siel. Room 115 was built at the same time as Room 116.

Room 116 was built at the same time as Room 115 and probably after Rooms 117 and 119.

Room 117. The date of 1269 from Beam 7 may very well date the construction of the room. It conforms to the inferred early date of this cluster. Room 117 was built before Room 116 and at the same time as 119. It also predates the front retaining wall of Court 114.

Room 119 is contemporaneous with Room 117 (1269) and probably earlier than Rooms 120 and 121.

Storerooms

Rooms 120 and 121 were probably built together after the construction of Room 119. The location of the two storerooms together, facing away from the courtyard, may have some significance. They may originally have been associated with the ceremonial complex comprised of Rooms 122 and early 123.

Storage Chamber

"Room" 118 is really two very small jacal chambers located on the roofs of Rooms 117 and 119. Their exact function is unknown.

Room Cluster 24 served both ceremonial and secular functions during its occupation. Room 122 was originally a ceremonial structure, and the unified group of storage chambers behind it may have been associated with the kiva also. The date of 1269 from Room 117 may date the ceremonial complex. Just when these rooms were converted to secular use is not known. If this conversion accompanied that of the associated kiva, it must have been no earlier than 1286. On the other

hand, it may have occurred before the kiva itself was divided into three domestic chambers.

Room Cluster 25

At present this "room cluster" consists of only two chambers, Rooms 150 and 151. Room 151 cannot be identified as to function because of its extremely fragmentary condition. It is possible that both rooms are storage chambers associated with another cluster. Their physical separation from the rest of the pueblo leads to their inclusion in a separate cluster. Room 150 is a granary; Room 151 may have been a dwelling.

The fact that these rooms are located in this isolated and hard-to-reach spot suggests that they were built after the floor of the cave had been filled with rooms. On the basis of physical evidence alone, Rooms 150 and 151 are probably among the latest chambers to be built at Kiet Siel. This inference is borne out by the date of 1285 from Beam 7 in Room 150. Beam 8, dated at 1255, is a large plank, probably reused from an earlier structure. Since abutments show Rooms 150 and 151 to be contemporaneous, Room Cluster 25 was built as a unit in 1285 or later.

THE SOUTHWEST STREET

A number of rooms along the southeast side of this street were altered to keep the street's artificial fill from spilling into them. These large-scale modifications occur along the full length of the street and indicate that many of the rooms in this area predate the existence of the street.

The street itself may have developed slowly through use, or it may have been intentionally constructed. What little evidence there is supports the latter alternative. The area now occupied by the street once consisted of a number of separate courtyards belonging to the various room clusters. It is highly unlikely that any amount of cross-village traffic could have produced a street in place of these courtyards if the courtyards were maintained by their respective owners. It seems more likely that these courts were intentionally replaced by the street in response to the need for a clear route through this part of the village. The street was constructed by building a series of retaining walls across the gaps between rooms, by closing doorways in the northwest walls of Rooms 129 and 138, and by filling the street area with trash and debris to a depth of three to four feet. In the process, most of the features associated with the earlier courtyards were obscured. The construction of this street was a project that required the consent and cooperation of several households. As such, it constitutes evidence for some sort of organization above the household level.

The relationship of the street to dated rooms adjacent to it can be used to at least limit the time during which it could have been built. This type of evidence suggests that it was not built in one step, but rather in a series of operations beginning at the southwest end. The doorway of Room 129 was sealed in 1275, perhaps indicating preparation for the building of the street, or at least showing that trash was accumulating outside the door. Room 136, dated at 1277, was not modified in response to the construction of the street. This

suggests that its builders left the northwest wall blank because construction of the street was anticipated or already under way. The sealed doorway in Room 138 probably belongs to an older room, but may have been sealed when the street was built. If this is so, the date of 1277 for Room 138 agrees well with that of Room 136. The fact that Room Cluster 17 was not erected until sometime after 1274 probably means that the street was not in existence before then. Room Cluster 17 could not have predated the street. The tree-ring evidence suggests that the southwest street was built sometime after 1275, probably between 1275 and 1277.

THE GREAT RETAINING WALL

This structure is one of the most remarkable features of Kiet Siel. Although much of the present wall is of CWA construction, enough aboriginal work remains to show that the CWA crew achieved a very accurate reconstruction. An undertaking of this magnitude obviously involved the cooperation of many people from many different households. It was a project undertaken for the benefit of the whole village rather than a single household or a group of households. The successful completion of this project must have depended on some sort of intra-village integration, planning, and direction. Thus, Kiet Siel as a village must have been a functioning social unit.

The retaining wall can be dated only in relation to dates from rooms that depend on its presence for their existence. Dates of 1272 come from Rooms 77 and 33. However, the association of the date with Room 77 is suspect, and Room 33 could possibly have been built before

the retaining wall. A clearer relationship exists between the wall and Rooms 35, 36, 74, and Kiva 46 which are dated at 1275, 1276, 1275, and 1275 respectively. Therefore, the wall and the lower eastern street could not have been built after 1275 at the latest. It may have been constructed as early as 1272, if the dates from Rooms 77 and 33 may be accepted at face value. All undated rooms dependent on this wall for their existence can be inferred to postdate 1272.

ROOMS IN THE LOWER LEVEL OF THE CAVE

Evidence of the Tsegi Phase occupation of this level of Kiet Siel cave has been almost completely destroyed by erosion (Fig. 23). A few wall remnants and the remains of Rooms 156, 157, and Kiva 155 suggest a fairly large group of structures. There are no tree-ring dates from this part of the cave. However, there can be little doubt that the Tsegi Phase occupation was part of the total village of Kiet Siel. Whether it predates or postdates the upper level part of the village is unknown.

Room 156 is an unusual structure. Its shattered remnant suggests that it was a two-story circular chamber set atop a pile of boulders and loose trash (Fig. 24 b). Could this be a Kayenta attempt at a Mesa Verde-like tower? If so, it is only the third possible tower reported from a Kayenta site. Poncho House, a large Pueblo III Kayenta site located on Chinle Wash much closer to the Kayenta--Mesa Verde frontier, has a three-story rectangular structure (Guernsey 1931, Fig. 18, Pl. 38), which may be a tower. Ruin 8 in Long House Valley also has a three-story rectangular tower (see Chapter 9). The

hypothetical tower at Kiet Siel may exemplify the same sort of Mesa Verde influence as does the masonry of Room 68 and the pilasters in Kiva 2 in Turkey Cave. Unfortunately, this interesting structure cannot be dated.

PREHISTORIC SUMP OR WELL

This feature was discovered in 1958 by Roland R. Richert of the National Park Service Ruins Stabilization Unit. Excavation of a sump to collect water from seeps along the back wall of the cave revealed a prehistoric feature undoubtedly designed for the same purpose. The probable cutting date at 1274 probably records the year in which the sump was built. Thus, by 1274 efforts were being made to collect and conserve water. Perhaps the requirements of an increasing population were taxing the supply of water. Or the water supply itself may have been decreasing.

DATE CLUSTER ANALYSIS

The dates from Kiet Siel may be divided into two groups. The first group consists of a few scattered dates that fall before 1245. These undoubtedly are leftovers from pre-Tsegi Phase occupations of the cave. Most of the timbers with early dates are incorporated in structures that clearly date after 1250. A few come from firepits in post-1250 structures. The rest come from the trash midden in the lower cave. With the exception of a circular slab-lined pit structure unearthed in the lower cave by the CWA project, no pre-Tsegi Phase structures have been found. While a few may yet exist in the lower cave, it is extremely unlikely that any will be found on the upper

level. Since most of the structures of the present village are founded on solid bedrock, no underlying structures could exist. A few random wall remnants and a number of grooves pecked into the bedrock floor of the upper cave are probably the remains of pre-Tsegi Phase structures. This situation is quite logical when it is remembered that the floor of the upper level is of irregular, often steeply inclined bedrock. In order to provide a solid foundation for the Tsegi Phase structures, the older buildings had to be removed from the bedrock surface. Thus, evidence of all earlier occupations of the upper level was probably intentionally destroyed by the builders of the Tsegi Phase pueblo.

The second and much larger group of dates is that associated directly with the Tsegi Phase pueblo. The dates from this group are numerous enough to form several distinct and significant clusters. The distribution of cutting dates per year from 1245 to 1286 is graphed in Figure 41. Two earlier cutting dates---one at 950 and the other at 1209---are omitted. Both come from reused timbers that were cut before the construction of the Tsegi Phase village.

The graph may be divided into five parts, or periods, on the basis of the clustering. The first part, extending from 1245 through 1271, shows a rather low and uneven rate of tree cutting. The second part, from 1272 through 1275, shows a tremendous spurt of cutting activity, especially in 1273, 1274, and 1275. The 1274 cluster would more nearly match 1273 and 1275 if four probable cutting dates at 1274 were included in the chart. During the third period---1276 through 1282---the number of dates per year tails off to zero in 1282. The

Fig. 41. Number of cutting dates per year from Kiet Siet.

fourth part, from 1283 through 1286, represents a brief surge of tree cutting on a rather minor scale. The fifth part falls after 1286 and is not represented by tree-ring dates.

In contrast to the situation at Betatakin, the date clusters at Kiet Siel correspond fairly well to the actual construction activity that took place. The only exception to this statement is the first period, 1245-71. The few dates that fall in this period are probably much more significant than their numbers indicate. Most of them occur in chronological isolation. That is, they are not associated with later dates; therefore, they cannot be interpreted as coming from old beams reused in later structures. Furthermore, they are associated with rooms whose location within the cave does not preclude an early date. The lack of additional dates from these supposedly early structures is due almost entirely to the preponderance of aspen and boxelder timbers. As is shown below, there is reason to suspect that in general nonconiferous trees were used before coniferous trees at Kiet Siel. The significance of the pre-1272 dates increases in light of these circumstances. These factors produce a situation wherein a considerable amount of pre-1272 building activity may be inferred but not always precisely identified or accurately dated.

Twelve room clusters are assigned to the first period. Unfortunately, it is almost impossible to date them absolutely, since few have more than one tree-ring date and many have no dates. Some of these clusters represent the initial Tsegi Phase occupation of Kiet Siel. Just which ones is problematical. Dates in the 1240's and 1250's suggest that Room Clusters 18 and 16 are among the earliest.

Room Clusters 2, 9, and 14 and the ceremonial complex at the southwest end of the pueblo probably date in the 1260's. In addition, Room Cluster 12 may have been built in this decade also. Clusters 3, 4, 5, 8, 21, and 23 are early and may be inferentially assigned to the pre-1272 period. All these structures predate the retaining wall; consequently, they all are located in areas of the cave where fairly level bedrock provides a firm foundation. Figure 42 is a ground plan of Kiet Siel as it might have appeared about 1271, at the end of the first period.

Despite the presence of a number of earlier room clusters, the apparent surge in tree-cutting activity between 1272 and 1276 does in fact correspond to a period of increased construction. During this period Kiet Siel took on the general appearance that it now presents to the observer. The front retaining wall and its associated terrace were constructed at this time. The street that gives the southwestern part of Kiet Siel its characteristic appearance may have been begun during this period. Construction subsequent to the second period consisted of the grafting of new rooms onto the basic layout that was established by 1275.

Four room clusters were built during the second construction period. Clusters 10, 17, and 19 were sandwiched between previously existing clusters. Room Cluster 6, Room 74, and Kivas 46, 75, and 76 were built on the terrace behind the front retaining wall. The older Clusters 4, 8, 9, 14, 16, and 21 were augmented or modified during this period. Figure 43 is a hypothetical ground plan of Kiet Siel as it probably existed in 1275, at the end of the second construction period.

FIGURE 42
KIET SIEL
GROUND PLAN AS IT APPEARED IN 1271

FIGURE 43
KIET SIEL
GROUND PLAN AS IT APPEARED IN 1275

It seems unlikely that normal population growth could account for this spurt of building activity, although it is not impossible. Immigration from an outside source is indicated as the most probable cause for this three-year construction boom.

The third period, from 1276 through 1282, is characterized by a decline in the number of dates and by less construction activity. During this period Room Clusters 7, 11, and 20 were constructed. In addition, Room Cluster 1 probably dates to this period. Clusters 9 and 19 were enlarged or modified. The expansion of Kiet Siel during the third construction period was probably a result of normal population growth and the creation of new families by marriage. A population influx seems unlikely. The four room clusters added were fitted into the few open spaces left on the cave floor.

A trend that is more marked in the next period apparently began at this time. This was the conversion of living rooms into storage chambers, as exemplified by Room 65 in Room Cluster 9. It is probable that these conversions were made by people who belonged to households other than the one that had lived in the dwelling. The room clusters had probably been abandoned by their owners before their living rooms were converted into granaries by people of neighboring households. This suggests that sometime between 1275 and 1279 a few households left Kiet Siel, presumably for good. Those who remained behind put the abandoned rooms to use as granaries. Since the dwellings were converted to storage use, the inference follows that all the old granaries were used also. Figure 44 is a ground plan of Kiet Siel as it might have appeared in 1282.

The final period of construction at Kiet Siel began in 1283 and continued through 1286. This period is characterized more by reconstruction and remodeling than by actual construction. Room Clusters 13, 22, 25, and possibly 24 were added at this time. The creation of Clusters 22 and 24 involved the reoccupation and modification of previously existing structures. In addition, Clusters 2 and 4 were remodeled. Much of the construction performed during this period involved the building of new granaries or the conversion of former dwellings to granaries. Thus, more people were moving out and their former habitations were being used by those who remained behind. The four room clusters constructed during this brief period suggest that there also was an influx of population. These people, perhaps no more than three households, apparently reoccupied a number of abandoned rooms. Room Cluster 13 may have been built by immigrants or by refugees from the burned dwelling next door. Figure 45 is a floor plan of Kiet Siel as it probably looked at the end of the last phase of construction in 1286. The fifth period was characterized by a lack of construction activity and the gradual abandonment of the site. This period is discussed in the next section.

ABANDONMENT

The abandonment of Kiet Siel is no more susceptible to dating than was that of Betatakin. Ordinarily, trees were not felled at the time of abandonment, and if they were they would be almost impossible to identify. Once again the problem of limitations imposed by the extent of the cave on the size of a cliff pueblo arises. There is

abundant evidence that Kiet Siel Cave was filled while the village was still growing. The crowding together of room clusters toward the end of the occupation, the position of Room Cluster 25, and the associated structures in Turkey Cave attest to this fact.

Construction continued at least as late as 1286, when Rooms 15 and 150 were built and when the early kiva was divided into three secular chambers. If there was any later construction, it was done entirely with reused timbers or with nonconiferous beams. There is little evidence for any such activity. The latest identifiable construction may be the conversion of Room 84 into a granary---an event which must have taken place several years after the room was built in 1283. How long Kiet Siel could have been inhabited after 1286 with no tree cutting at all is conjectural. As was the case for Betatakin, 20 to 30 years is probably the maximum allowable time. Therefore, the traditional date of 1300 for the Anasazi withdrawal from the San Juan drainage is probably a good approximation for the abandonment of Kiet Siel.

Although the Kiet Siel tree-ring dates shed little light on the date of abandonment, they provide much information about the processes by which the abandonment took place. The foregoing analyses have made it clear that Kiet Siel was not abandoned suddenly, but that its decline was gradual. The abandonment of some room clusters may have begun as early as 1275. Certainly the process was under way by 1280, for Room Cluster 9 was abandoned no later than 1279. The fact that a number of deserted living rooms were converted into granaries by the people who stayed behind indicates that the village was still

viable. Indeed, there is evidence that new people were moving in while others were moving out. Obviously, the population of Kiet Siel was in a state of flux from at least 1280 onward.

There is no evidence to indicate that the abandonment of a group or groups of room clusters took place simultaneously. On the contrary, the different times at which they were reoccupied and remodeled suggests that they were abandoned individually. In other words, each household acted independently of the others in its decision to depart Kiet Siel. Thus, we get a picture of independent households, coming and going at will, taking their places within Kiet Siel for a time before moving on. The final abandonment of Kiet Siel may have been more of a mass movement than the earlier comings and going would indicate. It probably was not hurried, however. Indeed, the vast number of sealed doorways found in 1895 by Richard Wetherill and Charlie Mason (McNitt 1957: 83) suggests that many of Kiet Siel's inhabitants were hedging their bets against an eventual return to the village.

The causes of abandonment of Kiet Siel are undoubtedly intimately linked to those of the abandonment of Tsegi Canyon at the end of the 13th century and are discussed in a subsequent section. Nevertheless, two things should be mentioned in connection with Kiet Siel. First, the wholesale conversion to granaries of abandoned living rooms after 1275 indicates one of two things. Either the people who remained behind were doing quite well agriculturally, or times were getting hard and they were attempting to accumulate a food reserve against an anticipated shortage. In view of the improbability of

people leaving the village during times of plenty, the latter alternative appears to more accurately reflect the reality of the situation. Second, the complete lack of evidence of violence and the number of sealed doorways noted when the site was discovered argue against warfare or any kind of strife with a different group of people.

NONCHRONOLOGICAL ANALYSES

POPULATION ESTIMATES

The same principles of analysis and limitations of data apply to the consideration of Kiet Siel population changes as to those of Betatakin. These were discussed in Chapter 7 and are not repeated here. Because individual room clusters are more poorly dated than those at Betatakin, it is convenient to consider Kiet Siel's population growth in terms of the four periods outlined above. It should be stressed that this analysis is restricted entirely to the upper level of Kiet Siel Cave. The number of people who lived in the lower level is unknown.

The number of people involved in the founding of Kiet Siel is unknown, because so few of the early period room clusters are well dated. The 12 room clusters assigned to the first period indicate that the population of the village stood at about 60 people in 1272. The addition of at least five households during the second period brought the minimum number of people up to 80. The third period saw the addition of at least four households, and the population probably reached 100 to 125 persons at the very least. There is evidence for a decline in population after the third period. However, this was offset

by a few new arrivals, and the population at 1286 probably equaled 125-150 persons.

The time of maximum population at Kiet Siel is difficult to estimate because of the state of flux apparent after 1275. However, the population peak probably came between 1280 and 1286. As far as can be determined, at least 21 room clusters were occupied during this period, yielding a minimum population of 105 persons. To this must be added the number of people living on the lower level. I would estimate this at probably no more than 25 people in five room clusters. Thus, the population of Kiet Siel probably reached a peak of from 130 to 150 persons sometime between 1280 and 1286. After 1286 there was probably a fairly gradual decline with perhaps a sudden drop to zero at the time of final abandonment.

As at Betatakin, two types of population growth can be perceived at Kiet Siel, although less clearly. Immigration is responsible for the founding of Kiet Siel and probably for many of the subsequent population increments, especially those at 1272-75 and 1283-86. Growth by natural accretion is less obvious but is probably involved in all periods, especially in the first after the founding of the village and in the third between 1275 and 1283. Certainly the addition of new living rooms to Room Clusters 2 and 6 may be ascribed to this process.

REUSE OF TIMBERS

Kiet Siel Cave was occupied long before the present village was built there after 1250. As a natural result of the earlier occupations,

a number of old construction timbers undoubtedly were lying around the cave when the Tsegi Phase people arrived. As might be expected, a number of these were reused as construction beams. In addition, beams from abandoned Tsegi Phase structures were often reused. Reused beams occur in Rooms 13, 56, 84, 98, 100, 138, and 150. An equally common use for these old timbers apparently was as firewood. The early dates from the firepits in Room 13 and Kiva 78 provide the basis for this hypothesis. This may account for the fewer number of early dates than might otherwise be expected, judging from the extent of pre-Tsegi Phase trash deposits. It is also possible that the early firepit dates result from the use of long-dead trees for firewood.

STOCKPILING OF TIMBERS

There is little evidence at Kiet Siel for such long-term stockpiling of constructional timbers as was recognized at Betatakin. A few rooms, best exemplified by Rooms 44, 45, 69, and 80, exhibit a range of dates that may be ascribed to stockpiling. In almost all cases in which stockpiling may be inferred, the timbers that are thought to have been stockpiled were cut in 1273 and 1274. Most rooms that have beams cut in 1273 or 1274 can be dated to a later year. The majority of these were built in 1275, but there are a few later ones also. This range of only two to five years shows that stockpiling was of a very short-term nature. It indicates the cutting of a number of trees in 1273 and 1274 in anticipation of almost immediate use; and, in fact, most of them were used in 1275. The 1273-74 stockpile may have

been accumulated in connection with the construction of the front retaining wall.

USE OF DEADFALLS

Another practice for which there is good evidence at Kiet Siel is the utilization of dead trees for constructional purposes. The closing material in many of the ceilings consists of long slender splints of wood that were split from the trunks of large trees. The rings in many of these splints show almost no curvature, indicating that they came from trees much larger than those commonly used for roofing beams. In addition, these fragments often exhibit the very tight outer rings thought to characterize tree growth just prior to the natural death of the tree. Almost invariably these specimens date from 100 to 300 years earlier than the site. A prime example of this phenomenon at Kiet Siel is the number of splints from Room 92, collectively listed under the number F-3124-1 (Table 27). All of these were broken from a single large tree that died not long after 1156. This evidence indicates that long-dead windfalls were split up to make these splints. Such splints can be obtained more easily from dead than from living trees, because the latter are more difficult to split. Other Tsegi Phase sites, particularly Twin Caves Pueblo, exhibit the same situation. However, this phenomenon is not confined to the Tsegi. Throughout the northern Southwest roof splints of this type invariably date earlier than the site with which they are associated. Instances of this phenomenon are known from areas as

widely separated as the Red Rock Valley of northeastern Arizona and the Sierra Ancha of central Arizona.

That such deadfalls do occur has been proved in the Tsegi. In a large rock shelter downstream from Kiet Siel lies the shattered remnant of a large Douglas-fir tree that died long ago and toppled into the shelter. The interior of this log is rotten, while the outside is still solid. Fragments identical in shape to the pre-historic roofing splints can be torn, without benefit of tools, from this deadfall. A core taken from the log gave a near cutting date of 1586. Thus, this particular log has been lying on the ground ready for use for about 250 years. A section collected from a windfall in Dogoszhi Biko by Hargrave in 1935 yielded a cutting date of 1811, which means that the tree had been dead 124 years before it was sampled. The roof splints dated at 1156 could easily have come from a deadfall like these.

TREE-CUTTING ACTIVITIES

The data on complete and incomplete terminal rings in the Kiet Siel collection of tree-ring specimens are presented in Table 28. There are fewer than the total number of specimens because those specimens that lack the terminal ring are omitted. As was the case at Betatakin, complete rings predominate over incomplete rings. At Kiet Siel 70% of the specimens have complete terminal rings as compared to the 68% complete from Betatakin. Thus, there appears to be no significant difference between the two collections. Further analysis, however, isolates some differences.

Table 28. Terminal Rings from Dated and Undated
Tree-Ring Specimens from Kiet Siel

Species	Nature of Terminal Rings		Total
	Complete	Incomplete	
Douglas-fir	41	10	51
White fir	39	2	41
Juniper	37	14	51
Pinyon	7	7	14
Ponderosa pine	1	1	2
Quaking aspen	77	55	132
Boxelder	17	5	22
Oak	2	0	2
Total	221	94	315

Of the white fir specimens, 95% were cut after they had completed growth. Unfortunately, nothing is known about the growing season of this species in this area. On the basis of the nature of the sites in which they now grow, it is possible to infer that their growing season begins and ends before that of Douglas-fir. This, however, is not sufficient evidence on which to base an accurate estimate of the time of year at which these trees were cut. No comparison with Betatakin is possible, since no white fir occurs there.

Of the Douglas-fir trees, 80% were cut after growth had ceased for the year. Thus, they were felled sometime between the end of June and the following May. This compares with 84% complete rings in Douglas-fir from Betatakin.

At Kiet Siel 73% of the juniper trees were cut after the growing season, that is, sometime between late summer and the following spring. This is considerably different from the 60% frequency of complete rings from Betatakin juniper samples. Pinyon also exhibits a considerable difference between Betatakin and Kiet Siel. Of the Kiet Siel pinyons, 50% were cut during the growing season which occurs in June, July, and August. The remaining 50% were cut during the rest of the year. At Betatakin 74% of the pinyon trees were cut during the growing season. The two ponderosa pine specimens from Kiet Siel are too few to yield significant results.

The nonconiferous species also present a distributional picture different from that of Betatakin. Only 58% of the Kiet Siel aspens have complete terminal rings as compared to 77% from Betatakin. The boxelder sample from Kiet Siel yields 77% complete outer rings, as compared to only 57% from the Betatakin boxelder specimens. The oak samples from both sites are too small to be of value.

Table 29 includes a Chi square comparison of the distribution of terminal rings at Betatakin and Kiet Siel. The observed frequencies are those from Kiet Siel; the expected frequencies were generated by applying the Betatakin percentages to the Kiet Siel data. The results of the analysis indicate that there is less than one chance in 1000 that these two samples were drawn from identical populations.

The attempt to isolate the factors responsible for the difference between the Betatakin and Kiet Siel collections with respect to the nature of the terminal ring involves two more Chi square analyses. Since these are identical in model, assumptions, and

Table 29. Chi-Square Comparison of Terminal Rings
from Kiet Siel and Betatakin

Species	Nature of Terminal Rings				Total
	Complete		Incomplete		
	fo	fe	fo	fe	
Douglas-fir	41	42.8	10	8.2	51
Juniper	37	30.6	14	20.4	51
Pinyon	7	3.6	7	10.4	14
Quaking aspen	77	100.2	55	31.8	132
Boxelder	17	12.5	5	9.5	22
Total	179		91		270

Level of Measurement: Two nominal scales

Model: Independent random samples

Assumptions: Growing season of trees of different species is identical at Betatakin and Kiet Siel

Hypothesis: The Betatakin and Kiet Siel collections represent independent random samples drawn from identical populations.

Cell	fo	fe	fo ²	fo ² /fe
a	41	42.8	1681	39.3
b	10	8.2	100	12.2
c	37	30.6	1369	44.8
d	14	20.4	196	9.6
e	7	3.6	49	13.6
f	7	10.4	49	4.8
g	77	100.2	5929	59.3
h	55	31.8	3025	95.2
i	17	12.5	289	23.3
j	5	9.5	25	2.5
Total	270	270.0		304.6

$$\chi^2 = 304.6 - 270.0$$

$$\chi^2 = 34.6$$

The hypothesis of identical populations may be rejected.
 χ^2 value of 18.465 = probability of .001

hypotheses to examples presented in the Betatakin section, only the results are mentioned here. The first test was applied to the terminal ring distribution of the species with a known growing season---Douglas-fir, juniper, and pinyon. This analysis is identical to that run on similar data from Betatakin (Table 13). Expected frequencies were again calculated on the basis of the assumptions that Douglas-fir had a two-month growing season and that pinyon and juniper had three-month growing seasons. The hypothesis tested is that trees were cut at random throughout the year. The resultant Chi square value of 5.2 corresponds to a probability of greater than .05. Therefore, the hypothesis cannot be rejected. The observed frequencies could have been achieved by random cutting activities spread out over the entire year. The fact that the frequencies could have been achieved by random sampling does not, of course, mean that they were. However, the distribution of complete and incomplete terminal rings among the species does not indicate any particular time of year as did the Betatakin data.

The second test was run on dated specimens that fall into the 1272-75 cluster. This is similar to the analysis of dated specimens from Betatakin presented in Table 14. In the present case, pinyon is eliminated because there are only two samples, and the analysis is confined to juniper and Douglas-fir. The objective of the analysis is to determine if the large number of trees cut over a very short period of time were cut at any particular time of the year. It is logical to infer that a group of trees cut in one year were cut at one time. The expected frequencies were calculated on the basis of the usual assumed

lengths of growth periods for the two species. The specific hypothesis tested is that juniper and Douglas-fir trees were cut at random throughout the years 1272, 1273, 1274, and 1275. The analysis produced a Chi square value of 1.3, far below that required to reject the hypothesis at the .01 level of confidence ($X^2 = 6.635$). The observed distribution could have been achieved by random cutting.

These tests make the nature of the difference between the Betatakin and Kiet Siel samples somewhat clearer. Obviously, tree cutting was a year-round activity at Kiet Siel, whereas at Betatakin it was normally a seasonal project. There are probably two major factors involved in producing this difference. First is the lack at Kiet Siel of long-term stockpiling. The accumulation of stockpiles such as those at Betatakin would tend to produce seasonally restricted tree-cutting activity. A group of men who set out to fell a number of trees for future use would probably limit their activity to a fairly short period of time. Second, the way in which Kiet Siel was populated would tend to produce a wide range of uncoordinated tree-cutting activity. There is no evidence for advance planning as there was at Betatakin. Individual households operated autonomously and seemed to move in and out at will. Therefore, each household was probably responsible for cutting its own structural timbers. This activity would occur whenever a new household moved into the village and would not involve any seasonal patterning. The tremendous amount of remodeling and repair would also tend to destroy any seasonal regularity since such alterations would be effected at whatever time of year the necessity arose.

In contrast to Betatakin where tree cutting was probably a communal task involving village-wide cooperation, tree cutting at Kiet Siel was more individualistic and opportunistic in nature. Two possible exceptions to this generalization with reference to Kiet Siel come to mind. First, the great retaining wall obviously was a project that involved more than one household. Trees used in this wall may have been cut at one time. If so, their rings would record the time of year during which this was done. Unfortunately, the beams that protrude from the wall are inaccessible and could not be sampled. Second, trees cut for the initial Tsegi Phase occupation of Kiet Siel were probably cut at one time. Little evidence can be adduced to support this hypothesis since the earliest rooms cannot even be identified. Furthermore, the beams are almost 100% nonconiferous species whose growing seasons are not precisely known.

DIFFERENTIAL USE OF SPECIES

The use-category distributions of 405 in situ wood specimens from Kiet Siel are presented in Table 30. A Chi square analysis similar to that presented for Betatakin (Table 16) yielded similar results. Six species---Douglas-fir, white fir, juniper, pinyon, aspen, and boxelder---were classified against the two basic categories of use: roof beams and posts. The hypothesis that species and use-category were independent of one another was rejected at the .001 level of confidence. In this case this was due almost entirely to the distribution of aspen specimens. Far fewer than expected were classified as posts. In contrast to Betatakin, the distributions of

Table 30. Distribution of Species
per Use-Category at Kiet Siel

Use-Category	Species								Total
	DF	WF	JUN	PNN	PP	Pop	Box	Oak	
Roof beams	50	33	40	9	2	161	14	6	315
Jacal wall posts	4	2	1	1	0	6	5	1	20
Beam support posts	0	3	0	1	0	0	2	0	6
Other posts	0	2	6	1	0	0	0	1	10
Firepits	9	0	11	17	1	1	0	1	40
Sump	2	0	0	0	0	0	0	0	2
Intra-wall logs	3	0	1	0	0	4	3	1	12
Total	68	40	59	29	3	172	24	10	405

Douglas-fir and pinyon at Kiet Siel did not differ appreciably from the expected values. The values for white fir and boxelder were distributed slightly in favor of roof beams over posts. The observed frequencies of juniper did not differ markedly from the expected frequencies.

Another hint of cultural preference for certain species for particular uses comes from the material recovered from firepits. The sample is highly selective, and so was not included in the Chi square analysis. Nevertheless, Table 30 shows a predominance of pinyon and juniper from the firepits. The number of pinyon specimens (32) from the trash excavations may be taken as supporting evidence on the assumption that the charcoal specimens in the trash come from cleaned-out firepits. However, not all the specimens from the midden belong to the Tsegi Phase occupation. Nevertheless, there seems to have been

a preference on the part of the Kiet Siet villagers for pinyon and juniper as firewood.

DEFORESTATION

There is evidence that the inhabitants of Kiet Siet, as a result of their need for construction timbers, nearly denuded the immediate vicinity of trees. In Table 31 the percentages of dated specimens by species are compared with the four construction periods.

Table 31. Species versus Construction Periods at Kiet Siet

Species	Construction Period			
	1245-71	1272-75	1276-82	1283-86
	Percentages			
Douglas-fir	48	41	32	18
White fir	4	34	21	55
Juniper	35	18	42	9
Pinyon	13	5	5	18
Ponderosa pine	0	2	0	0
Total	100%	100%	100%	100%

The significant factor in this connection is the predominance of white fir in the last period and its virtual absence in the early period. Of slightly lesser importance are the decreasing percentage through time of Douglas-fir and the increasing importance of juniper through the first three periods. All three phenomena are probably related to the depletion of timber resources by construction work at Kiet Siet.

White fir today grows in more inaccessible sites than do the other species. It is confined to deep coves, well watered ledges in the cliffs, and sheltered or well watered locations at the very top of the talus. If these conditions prevailed in the past, and there is no reason to suppose that they did not, it follows that by about 1280 the people of Kiet Siel had to seek out the more inaccessible species for roofing beams. It is not likely that they would bypass more easily available trees for these difficult-to-reach specimens. The increasing importance of juniper---a somewhat inferior species for construction work---is probably related to this trend. Junipers, which had been ignored previously, were sought out more and more as the supply of better species dwindled. The decline in importance of Douglas-fir illustrates this trend. Thus, as the reserve of suitable tree species dwindled, less suitable and more inaccessible trees were exploited for construction work.

A corollary of this hypothesis is that the most accessible tree species were used first. The most accessible species would have been the quaking aspen and boxelder that grew in the canyon bottom along the stream bed. That this was indeed the case is shown by the structural association between aspen beams and the few coniferous specimens that yielded early dates. The preponderance of aspen in rooms assigned to the first construction period has already been mentioned. The fact that only three aspen beams occur in the ceilings of the four rooms that were definitely built in the 1280's is significant in this regard. The early preponderance of aspen probably results only in part from accessibility. The clearing of

the bottom land for farming undoubtedly produced quantities of felled aspen trees that were then available for use in construction work.

The prehistoric denudation of the canyon in the vicinity of Kiet Siel provides a means of estimating the nature and degree of prehistoric man's impact on his environment. When the founders of Kiet Siel first appeared in the late 1240's, the canyon bottom must have supported a fairly heavy growth of aspens and other moisture-loving vegetation. This was cleared out to make room for the fields that supported the village. As time passed and the village grew, more land was needed for farming and more beams were needed for construction. By about 1270 the convenient supply of aspen must have been exhausted, for the next five years saw a tremendous increase in the use of coniferous species. The bottom land within easy transportation range of Kiet Siel had been completely cleared, and the trees of the coves and talus slopes now became the primary source of beams. By 1280 even this resource was depleted, and the deeper coves and recesses and higher ledges were being stripped of their white fir trees. Thus, in a span of about 40 years the vegetational pattern of Kiet Siel Canyon underwent a marked change. The activities of man produced a profound change in the landscape. It is not beyond the range of possibility that the denudation of the bottom land hastened the destruction of the farmland by the Tsegi-Naha arroyo. In this regard the clearing of land for agriculture may be compared to the present overgrazing. While neither may be considered the sole cause of a cycle of erosion, by destroying the natural plant cover

that otherwise would tend to inhibit the destructive capabilities of the water both considerably affect the rate at which the cutting proceeds. Thus, by the very action of feeding themselves, the Tsegi Phase farmers may have hastened the end of their occupation of the canyons.

PREHISTORIC ENVIRONMENT OF KIET SIEL

The prehistoric assemblage of tree species from Kiet Siel differs strikingly from that now present in the vicinity. The prehistoric collection from Kiet Siel includes the following species: quaking aspen, boxelder, Gambel oak, Douglas-fir, white fir, juniper, pinyon, and ponderosa pine. With one significant exception, the same species grow nearby today. The exception, of course, is quaking aspen, which is not found within miles of Kiet Siel today. Two possible explanations for this difference between the prehistoric and historic conditions come to mind.

First, the prehistoric deforestation discussed above may have caused the disappearance of aspen from the canyon. This is unlikely in view of the extent of the canyon and its innumerable side channels, coves, and rincons where aspen may have grown. It seems incredible that this much farmland would have been necessary for the Tsegi Phase population of Kiet Siel Canyon. It would have taken an intentional eradication project to eliminate all the aspens.

The second explanation of this phenomenon is that there has been an environmental change that has rendered the canyon unsuitable for aspen growth. This interpretation seems more likely, for aspen

cannot grow in the present environment of Kiet Siel Canyon. The inference to be made, then, is that the environment of Kiet Siel Canyon up to about 1300 was more moist than it is at present. The additional moisture was provided by the high level of ground water that prevailed during periods of alluviation in the Laguna Creek drainage. The aspens must have been wiped out by arroyo cutting, since Kiet Siel Canyon, unlike upper Betatakin Canyon, is influenced by the depositional regimen of Laguna Creek. The progressive lowering of the water table as erosive forces ate into the alluvium that fills the canyon would deprive the aspen of their water supply and ultimately cause their death. Since the arroyo cutting took place throughout the alluvial deposits, the aspens growing on these deposits in the Tsegi system would be wiped out. Only those growing in areas where the water table was not affected by the cycles of erosion, such as the head of Betatakin Canyon or where permanent springs were located, survived.

If the second hypothesis is correct, we are left with two cycles of erosional activity that could have produced the observed result---the Tsegi-Naha interval and the present interval of erosion that began late in the 19th century. The fact that in 1895, before the recent arroyo had reached Kiet Siel, Richard Wetherill found Kiet Siel Canyon to be choked with oak (McNitt 1957: 81) and not aspens indicates that the Tsegi-Naha erosion was responsible for the disappearance of aspen from the canyon.

A series of important environmental changes may be recognized at Kiet Siel. At the beginning of the Tsegi Phase the canyon bottom

was occupied by a growth of quaking aspens. Later, many of these trees were cut in land-clearing operations and for use in the village, and the number of aspens near Kiet Siel was sharply reduced. The extinction of the aspen forest was completed by the cutting of the Tsegi-Naha arroyo which lowered the water table below the reach of the trees' roots. During the deposition of the Naha formation, when the water table was once again high, oak rather than aspen flourished in the canyon bottom. The cutting of the present arroyo since 1880 has reduced the oak forest to small groves fringing the talus slopes.

CONCLUSIONS

Many types of evidence indicate that Kiet Siel, unlike Betatakin, is a multi-component site. Anderson's trash mound excavations isolate at least three distinct occupations: a late Pueblo I--early Pueblo II occupation dated at about 950 to 1000, a late Pueblo II horizon dated in the late 1100's and early 1200's, and a Tsegi Phase occupation after 1250 (Anderson 1966a). Tree-ring dates from reused timbers in Tsegi Phase structures reflect the two earlier components. Nevertheless, no structures assignable to either of the early occupations are now present. Any such structures present on the upper level were intentionally razed by the Tsegi Phase inhabitants of Kiet Siel. Early structures in the lower level are buried under later debris.

The Tsegi Phase occupation may be divided into five periods on the basis of architectural and tree-ring evidence. The first period begins with the founding of the village sometime around 1250 and lasts until 1272. The second period, 1272-75, is marked by an influx of

population and a flurry of construction activity that produced the village layout that now characterizes Kiet Siel. The third period, extending from 1276 to 1282, was one of rather slow population growth. During this period some households apparently left Kiet Siel, beginning a trend that continued into the next period. The fourth period, 1283-86, was marked by the exodus of a number of households. At the same time a few new households moved in and reoccupied rooms abandoned by those who had gone. During the fifth period, post-1286, the population probably declined as households drifted away until, by 1300, the village was abandoned.

Anderson (1966a) identifies two stratigraphically distinct constellations of pottery-type frequencies within his Tsegi Phase sample from the Kiet Siel trash mound. Anderson believes that the earlier constellation correlates with the pre-1275 Tsegi Phase occupation of the site and the later constellation equals the post-1275 occupation. His analysis agrees with the history of Kiet Siel as reconstructed on the basis of architecture and tree-ring dates. His findings emphasize the impact of the 1272-75 immigration on the people of the village. It appears that these immigrants brought with them pottery-making ideas that significantly altered the ceramic industry of Kiet Siel.

The dated history of Kiet Siel holds significant implications for a number of nonchronological subjects. The processes by which Kiet Siel was founded and populated were quite different from those involved at Betatakin. With the possible exception of the initial Tsegi Phase occupation, about which little is known, Kiet Siel exhibits

no evidence for a unified pattern of settlement. While the founding households may have constituted a single larger social unit, there is no evidence that they were integrated with those who came later. The early households did not constitute a vanguard sent out to prepare the cave for habitation by a larger group. There is no evidence for communal cooperation to lay in a supply of construction materials to be used by later arrivals, as there is at Betatakin. After 1272, and perhaps even before, households came and went quite independently of one another. It appears that Kiet Siel grew by the nondirected accretion of relatively independent household units. In contrast to Betatakin, nothing at Kiet Siel suggests that it was settled in response of a preconceived and directed plan. The inference follows that Kiet Siel as a social unit did not exist prior to the establishment of the village in Tsegi Canyon. The only exception to this inference is that the founding households may have constituted a single social unit that existed prior to the beginning of the Tsegi Phase village. The size and composition of this possible social unit cannot be determined. By 1272 at the latest the original unity of the social unit had broken down in response to the increase in population that resulted from the immigration of a number of unrelated households.

Several lines of evidence indicate that Kiet Siel was a less tightly integrated village than Betatakin. The apparently nondirected arrival and departure of seemingly independent households reflects this looser integration. The rapid turnover in households at Kiet Siel probably inhibited the development of strong social ties, especially in

light of the probability that the people of Kiet Siel were not integrated into a single social unit before their arrival there. Architectural differences between Betatakin and Kiet Siel suggest a higher level of social control at Betatakin. The site plans (Figs. 16 and 23) illustrate some of the significant differences. Betatakin rooms are uniformly rectangular, while Kiet Siel rooms exhibit a variety of shapes. Betatakin masonry is uniformly good, while that at Kiet Siel is extremely variable. The regular occurrence of jacal walls at Betatakin contrasts with the variety of contexts in which jacal walls occur at Kiet Siel. Interior living room features are highly standardized at Betatakin and quite variable at Kiet Siel. The two kivas at Betatakin are much more similar to one another than are any two of the seven kivas associated with Kiet Siel. Thus, the people of Betatakin adhered to a single set of architectural concepts while those of Kiet Siel followed a variety of different standards.

Other evidence that contrasts Kiet Siel and Betatakin may be cited in this context. The greater number of kivas at Kiet Siel probably indicates a greater number of ceremonial units and consequent greater heterogeneity. Despite the fact that it is the smaller of the two, Betatakin has more recognizable courtyard complexes than does Kiet Siel. This fact may reflect the existence of a broader range of social ties at Betatakin. The foregoing discussion may be summarized by the following statement: many types of evidence show Betatakin to be more homogeneous than Kiet Siel. The homogeneity of Betatakin probably reflects a more unified set of cultural patterns

and of stronger bonds of social integration to enforce adherence to these patterns at Betatakin. The extreme heterogeneity of Kiet Siel probably resulted from the presence of a number of previously unrelated social units that possessed a corresponding number of similar but slightly different ideal patterns of behavior. Thus, Betatakin was probably the more tightly integrated of the two villages.

Despite evidence for a relatively low level of social integration at Kiet Siel, there are indications of a certain degree of village-wide organization. The very existence of the village implies at least a minimum of integration. The construction of the huge front retaining wall must have involved many, if not all, the households at Kiet Siel. It certainly could not have been produced by a single household. The retaining wall project involved the cutting and transportation of reinforcing timbers, the gathering and shaping of stones for the wall, the mixing of mortar, and the transportation and emplacement of fill. A task of this magnitude requires village-wide planning, direction, and cooperation. Thus, there must have been integrative mechanisms by which enough people to accomplish the task could be mobilized and directed. The construction of the southwest street, while not nearly as difficult a task as the building of the retaining wall, required advanced planning and the consent if not the active cooperation of several households. Thus, the existence of the retaining wall and the southwest street testifies to the existence of social processes of community decision-making, planning, cooperation, and organization of labor.

A few inferences may be made about the social organization of Kiet Siel. One thing that stands out here even more than at Betatakin is the fundamental nature of the room cluster and its social counterpart, the household. The essential autonomy of the household is demonstrated by the manner in which room clusters were built, abandoned, and reoccupied throughout the history of the village. At Kiet Siel, as at Betatakin, the household was the basic socio-economic unit of which the village was composed. In general, the actions of each household seem to have been independent of those of other households. In this respect Kiet Siel conforms more closely than Betatakin to Jennings' (1966: 58) characterization of Kayenta Branch villages as "aggregations of family homesteads." Nevertheless, the existence of the village itself and the construction of the retaining wall and the southwest street imply the existence of means by which households were organized. Newly arrived households must have been integrated into the larger social structure of the village in some way.

Tsegi Phase settlement patterns in general and that of Kiet Siel in particular resemble Hopi village layouts closely enough to permit the inference of similar social organization. This hypothesis was developed in the discussion of Betatakin and is not repeated here. Suffice it to say that the archaeological similarities between Kiet Siel and Betatakin are strong enough to indicate essential cultural identity. It is probable that at Kiet Siel, as at Betatakin, the integrative mechanisms of society involved social units with overlapping memberships that cross-cut the residential units and served

to bind them together in a larger whole. These social units cannot be recognized in the architecture of Kiet Siel because they were nonlocalized. This type of organization is similar to that inferred for Betatakin and much like that of the ethnographic Hopis. The larger integrative units among the Hopis are of two basic types: kinship and ceremonial. There is evidence that both these types were present at Kiet Siel.

Arguments for the existence of nonlocalized lineages and clans in the Tsegi Phase were developed in Chapter 5 and in the discussion of Betatakin. These arguments apply to Kiet Siel also. However, one aspect of this problem deserves comment in light of the Kiet Siel data. Eggan (1950: 129-30) hypothesizes that the Hopi lineage, clan, and phratry systems developed on the Hopi Mesas in the early 14th century in response to the need to integrate large numbers of immigrants into the local villages. He infers that the newcomers arrived as "communities or fragments of communities, such as household groups, and not as lineages or clans as such" (Eggan 1950: 130). The Kiet Siel data on the autonomous nature of the household support Eggan's inference, at least as far as Kayenta Branch immigrants to the Hopi area are concerned. The people of Kiet Siel apparently faced the same sort of problems with regard to the social integration of newcomers as did the inhabitants of the Hopi Mesas half a century later. Therefore, it seems possible that similar mechanisms of integration developed in response to the similar needs. Thus, the lineage, clan, and perhaps phratry systems may have developed in the Kayenta area as well as on the Hopi Mesas. This means that Eggan's hypothesis should

be modified to include a wider geographical area and at least 50 years' additional time depth. The social integration of Kiet Siel thus may have been based at least in part on kinship organization.

There is also evidence from Kiet Siel that suggests a ceremonial component in the integration of the village. Kiet Siel kivas are associated with the village as a whole and not with any sub-village residence units. This is most clearly shown by the two kivas in Turkey Cave that are completely isolated from any residence units. It seems likely then that ceremonial rights and obligations cross-cut the residence and kinship units and served as a strong integrative force. In addition, it is possible that the social units associated with each kiva or ceremony were dependent on other social units that provided other essential ceremonies in the same or a different kiva. The social units associated with a kiva may have been based on kinship or on voluntary association, as among the Hopis. Whatever their nature, they were not localized. The apparent association of Room Cluster 7 with Kiva 46 suggests the presence of such kiva-oriented ceremonial social units. It is not likely that a single household required a kiva of its own; therefore, a larger but nonlocalized social unit is indicated. Such a unit could have been a lineage or clan or some sort of ceremonial association (Dozier 1965: 43-6). Room Cluster 7 may have been occupied by the head of a lineage, clan, or ceremonial association that had some sort of proprietary interest in Kiva 46. Rooms 74 and 122, which are "adjuncts" to Kivas 46 and 123 respectively, may be ceremonial rooms that belonged to lineages, clans, or ceremonial associations

connected with the particular kivas involved. The absence of a great kiva argues against a single village-wide religious integration of Kiet Siel. Thus, along with developing lineage and clan systems, overlapping ceremonial units may have been important in integrating the prehistoric village of Kiet Siel. It should not be too surprising that the reconstructed social organization of Kiet Siel sounds much like the organization of the Hopis, for there is a strong Kayenta component in Hopi culture.

CHAPTER 9. OTHER DATED TSEGI PHASE SITES

Eleven Tsegi Phase sites in addition to Betatakin and Kiet Siel produced tree-ring dates. The methods of data presentation and the types of analysis attempted here differ considerably from those that appear in Chapters 7 and 8. A number of factors are responsible for the different treatment accorded these sites. Most of them are situated in poorly sheltered locations and are less well preserved than Betatakin and Kiet Siel. Most were excavated and left to stand open and unprotected, a condition that hastened their deterioration. The sites are not included in Navajo National Monument; consequently, they have not been stabilized and are not protected from vandalism. One result of the poor preservation is a lack of in situ wood that may be used for intra-site dating. Another result is the obliteration of many architectural features. Since the sites are not maintained, blow sand has accumulated in the rooms and obscures many details.

The nature of the tree-ring collections from these sites prohibits the types of analyses to which the Kiet Siel and Betatakin data were subjected. Specimen collection at these sites was in the nature of survey work, and precise provenience data are often not available. Since these collections were made for the sole purpose of dating the sites, nonconiferous timbers were not sampled. Therefore, the samples are inadequate for the nonchronological analyses like those undertaken at Kiet Siel and Betatakin. Thus, the two

major sites provide detailed data for the analysis of the Tsegi Phase, while the other sites afford a broad range of supplementary data on a larger sample of sites. The 11 additional sites illuminate the background against which the more specific analyses of Kiet Siel and Betatakin are performed.

The discussion of each of these sites is divided into three parts: (1) the presentation of the archaeological data, (2) the presentation of the tree-ring data, and (3) the analysis of the data. The presentation of the archaeological data generally includes a discussion of the local environment, a plan of the site, a brief description of the architecture and room typology, an analysis of room clusters and courtyard complexes if possible, and a list of the pottery types present. The poor preservation of the sites and the blow sand that has accumulated in them obliterate or obscure many structural details; therefore, architectural data are not presented for these sites. Most observable architectural features are indicated on the site plans.

The tree-ring data do not include information on the undated specimens. The sampling procedures used and the lack of provenience control render these data useless for nonchronological analyses. The dates are presented in tables identical to those for Betatakin and Kiet Siel (Tables 11 and 27).

The analysis of the dates is restricted to a consideration of the site as a whole. Provenience controls are inadequate to permit an analysis of sub-village units except in a few isolated instances. The interpretation of each site includes as detailed an analysis as may be

made from the data available. Thus, some sites receive more detailed treatment than others. The objective is to approximate as closely as possible the kinds of interpretation made for Kiet Siel and Betatakin. Unfortunately, the data rarely permit much interpretive refinement.

SCAFFOLD HOUSE

The discovery of Scaffold House has not been recorded. However, it is hard to see how Richard Wetherill, whose name appears on many less accessible sites in the canyon, could have missed Scaffold House. He probably "discovered" the site in 1895 or 1897 and left no record of his visit. Byron Cummings may have visited Scaffold House in 1909 or 1910, although there is no recognizable reference to it in his field notes (Lindsay 1963a).

Fewkes' (1911: 18-20) description marks the first appearance of Scaffold House in the literature. Fewkes describes selected aspects of the site such as the two kivas, a "kihu," and the scaffold. His remarks indicate that the site had not been excavated at the time of his visit in 1910.

According to Turner (1962: 3), Scaffold House was excavated for the Arizona State Museum by Byron Cummings in 1916. No report on this work has appeared, but its results are apparent in the clean condition of the site; the kivas and rooms have been cleared. The material recovered from these excavations is now at the Arizona State Museum in Tucson. Subsequent to Cummings' work, Scaffold House was recorded in the surveys of the Museum of Northern Arizona (NA-3173),

The Rainbow Bridge--Monument Valley Expedition (RB-356), Gila Pueblo (Marsh Pass 6:9), and the Arizona State Museum (Arizona D:6:5).

ENVIRONMENTAL SETTING

Scaffold House is located in a large rincon on the east side of the main Tsegi just below the mouth of Bubbling Springs Canyon (Fig. 1). The ruin is located at the foot of the apparently vertical cliff face in the upper middle of Figure 3. A vertical black "line" near the mid point of the cliff is the crack in which the scaffold is situated. The ruin itself extends along the base of the cliff to the left of the scaffold.

Figure 46 a illustrates the local environment at Scaffold House. The talus slopes and Kayenta bench in the foreground and across the canyon are covered with pinyons and junipers. The rincon in which the site is located is choked with Gambel oaks that thrive on moisture from a number of seeps. Douglas-firs may be seen along the top of the talus slopes on the other side of the canyon.

Like most other Tsegi Phase sites, Scaffold House is situated in an area where the canyon floor widens to provide a broad alluvial surface suitable for farming. Unlike many other Tsegi Phase sites, Scaffold House overlooks part of the farmland used by its inhabitants. Figure 46 a shows a portion of this land in the right middleground. This view also illustrates the manner in which the alluvial surface constricts downstream from the site. At present there is no spring at Scaffold House, although there are many seeps in the rincon. A large seepage zone immediately in front of the site could easily have been

a

b

Fig. 46. Scaffold House and environs. a, view down-canyon from Scaffold House. The broad alluvial flat below the ruin was farmed by the people of the village. b, general view of Scaffold House. Room Clusters 5 and 7 are in the foreground.

developed by the construction of sumps, if it was not a flowing spring at the time the village was occupied.

DESCRIPTION OF THE SITE

Scaffold House consists of 35 rooms and courtyards and perhaps two kivas scattered along a series of rock ledges and the top of a talus slope at the foot of the Navajo sandstone cliff (Figs. 46 b and 47). The cliff is only slightly overhung, but does provide some protection from the elements. Nevertheless, Scaffold House is less well preserved than Betatakin and Kiet Siel. Few roofs remain in place, but a number of construction timbers scattered over the site provide material for tree-ring dating.

The several types of room that were present at Kiet Siel and Betatakin may be recognized at Scaffold House. Poor preservation and limited field notes render it impossible to differentiate between granaries and storerooms. The rooms are grouped into eight recognizable room clusters as indicated in Table 32. Courtyard Complex 1, the only identifiable unit of its kind, is formed by Room Clusters 3 and 4, both of which probably shared Court 10.

Additional structures were probably present in the area between Rooms 28/29 and Room 30 which is now occupied by a number of huge blocks of Navajo sandstone that have tipped away from the back wall of the rock shelter. Shattered wall remnants and jumbled building stones in this area testify to the former presence of several rooms. The slight evidence remaining indicates that the massive blocks of sandstone were not tipped so far forward during the occupation of the

FIGURE 47

SCAFFOLD HOUSE
NA-3173; ARIZONA D:6:5

- II = second story door
- = sealed doorway
- ┐ = first story door
- f = fireplace
- e = entrybox
- d = deflector
- v = vent
- b = bench

SCALE 0 5 10 20 FEET
0 1 2 3 4 5 METERS

Table 32. Composition of Room Clusters at Scaffold House

Room Cluster	Structural Units			Total Number of Rooms
	Court-yards	Living Rooms	Storage Chambers	
	Room Numbers			
1	?	1	2	2
2	?	3	4,5,6	4
3	7	9	8?	2?
4	10	11	12,13	3
5	16	15	17,18,19	4
6	?	22	21	2
7	23	20	$\frac{24}{25}, \frac{26}{27}, \frac{28}{29}$	7
8	30	33	31,32	3

village. The long narrow crevices between the innermost blocks and the face of the cliff were divided by cross walls into a number of small rooms. All these rooms seem to have been fairly small and were probably storage chambers. Sometime after these rooms were built the sandstone blocks tilted forward, destroying most of the rooms behind them. Living rooms associated with these storage chambers were probably crushed by the rockfall and now lie buried under tons of rock. This area of jumbled rock may be seen beyond the nearest rooms in Figure 46 b.

Ceremonial chambers present a problem at Scaffold House as they do at many Tsegi Phase sites. However, there is no doubt about Kiva 1 (Figs. 47 and 48 a). This structure possesses all the features

a

b

Fig. 48. Architectural features of Scaffold House. a, Kiva 1. Note roof construction, southern recess, and interior wall plaster. b, the scaffold viewed from below.

necessary to identify it as a kiva. It is fully subterranean and has the typical kiva-type ventilator-deflector-firepit complex. The interior is plastered with many coats of tan clay. There are no interior decorations. The most striking feature about this kiva is that it is still partially covered by a roof that was constructed in the typical Kayenta manner (Fig. 48 a). It is noteworthy that the position of the two primary beams corresponds exactly to the beam seats and upright posts in Kiva 46 at Kiet Siel (Figs. 23 and 25).

Kiva 2 is a more ambiguous structure. While it may be a kiva, the possibility exists that it is a semi-subterranean dwelling. Its shape is not typical of Tsegi Phase kivas. Fewkes (1911: 19) notes the presence inside this structure of three upright roof support posts, of which only one remains. This type of roof support is unique in Tsegi Phase architecture, either secular or religious. The presence of a very narrow bench on the east side of the room may indicate that it is a kiva. However, the erosion of the south side has obliterated a possible southern recess or ventilator that might confirm a ceremonial function.

Fewkes (1911: 19-20) identifies Room 33 as a "kihu" on the basis of a well preserved entrybox and a number of pictographs on the cliff face that forms the northwest wall of the room. The entrybox is a standard living room feature, of course, and the pictographs probably predate the construction of the room. The room does, however, possess three unusual features. First, it and all the other rooms in Room Cluster 8 are larger than the other rooms at Scaffold House. Second, only the lower half of the northwest wall (cliff face)

is plastered, giving the effect of a dado. Third, it is built over "Room" 34, which is completely filled with debris. Nevertheless, Room 33 is not sufficiently different from the average Tsegi Phase living room to warrant questioning its secular status. The large size of the rooms in this cluster may reflect some sort of social phenomenon, but it is difficult to see what it might have been.

The outstanding feature of Scaffold House, and the source of the site's name, is the magnificently constructed scaffold (Fig. 48 b). In Fewkes' (1911: 18) words, the scaffold is "as daring a piece of aerial building as can be found anywhere among cliff-dwellings..." This remarkable structure has been almost perfectly preserved by the absolute dryness of the narrow cleft in which it was erected. The scaffold is a horizontal platform suspended some 30 feet above the rooms below it. It is constructed in the manner of a roof. Sturdy auxiliary beams were set in natural nooks and pecked niches in the sides of the crevice. A number of primary beams were then laid on the auxiliaries. The primaries were covered in turn with secondary beams, atop which is a tightly packed layer of sticks covered with juniper bark. The whole thing was then sealed with a six-inch thick clay floor. A hatchway was left near the middle of the platform. The fact that the scaffold still supports a man's weight is a testament to the skill of its long-dead builders. Although it is not too difficult to reach the top of the scaffold, it is impossible---short of burrowing down from the top---to reach the beams that support it. Therefore, the scaffold has never been sampled for tree-ring dating.

The functions of this unique structure are conjectural. Whatever its use may have been, it was important enough to warrant the expenditure of no little effort and skill. The scaffold would have made an excellent lookout. From it one can see down-canyon almost to the mouth of Betatakin Canyon. In any other direction, however, the line of sight is blocked by the enclosing walls of the crevice. It may have been a refuge in time of defense. A number of factors argue against this interpretation: there is no water in the crevice, the scaffold will not support very many people, and the judicious use of fire by an enemy would turn the scaffold into a death trap. It seems more likely that it is a storage structure akin to the galleries at Betatakin, Batwoman House, and Swallow's Nest. In the absence of a high inaccessible ledge, the people of Scaffold House made do with the available resources and produced one of the most remarkable structures in the Kayenta area.

The absence of tree-ring dates from individual rooms renders impossible any analysis of population change through time. Therefore, the site is considered to be a synchronous unit for purposes of population estimation. The assumption that at some time during the occupation of the site all the dwellings were inhabited simultaneously is probably not out of line for a small site such as Scaffold House. For larger sites such as Betatakin and Kiet Siel such an assumption would be fallacious in the extreme, as has been shown. The eight recognizable room clusters at Scaffold House suggest the presence of eight households. Perhaps two more clusters lie crushed beneath the rock fall in the western part of the site. This brings the total to

ten. Using Turner and Lofgren's (1966) figure of five persons per household, the maximum population of Scaffold House may be estimated at about 50 people.

CERAMICS

Pottery types present in the Arizona State Museum survey collection from Scaffold House are: Lino Gray, Tusayan Corrugated, Moencopi Corrugated, Betatakin Black-on-white, and Kayenta Polychrome. This collection was made in 1964, at which time the site was found to be nearly stripped clean of sherds. The total sample consists of 24 sherds, of which only ten could be classified. Therefore, even the types present or absent, much less the counts, are of little use in characterizing the site. Most of the types are part of the Tsegi Phase assemblage. The only exception is Lino Gray. The presence of this type reflects an earlier utilization of the shelter that is also indicated by the early types of petroglyphs and pictographs and the large number of Basketmaker II and III open sites nearby. There are no structures that can be assigned to this early period; the rooms that now occupy the cave were built during the Tsegi Phase.

TREE-RING DATA

There are 34 numbered tree-ring specimens from Scaffold House in the Laboratory of Tree-Ring Research collections. Identification of duplicate specimens shows that 32 different trees are represented. The Gila Pueblo specimens (GP-series) were collected by Deric O'Bryan in 1941. The Douglass Collection specimens (SH-series) were collected

during visits I made to the site in 1962 (SH-1 through SH-17) and 1963 (SH-18 through SH-23).

Gladwin (1957: 277) lists 12 dates from Scaffold House that were derived by the Gila Pueblo staff. The dates from Scaffold House are presented in Table 33. Most of the timbers are not in place, and the original provenience of many of the specimens is unknown. Those dates that come from in situ beams are listed first. The remaining dates are divided between the eastern and western parts of the site; that is, whether they come from the areas to the east or west of the rockfall.

Table 33. Dated Tree-Ring Specimens from Scaffold House

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room 11</u>							
Roof Beam	SH-18	JUN	Core	C	X	1190 -- 1275B	
Loose Log	SH-4	JUN	Wood sec.	I	X	1133p -- 1276cB	
<u>Room 31</u>							
Loose Logs	SH-13	JUN	Wood frag.	C	X	1189p -- 1283rL	
	SH-14	JUN	Wood frag.			1167+ -- 1283+v	Ring count to 1200 (4)
<u>Room 32</u>							
Log lying across walls	SH-16	PNN	Wood frag.	I	X	1138 -- 1284G	
<u>Kiva 2</u>							
Post	SH-17	PNN	Wood frag.			1201 -- 1271v	
<u>East end of Ruin</u>							
Loose Logs	SH-6	JUN	Wood sec.	C	X	1231p -- 1266cL	

Table 33--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>East end of Ruin</u> (cont.)							
Loose Logs	SH-20	DF	Core			1219p -- 1273v	
	SH-22	PNN	Core	I	X	1210 -- 1277rL	
	SH-23	JUN	Core	C	X	(1100p -- 1273rB)	Tentative date
	GP-4264	DF	Wood frag.			1181p -- 1277v	
<u>West end of Ruin</u>							
Loose Logs	SH-7	DF	Wood sec.	C	X	1163p -- 1284rGB	
	GP-4267						
	SH-8	DF	Wood frag.			1215p -- 1282v	
	SH-9	PNN	Wood frag.	C	X	1131 ₊ p -- 1284LB	Ring count from pith to 1150
	SH-10	PNN	Wood sec.	C	X	1172 ₊ p -- 1275cB	Ring count from pith to 1180
	SH-11	DF	Wood frag.			1194p -- 1261v	

Table 33--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>West end of Ruin</u> (cont.)							
Loose Logs	SH-12	DF	Wood frag.			1204p -- 1272v	
	GP-4258	PNN	Wood frag.	I	X	1210p -- 1277G	
	GP-4259	PNN	Wood frag.	C	X	1194p -- 1274rG	
	GP-4260	PNN	Wood frag.	I	X	1201p -- 1285rG	
	GP-4261	PNN	Wood frag.	C	X	1152 p -- 1274r	Ring count from pith to 1180
	GP-4265	DF	Wood frag.	I	X	1219p -- 1274r	
	GP-4266	DF	Wood frag.	C	X	1210p -- 1278rG	
	GP-4268	PNN	Wood frag.	I	X	(1230p -- 1282G)	Tentative date

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Room 11 was probably built in the summer of 1276, if the dated loose beam is truly associated with the structure. Both of the dated timbers associated with this room could have been cut within a short time of one another near the beginning of the juniper growing season in 1276. If SH-4 is not genuinely associated with Room 11, the chamber was probably built between the growing seasons of 1275 and 1276. Room Cluster 4 was probably begun in 1275 or 1276 with the construction of Room 11, since wall abutments show Rooms 12 and 13 to be later.

Room 31. The loose logs in this room cannot be positively associated with it. The chances are good that these beams are remnants of the roof, but this cannot be proved. Therefore, I can only state the possibility that Room 31 was built in 1283 or later. This date agrees with the possible date of 1284 for Room 32 which abutments show to be contemporaneous with Room 31.

Room 32 may have been built in 1284, if the association of SH-16 with the room is genuine. Since the association is tenuous at best, the date can be only tentatively applied to the room.

Kiva 2 was built sometime after 1271 as shown by the near cutting date directly associated with the structure. It is not likely that SH-17 is a repair timber, since upright roof support posts are not easily replaced. There is no way to determine if Kiva 2 was built before or after Kiva 1.

Five cutting dates from the eastern part of the site, including those from Room 11, range from 1266 to 1277. The date of 1266

probably comes from a reused or deadwood timber and is not directly related to the Tsegi Phase village. The other dates from the eastern sector suggest that most of the construction in this area took place between 1275 and 1280. It is not known when the scaffold was added to this sector of the site.

The dates from the western end of the site are difficult to interpret. This is probably due in part to the destruction of rooms by the shifting of the rockfall boulders. It is impossible to assign the loose timbers to any particular rooms. They may have come from Room Cluster 8 or they may have come from rooms that are now destroyed. Cutting dates from this area range from 1274 to 1285 and tend to cluster around 1280. Thus, the western end of the pueblo appears to be later than the eastern end. Most of the construction in this area probably took place between 1277 and 1285. The possible dates of 1283 and 1284 for Rooms 31 and 32 suggest that Cluster 8 was the last such unit added to the village.

As at Betatakin and Kiet Siel, the abandonment of Scaffold House cannot be dated. It may have occurred anytime after 1285. Again, 1300 seems as good a guess date as any. There is some room left in the shelter for additional structures; consequently, construction probably ceased at the time of abandonment rather than at the point when all the floor space under the overhang had been used.

CONCLUSIONS

Scaffold House was probably begun about 1273, and construction continued until 1285. Small date clusters at 1274, 1277, and

1284 may indicate the construction of room clusters by newly arrived or newly created households. The earliest building took place in the eastern part of the shelter where more level floor space was available. The village grew in a linear fashion as later room clusters were constructed farther west along the cliff wall. The last room cluster, Cluster 8, was probably constructed in 1283-85, at which time Scaffold House achieved its population peak of about 50 persons.

There is little evidence bearing on the nature of the organization of the village. Households were present, and presumably they were relatively autonomous like those of Betatakin and Kiet Siel. It is probably safe to infer that the village grew by the accretion of households. The social mechanisms by which the people of the households were integrated into a single village structure were probably similar to those inferred for Betatakin and Kiet Siel.

SWALLOW'S NEST

Events connected with the discovery of Swallow's Nest are not known. Since the ruin directly overlooks Laguna Creek, it can hardly be missed by anyone traveling through the canyon. Therefore, it probably was seen by Richard Wetherill and Charlie Mason in 1895, even though no record of their visit exists. Cummings visited the site in 1909 (Hargrave 1935a: 12; Turner 1962: 2), but apparently did not excavate it at that time (Judd 1950: 24). Fewkes made a brief stop at Swallow's Nest on his way up the canyon in 1910 (Fewkes 1911: 12).

Sometime between Fewkes' visit and the Rainbow Bridge--Monument Valley Expedition survey of 1933, Swallow's Nest was excavated, for Hargrave (1935a: 28) reports that "the site was excavated many years ago." No records of this work have been found; consequently, who did the work and when it was done are unknown. Hargrave recorded the site as NA-2507 in the Museum of Northern Arizona system. In the late 1930's, George W. Brainerd of the Rainbow Bridge--Monument Valley Expedition dug a Basketmaker II house that had been overlooked during the original excavation of Swallow's Nest Cave. Many tourists visited Swallow's Nest when Navajo National Monument headquarters was at Kayenta, and the route to Betatakin and Kiet Siel passed up the canyon from Marsh Pass. Since the transfer of the headquarters to the head of Betatakin Canyon in 1938, relatively few people make the trip to the ruin. In 1964 Swallow's Nest was added to the Arizona State Museum Archaeological Survey as Arizona D:7:9.

ENVIRONMENTAL SETTING

Swallow's Nest occupies a small high-roofed cave eroded from the Wingate sandstone. The site looks directly out on Laguna Creek which flows in a wide shallow channel only about 100 feet below (Fig. 1). A steep cone of loose talus inclines down from the cave to the valley floor below. The floor of the canyon is rather wide in this area, as might be expected from its location near the mouth. Swallow's Nest is located in that part of the canyon in which the Rock Point member of the Lukachukai formation is exposed. Outcrops of this member first appear in the stream bed about two miles upstream from

Swallow's Nest. The cliffs of Navajo sandstone in this area are stepped so far back that they cannot be seen; thus, in this area the canyon appears to be less confined than elsewhere.

The vegetation consists of sagebrush and grass on the alluvial surfaces, pinyons and junipers on the talus slopes and Kayenta bench, and a few isolated Douglas-firs in protected coves in the Navajo sandstone.

The broad alluvial flats immediately below Swallow's Nest would have been ideal for farming. The suitability of this part of the canyon for agriculture is shown by a large Navajo orchard directly across the canyon from the ruin.

There is no evidence that Swallow's Nest Cave ever had a spring or seeps. However, Laguna Creek is only 100 feet below the ruin and may have provided water for the people of Swallow's Nest. If Laguna Creek was not a flowing stream at the time, a number of nearby springs could have been used.

DESCRIPTION OF THE SITE

Swallow's Nest consists of a compact cluster of at least 18 rooms and a kiva that completely fills the floor of the small cave (Fig. 49). The 18 domestic rooms are arranged in five rows across the cave. The presence of additional rooms outside the cave is indicated by wall stubs that protrude at intervals from the talus. These rooms are not shown in Figure 49, because settling and shifting of the talus has completely destroyed the positional relationships of the wall remnants. The floor of the cave drops rapidly from back to

FIGURE 49
 SWALLOW'S NEST CLIFF DWELLING
 NA-2507; ARIZONA D:7:9

f = firepit
 e = entrybox

SCALE 0 5 10 20 FEET
 0 1 2 3 4 5 METERS

front. As a result, Swallow's Nest presents a stepped profile. The floor level of each row of rooms coincides with the rooftop level of the row of rooms immediately in front.

The back wall of the cave is extremely friable and readily crumbles away. To offset this condition, the builders of Swallow's Nest sealed the back wall with a thick coating of clay. As a consequence, the cave wall has the appearance of a heavily plastered masonry wall that has been over-enthusiastically chinked.

Many of the architectural details of the individual rooms have been destroyed. Those that remain fall well within the range of variation in the Tsegi Phase. The terraced nature of the site suggests a predominance of hatch entries, but this inference cannot be confirmed. The entrybox complex in Room 5 indicates that this chamber had a doorway that was reached by way of Rooms 11 and 16.

The "gallery" at the rear of the cave is neither as high nor as inaccessible as those at Betatakin and Batwoman House. It definitely is a storage structure rather than a defensive feature. The gallery cannot be related to any particular room cluster and therefore may be a community structure.

The site plan of Swallow's Nest differs somewhat from the layout of most Tsegi Phase sites. Whether this reflects some social difference or is related only to the size and shape of the cave is conjectural. The presence of at least three living rooms suggests a corresponding number of room clusters. Unfortunately, the rooms are so crowded that the normal distinctions between room clusters are not present. Another complicating factor is the apparent absence of

courtyards. Probably courts were located on the rooftops and are no longer discernible because the roofs are not preserved. The room clusters listed in Table 34 are, therefore, only tentatively identified.

Table 34. Composition of Room Clusters at Swallow's Nest

Room Cluster	Structural Units			Total Number of Rooms
	Court-yards	Living Rooms	Storage Chambers	
	Room Numbers			
1	Rooftop?	5	2,3,4	4
2	Rooftop?	7	8,9,10,11?	5?
3	?	12	13,17?,18?	4?
4	16?	15	14	2

As at Scaffold House, no temporally refined estimates of population can be made at Swallow's Nest. Once again it is assumed that at some point in time all the room clusters were occupied simultaneously. The four recognizable room clusters were perhaps augmented by two more, producing a maximum of six households. Thus, the maximum population of Swallow's Nest was probably about 25 to 30 persons.

CERAMICS

Pottery types present in the Museum of Northern Arizona and Arizona State Museum survey collections from Swallow's Nest include:

Lino Gray, Tusayan Corrugated, Moencopi Corrugated, Kiet Siel Gray, Tusayan Black-on-white, Kayenta Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, Kiet Siel Polychrome, Tsegi Black-on-orange, and Tsegi Polychrome. Except for one sherd of Lino Gray, this is a typical Tsegi Phase assemblage.

TREE-RING DATA

The three tree-ring specimens from Swallow's Nest were collected by Hargrave during his 1933 survey for the Rainbow Bridge--Monument Valley Expedition. All three are included in the Museum of Northern Arizona collection.

Swallow's Nest presents a good example of multiple publication of tree-ring dates. McGregor (1934: 8; 1938: 6) twice lists a single date of 1249. Douglass (1938: 12) reports a range of 1250 $\pm$ 5 from two specimens. Gladwin (1957: 277) lists one date at 1249. Smiley (1951) lists two dates at 1249 and 1250. The two dated specimens from Swallow's Nest are presented in Table 35. Since neither specimen is a cutting date or has a terminal ring, these columns are omitted from the table.

Table 35. Dated Tree-Ring Specimens
from Swallow's Nest

Provenience	Catalogue Number	Species	Form	Dates	Remarks
<u>West Side</u>					
Loose Log	F-3107	DF	Wood sec.	1165p -- 1252v	Date previously published as 1249
<u>Talus</u>	F-3122	PNN	Wood sec.	1163p -- 1269v	Date previously published as 1250

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Obviously, an analysis of chronological differences within Swallow's Nest is not possible. Both dates are close to cutting dates and fall within the temporal limits of the Tsegi Phase. If they may be taken as representative, they suggest that Swallow's Nest was one of the earlier Tsegi Phase sites to be built in the Tsegi. This is compatible with its location nearer the mouth of the canyon than the other sites. On architectural grounds it may be inferred that the rooms inside the cave were built before those that are located on the talus slope outside the overhang.

The plan of Swallow's Nest suggests that it was occupied by a localized lineage. The tightly packed cluster of rooms with an associated kiva very much suggests the so-called unit-pueblo which has been supposed to indicate an independent localized lineage. In view of the inference made in Chapter 5 that localized lineages

preceded the development of nonlocalized lineages in the Kayenta area, the possible early date of Swallow's Nest supports the hypothesis that it was occupied by a localized lineage group. On the other hand, this distinctive site plan may have resulted from nothing more than the necessity to adapt the village layout to the available floor area in the cave.

SITE NA-8435

NA-8435 has no recorded history. It must have been seen by Wetherill and Mason in 1895, for it directly overlooks the trail to Kiet Siel. As far as is known, the site was not recorded in any survey system until 1962 when it was designated NA-8435, although it has been seen by hundreds of visitors to Kiet Siel. The site may have been included in the Rainbow Bridge--Monument Valley survey and early Museum of Northern Arizona surveys, but it cannot be recognized on the basis of the descriptions on the site cards. It also bears the Arizona State Museum Survey number Arizona D:6:8.

ENVIRONMENTAL SETTING

NA-8435 occupies a huge rock shelter located about half a mile downstream from Kiet Siel (Fig. 1). The local environment is identical to that described in Chapter 8 for Kiet Siel. Access to the ruin is achieved by means of a steep loosely packed talus slope overgrown with Gambel oaks. A large seepage zone at the foot of the talus has produced a small swamp that abounds with aquatic life. The seepage zone would have provided an ample supply of water for the people of

NA-8435. Abundant farmland is located in the canyon bottom below and to the south of the ruin.

DESCRIPTION OF THE SITE

NA-8435 is comprised of at least 14 rooms strung out along the back wall of the northern half of the cave (Fig. 50). Rooms 9 through 14 occupy a narrow ledge of bedrock that juts from the back wall of the cave. The remaining rooms are situated on the summit of a loose talus slope that extends steeply downward and out of the cave. Scale from the friable ceiling and walls of the cave has nearly buried Rooms 1 through 7.

Room 1 is an unusual structure. It is a small circular subterranean structure three feet in diameter and of unknown depth and is lined with typical Kayenta masonry. Its function is not obvious. It may have been some sort of storage chamber. A more likely interpretation is that it is a sump or well sunk into the talus to tap a buried seep. Only excavation will enable its true function to be assessed.

The designation "Room 2" is applied to two massive dry-laid walls which obviously do not belong to the Tsegi Phase occupation. They are probably Navajo, but it is remotely possible that they are Paiute or even Anglo in origin.

A curved depression pecked into a rock ledge below and in front of Room 9 and 12 may be the remnant of a kiva. If so, I would infer that NA-8435 was more or less independent of Kiet Siel. If NA-8435

had no kiva, its people probably participated in the religious life of the larger village.

Most of the rooms are too poorly preserved to enable them to be classified. The cave wall behind Rooms 3, 4, 5, and 6 is smoke-blackened---a condition that could have resulted from domestic fires or from the burning of the roofs of the rooms. On a purely subjective basis, I would classify Rooms 3, 6, and 11 as dwellings and the remaining rooms as courtyards or storage chambers. Using these classifications, three room clusters may be tentatively identified. The composition of these clusters is presented in Table 36.

Table 36. Composition of Room Clusters
at NA-8435

Room Cluster	Structural Units			Total Number of Rooms
	Court- yards	Living Rooms	Storage Chambers	
	Room Numbers			
1	?	3	4,5	3
2	7	6	8	2
3	Area SW of Rooms 9 and 10	11	9,10,12	4

The status of Rooms 13 and 14 is unknown, but they probably constituted a fourth room cluster. On this basis, a maximum population of about 20 people may be inferred for NA-8435.

CERAMICS

Pottery types in a small sherd collection from NA-8435 in the Arizona State Museum are: Tusayan Corrugated, Black Mesa Black-on-white, Betatakin Black-on-white, Kayenta Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, and Kayenta Polychrome. Except for Black Mesa Black-on-white, this is a typical Tsegi Phase assemblage.

TREE-RING DATA

The two tree-ring specimens from this site were collected during my 1962 visit to NA-8435. The data on the single dated specimen are presented in Table 37. Since this one specimen requires no comment, the Remarks column is omitted from the table.

Table 37. Dated Tree-Ring Specimen from NA-8435

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>Room 4</u>						
Surface	ADM-9	PNN	Chcl. sec.	C	X	1110p -- 1275rB

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Little may be said about a single date, especially when it is only indirectly associated with the site. The date indicates that in 1275 at least one tree was cut, perhaps for constructional purposes. The date falls in the range of the second period of construction at

Kiet Siel. Possibly NA-8435 was built by members of the same group of people that moved into Kiet Siel between 1272 and 1275. By 1275 Kiet Siel may have been so crowded that some of the group chose to settle a short distance away rather than try to squeeze into the larger village. If the people of NA-8435 did not build a kiva of their own, they probably remained ceremonially linked to Kiet Siel.

LOLOMAKI

Lolomaki is the first cliff dwelling up from the mouth of Dogoszhi Biko that can be seen from the floor of the canyon. It is not surprising, then, that it was visited at an early date. Richard Wetherill left no record of this site, though he may have been there. The first recorded visit was made by Byron Cummings' 1909 field party (Judd 1950: 24). Cummings named the site Ladder House after a well preserved ladder that was removed from the ruin. A year later Fewkes visited the site which he too called Ladder House (Fewkes 1911: 20). In 1933, Hargrave's survey party recorded the site as NA-2530 for the Rainbow Bridge--Monument Valley Expedition. The name Lolomaki first appears in Hargrave's report (Hargrave 1935a: 30). Where he got this name is not certainly known, but it is probable that one of the Wetherills was his source. The site is designated Arizona D:7:4 in the Arizona State Museum Survey.

ENVIRONMENTAL SETTING

Lolomaki is located at the head of a short western tributary canyon of Dogoszhi Biko about two miles upstream from the confluence

of Dogoszhi Biko and Kiet Siel Canyon (Fig. 1). Opposite Lolomaki several branch canyons converge on the main channel to produce a fairly wide stretch of canyon suitable for intensive farming. At present there is no flowing spring or seep at Lolomaki. However, some of the several nearby springs could easily have been developed to provide water for the site's inhabitants.

DESCRIPTION OF THE SITE

At present Lolomaki consists of 11 rooms and courtyards (Fig. 51) situated atop a large block of sandstone that abuts the face of the Navajo sandstone cliff. The site is difficult of access; to reach the summit of the sandstone block one must scramble up a narrow crevice and inch his way around an overhanging sandstone boulder that blocks the crevice.

Because of its exposed location, Lolomaki is poorly preserved. There are no roofs present, and many walls have fallen. Nevertheless, most of the rooms retain enough diagnostic features to permit them to be classified. Unfortunately, my field notes do not differentiate between granaries and storerooms. Rooms 1, 5/6, 7, 9, 10, and 11 are storage rooms. "Rooms" 2 and 4 are walkways built up behind retaining walls.

Room 3 may be the remnant of a living room. However, there is no concrete evidence beyond its size to support this inference. Room 8 has a firepit and a bench and may be a dwelling. At present there is no sign that it was roofed; consequently, it may be a courtyard rather than a living room. There is no kiva at Lolomaki. The

site was a single, or at most a double, household residence that sheltered fewer than ten persons.

CERAMICS

Pottery types present in the Museum of Northern Arizona collection from Lolomaki are: Moencopi Corrugated, Kiet Siel Gray, Tusayan Black-on-white, Kayenta Black-on-white, Tsegi Orange, and Tsegi Black-on-orange. This constellation of pottery types falls within the total Tsegi Phase assemblage. Hargrave's (1935a: 30) assignment of the site to middle Pueblo III seems out of line with the pottery sample available. Colton (1939: 59) places Lolomaki in the Tsegi Phase.

TREE-RING DATA

There are three tree-ring specimens from Lolomaki. Two specimens are in the Museum of Northern Arizona collection. One specimen in the Gila Pueblo collection is a duplicate of F-4176 sent to Gila Pueblo by the Museum. All the specimens were collected by Hargrave's 1933 survey party. The single date from Lolomaki has been published by McGregor (1936a, 1938), by Gladwin (1957: 277), and by Smiley (1951). This date is presented in Table 38. Since this specimen requires no comment, the Remarks column is omitted from the table.

Table 38. Dated Tree-Ring Specimen from Lolomaki

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>None</u>	F-4176	DF	Wood frag.	C	X	1209p -- 1277rL
	GP-1420					

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

The single date indicates that some construction was performed at Lolomaki in or after 1277. Whether or not this actually dates the construction of the site cannot be determined. Its lack of a kiva indicates that its inhabitants depended on a nearby village for ceremonial observances. The people of Lolomaki probably belonged to a larger community that included a number of people from two or more localized habitation sites. Ceremonialism was probably the mechanism by which these habitation units were unified. The sites involved in this union and the central village in which the kiva was located cannot be determined. Lolomaki is probably related to NA-2606 just upstream, but no kiva is known for NA-2606. If the latter had no kiva, both it and Lolomaki may have been connected with a larger site such as Batwoman House.

SITE NA-2606

The site around the point (north) from N.A. 2530 had fourteen recognizable rooms of which only four seem to have been adaptable for living quarters, the remaining ten probably being for storage. No kiva was obvious but as the site was

difficult to reach and the hour was late, little time was had for a thorough examination of the site. (Hargrave 1935a: 32)

This quote includes everything that is known about NA-2606, with the exception of the ceramic assemblage and tree-ring dates. Pottery types from NA-2606 in the Museum of Northern Arizona survey collections are: Tusayan Corrugated, Kiet Siel Gray, Flagstaff Black-on-white, Tusayan Black-on-white, Kayenta Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, and Kiet Siel Polychrome. With the exception of Flagstaff Black-on-white, this assemblage consists of types known to have been produced during the Tsegi Phase.

TREE-RING DATA

The Laboratory of Tree-Ring Research has eight specimens from NA-2606. Seven of the eight are in the Museum of Northern Arizona collection (F-series). The single Gila Pueblo specimen (GP-series) is a duplicate of F-4182 sent to Gila Pueblo by the Museum. All the specimens were collected by Hargrave in 1933. A single date of 1275 has been published by McGregor (1936a, 1938) and by Smiley (1951). Recently four additional specimens were dated, bringing the total number of dates to five. These dates are listed in Table 39.

ANALYSIS OF THE DATA

Considering the number and range of the tree-ring dates, it is unfortunate that so little is known about the site. The range of cutting dates suggests that construction at NA-2606 took place between

Table 39. Dated Tree-Ring Specimens from NA-2606

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Room at South End</u>							
Roof Beam	F-4184	JUN	Wood frag.			1206p -- 1275v	
<u>Unknown</u>	F-4180	DF	Wood frag.	C	X	1213p -- 1259B	
	F-4182	WF	Wood frag.	I	X	1225p -- 1277rL	Previously published as 1275
	GP-1421						
	F-4189	DF	Wood frag.			1253p -- 1277v	
	F-4190	JUN	Wood frag.	C	X	1193 ₊ -- 1266B	Ring count to 1200

For key to headings and symbols, see Chapter 6.

1259 and 1277. The faint cluster at 1275-77 may indicate a surge of building activity at that time.

BATWOMAN HOUSE

Batwoman House is a large cliff pueblo of 60 rooms and courtyards. It is located in the northern branch of a large cove that opens on the northwest side of Dogoszhi Biko about three miles upstream from its confluence with Kiet Siel Canyon (Fig. 1). Batwoman House derives its name from a large pictograph painted in white on the back wall of the cave. The pictograph consists of a series of concentric circles topped by the representation of a head(?) with long pointed ears. In naming the site, Cummings (1915: 277-8) equated this pictograph with the Bat Woman---a character in Navajo mythology. The events connected with the discovery of Batwoman House are unknown. Turner (1962: 2) states that Cummings undertook excavations at the site in 1909. However, in a letter published by Hargrave (1935a: 12), Cummings claims to have "discovered" and excavated Batwoman House in 1912. If Cummings did not visit the site until 1912, the first recorded observation of the ruin was made in 1910 by Fewkes during his trip up Dogoszhi Biko. Fewkes (1911: 21) refers to the site as Forest-Glen House, a designation that has not survived. Batwoman House was at least partially excavated by Cummings in one, two, or three trips to the site. Turner (1962: 2) states that Cummings dug at Batwoman in both 1909 and 1912, whereas Cummings himself (Hargrave 1935a: 12) implies that he worked there only in 1912. Unfortunately, Cummings' Batwoman field notes at the Arizona State Museum are not dated

(Lindsay 1963b). However, mention in these notes of previous work in 1912 and 1913 suggest that this notebook was compiled in 1914 when it is known that Cummings did some work at Batwoman House. The site is included in three institutional archaeological surveys: the Museum of Northern Arizona (NA-2531), Gila Pueblo (Marsh Pass 6:5), and the Arizona State Museum (Arizona D:7:3).

ENVIRONMENTAL SETTING

The small side canyon in which Batwoman House is located is especially favored insofar as water supply is concerned. Many springs and seeps feed a small stream which is swallowed up by a large sand dune before it reaches the main canyon. Vegetation on the canyon floor below Batwoman is particularly lush. Moss and ferns choke the stream bed, thick groves of Gambel oak dot the fringe of the talus slopes, medium-sized cottonwood and pine trees are abundant, and isolated pinyon trees achieve an unusually large size. The talus slopes that fall 800 feet from the base of the Navajo sandstone to the canyon floor are covered with pinyons, junipers, and yucca plants. Douglas-fir and white fir trees grow in the coves and along the tops of the talus slopes.

The area of extensive farmland nearest Batwoman House is in Dogoszhi Biko where the confluence of several side canyons, including that in which the ruin is located, has produced a broad alluvial surface. The alluvial floor of the Batwoman cove is too narrow to have accommodated many fields. Water from the Batwoman branch could easily have been channeled down to fields located in the main Dogoszhi

Biko. Batwoman House is located nearly a mile from its farmland, and like Betatakin is so positioned that the fields could not have been seen from the village.

A strong spring flows from the Navajo sandstone--Kayenta formation contact just below the village. This spring could have easily satisfied all the water needs of the villagers. The several huge Douglas-fir trees growing above and around the spring inspired Fewkes to name the site Forest-Glen House.

DESCRIPTION OF THE SITE

The 60 rooms that comprise Batwoman House are perched on a series of discontinuous ledges in the Navajo sandstone (Figs. 52 and 53). Entrance to the site is gained only after a long scramble up a talus slope more than 800 feet high. Once the top of the talus has been reached, a difficult climb up a narrow crevice in the rock must be negotiated before the site is gained. The idea that Batwoman House was built in such an inaccessible spot for defensive reasons is belied by two facts. First, the village is located in a spot from which the fields cannot be seen. Second, the spring, from which the Batwoman villagers must have procured all their water, is located about 300 feet north and 75 feet below the ruin---a spot completely inaccessible to the people if their village was under attack.

Batwoman House "Cave" is not really a cave; rather it is an immense rock shelter with only a slight overhang. As a consequence of its exposed location, the ruin is poorly preserved. Although

FIGURE 52

BATWOMAN HOUSE
 NA-2531; ARIZONA D:7:3
 sketch map

- = sealed doorway
- f = firepit
- d = deflector
- e = entrybox
- v = vent
- m = mealing bin
- b = bench
- n = niche
- w = "window"

APPROX. SCALE 0 1 2 3 4 5 METERS 0 1 2 3 4 5 10 20 FEET

a

b

Fig. 53. General views of Batwoman House. a, the ruin viewed from below. The large Douglas-firs at the left grow just above the spring. b, the southern part of Batwoman House.

there is a considerable amount of wood present, little of it is in place (Fig. 53 b).

Architecturally, Batwoman House is similar to the other Tsegi Phase sites considered in this report. One feature that distinguishes Batwoman from the others is the apparent absence of jacal walls. While poor preservation may account in part for this phenomenon, some evidence for jacal construction would have survived if its use was at all common. Internal room features conform to the standard Tsegi Phase patterns.

Perhaps the most striking feature of Batwoman House is its apparent lack of a kiva. With the unlikely exception of Room 3, there is no structure at the site that even remotely resembles a kiva. There is a slight possibility that a kiva existed in the area between Court 14 and Rooms 25 and 26. However, such a kiva could only have been built behind a retaining wall that has since collapsed, carrying with it all evidence for associated structures. Another unlikely possibility is that a kiva lies buried in the talus just below the ruin. There is no evidence for such a structure. Kidder's (1924: 69) statement that "Bat Woman House has nothing but round kivas" may result from his misinterpretation of Cummings' (1915: 277) statement that no circular kivas were found at Batwoman House.

In the absence of an obvious kiva, it is tempting to so designate Room 3, for this chamber possesses a conspicuous feature not common to dwellings. This is a split-level "bench" situated in the northeast corner of the room. The north half of the bench is about 24 inches higher than the south half, into which is set a rectangular slab-lined niche. Other features in the room are those

usually associated with dwellings: a T-shaped doorway, a masonry entrybox-deflector complex, a firepit, and a "window" (Fig. 52). The "bench" notwithstanding, the only feature that really gives a ceremonial cast to Room 3 is the absence of a clear-cut kiva. The chamber may have been the home of the head of a lineage or ceremonial association who required special architectural features to perform his religious duties, but it is not a kiva.

While it is a fairly simple matter to rationalize the absence of a kiva at a small site like Lolomaki, it is somewhat more difficult to do so for a large site such as Batwoman House. Probably a thorough search of the vicinity of the site would disclose one or more kivas in caves isolated from the village itself. This relationship is not at all unlikely, since the pattern of detached kivas is evident in the relationships between NA-3533 and Betatakin and between the Turkey Cave kivas and Kiet Siel.

Batwoman House possesses a gallery almost identical to that at Betatakin. Like Betatakin's gallery, that at Batwoman is inaccessible. As far as can be observed, it consists of a low wall built along the front of a ledge high above the village. Presumably the gallery was used for storage. Hargrave (1935a: 31) includes a photograph in which the Batwoman House gallery appears.

A minimum of ten room clusters may be recognized at Batwoman House. The data on these clusters are presented in Table 40. The exact composition of several of the clusters cannot be determined because of the poor preservation of the ruin. Therefore, many of the identifications in Table 40 are of a rather tentative nature. Most

of the features upon which the classification of the rooms is based are evident on the site plan (Fig. 52). For this reason and because none of the tree-ring dates are directly associated with any structural units, an extended discussion of the individual room clusters is omitted.

Table 40. Composition of Room Clusters
at Batwoman House

Room Cluster	Structural Units						Total Number of Rooms
	Court- yards	Living Rooms	Granaries	Storage Chambers	Grinding Rooms	Unknown	
	Room Numbers						
1	4,7	2,3	-	1,6,8,9	5	-	7
2	10	12	-	11,13	-	-	3
3	14	a	-	15-18?	-	-	5?
4	b	24	-	19,20, 21-23?	-	-	6?
5	?	?	-	25-30	-	-	6
6	32	35?	31,34	-	-	33	4?
7	39?	38?	-	-	-	36,37	3?
8	42?	60	40	43,44	-	41	5
9	?	48	?	?	-	?	?
10	55,57	56	58,59	-	-	-	3

a - destroyed

b - not numbered on map; area south of Room 24

The paucity of tree-ring dates and lack of provenience control on the specimens renders impossible a chronological analysis of population changes at Batwoman. The best that can be accomplished is an estimate of the maximum population that the village could have accommodated. In making this estimate, two possible room clusters must be added to the ten listed in Table 40. A cluster may have existed between Clusters 3 and 4, but all evidence for a living room or courtyard has disappeared. Another possible room cluster probably existed in the south end of the pueblo. Some of the rooms numbered 46-54 probably belonged to this cluster and some to Cluster 9. No living room that might belong to this possible cluster can now be recognized. Thus, there is a minimum of 12 room clusters, one of which has two living rooms. Calculations based on 13 nuclear families yield a population estimate of about 65 people. The undetected presence of perhaps two more room clusters would bring this total to 75 people.

CERAMICS

There is a relatively large number of potsherds from Batwoman House; therefore, the sample probably reflects the true ceramic assemblage of the site. Both the Museum of Northern Arizona and the Arizona State Museum have collections from Batwoman House that include the following pottery types: Tusayan Corrugated, Moencopi Corrugated, Flagstaff Black-on-white, Tusayan Black-on-white, Betatakin Black-on-white, Kayenta Black-on-white, Tusayan Polychrome, Kayenta Polychrome, Kiet Siel Polychrome, Tsegi Orange, Tsegi

Red-on-orange, and Tsegi Black-on-orange. Except for Flagstaff Black-on-white, these types are typical of the Tsegi Phase. Batwoman House, like Betatakin, appears to be a pure Tsegi Phase site.

TREE-RING DATA

Although there are 20 individual tree-ring specimens from Batwoman House in the Laboratory of Tree-Ring Research collections, identification of duplicates reveals that only 15 different trees are represented. Each of the institutional collections---Museum of Northern Arizona (F-series), Gila Pueblo (GP-series), and the Laboratory's Douglass Collection (BW-series)---includes specimens from Batwoman. The ten F-specimens were collected by Hargrave in 1933. GP-1422 and GP-1583 are duplicates of F-4185 and F-4177 sent by the Museum of Northern Arizona to Gila Pueblo. GP-4290 through GP-4295 were collected by Deric O'Bryan in 1941. BW-1 and BW-2 were collected during my visits to the site in 1963 and 1964.

Dates from Batwoman have been published four times. McGregor (1936a, 1938) lists two dates at 1275. Gladwin (1957: 277) gives a range of 1245 to 1275 from six specimens. Smiley (1951) lists two dates at 1275. The four dates derived from the 15 specimens by the Laboratory of Tree-Ring Research are presented in Table 41. Since these specimens require no comment, the Remarks column is omitted from the table.

Table 41. Dated Tree-Ring Specimens
from Batwoman House

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>Top tier of rooms</u>	F-4188	JUN	Wood frag.			1218 -- 1279v
<u>Loose Logs</u>	BW-1	DF	Core	C	X	1194p -- 1279rB
	F-4185	DF	Wood frag.			1195p -- 1275v
	GP-1422					
	GP-4295	PNN	Wood frag.			1099p -- 1246v

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Little confidence may be placed in so few dates from such a large site. The clustering in the late 1270's suggests that Batwoman House was built at that time. This agrees with the pure Tsegi Phase ceramic assemblage. Batwoman House deserves further sampling and analysis, even though most of the timbers are not in situ.

TWIN CAVES PUEBLO

Twin Caves Pueblo is located in the head of a cove on the northwest side of Dogoszhi Biko about five miles upstream from its confluence with Kiet Siet Canyon (Fig. 1). The cove was called Waterlily Canyon by Cummings (1915: 276). The ruin was named for a huge double-vaulted rock shelter located in the cove. The site, however, is not located in either of the vaults of the "Twin Caves."

As with most Tsegi Canyon sites, the history of the discovery of Twin Caves Pueblo is obscure. As far as is known, Fewkes was the first Anglo to see the site. However, its existence may have been known to John Wetherill. Fewkes observed the site in 1910 on his trip through "Navajo National Monument" (Fewkes 1911: 21). He named the site Pine-Tree House after a large Douglas-fir tree that grows on the rim of the canyon directly above the site.

According to Turner (1962: 2), Cummings visited "Twin Cave House" in Waterlily Canyon in 1911. Cummings states in a letter published by Hargrave (1935a: 14) that in 1914 "we discovered and explored Twin Cave Ruin..." An inscription on the cave wall reads: "Aug. 24, 1913 Mrs. B. Cummings" (Hargrave 1935a: 33). Cummings excavated Twin Caves Pueblo, but the year in which he did the work is not known. Turner (1962: 2-3) records that Cummings visited the site in 1911 through 1914. In 1926 Charles L. Bernheimer and Zeke Johnson of the Bernheimer Expedition visited Twin Caves Pueblo under the misapprehension that it was Batwoman House. Hargrave's Rainbow Bridge--Monument Valley Expedition survey party recorded the site in 1933 as NA-2536. A year later an Expedition field party undertook intensive studies in Waterlily Canyon that included the mapping and excavation of Twin Caves Pueblo. Apparently Hargrave returned in 1936, for a set of his field notes on the ruin is dated to that year (Hargrave 1936). No excavation reports have appeared, although Cummings (1915: 276) describes one of the kivas, and Hargrave (1935a: 33-4) briefly discusses the site. Twin Caves Pueblo bears the Arizona State Museum Survey number Arizona D:3:5.

ENVIRONMENTAL SETTING

The local environment of Twin Caves Pueblo is typical of the Tsegi Canyon system. For a photograph of Waterlily Canyon, the reader may consult Beals, Brainerd, and Smith (1945, Pl. 1 b). Waterlily Canyon is a large cove drained by a small side channel of Dogoszhi Biko. The Kayenta bench is exceptionally broad in this area and supports a particularly heavy growth of pinyon and juniper trees. In the head of the cove just below the ruin grow the only manzanita bushes that I have seen in the entire Tsegi Canyon system.

The nearest arable land of any extent is in the main canyon at the confluence of Waterlily Canyon with Dogoszhi Biko. In this area the canyon is quite wide and would have provided ample farmland for the people of Twin Caves Pueblo. Beals, Brainerd, and Smith (1945, Pl. 1 b) illustrate the broad alluvial flats at the mouth of Waterlily Canyon. Their photograph also shows the very limited amount of farmland available in Waterlily Canyon itself.

A fine spring issues from the Navajo sandstone--Kayenta formation contact about 100 feet below the pueblo. This spring, which would have supplied plenty of water for the inhabitants of the site, feeds a small stream whose waters never reach Dogoszhi Biko except during the summer downpours.

DESCRIPTION OF THE SITE

Twin Caves Pueblo is notable chiefly for its inaccessibility. It can be reached only after a hard scramble up loose talus followed by steep rock face that would challenge a "human fly." The ruin is

perched on a series of discontinuous ledges that break the surface of a nearly vertical rock face beneath the overhang of a huge, but relatively shallow rock shelter (Fig. 54). Rooms occupy every relatively level spot in this great shelter. The utilization of every suitable space has resulted in the pueblo being divided into three distinct sections. The high eastern and western sections are separated by a lower middle section. Access to the ruin is by way of the lower section, from which hand and toe hold trails lead in either direction to the upper groups of rooms. Again, water and convenience to farmland were probably more important factors in the selection of this spot for a building site than was defense, as incredible as that may seem to one who has scrambled up into the shelter and contemplated the vertical drop of hundreds of feet directly below.

The ground plan of Twin Caves Pueblo used in this report (Fig. 55) is adapted from a map made in 1934 by Vernon DeMars of the Rainbow Bridge--Monument Valley Expedition. A copy of this map was made available by the Museum of Northern Arizona. I made only two brief trips to Twin Caves Pueblo and took no notes on either occasion. Fortunately, the Museum of Northern Arizona has two sets of notes on the site. The first of these was made by DeMars in 1934; the second, by Lyndon L. Hargrave two years later. Hargrave's notes are more complete from an archaeological standpoint; however, DeMars' notes provide useful supplemental information. Hargrave and DeMars each had their own set of room numbers, both of which differ from mine (Fig. 55). Therefore, a correlation of these three room-numbering systems is presented in Table 42.

Fig. 54. General view of Twin Caves Pueblo. The rooms of the western section can be seen at the left; the rooms of the central section are situated below those of the western section and to the right of the water stain on the cave floor; the rooms of the eastern section occupy the narrow ledge above and to the right of the central section.

Table 42. Correlation of Twin Caves Pueblo Room Numbers

Figure 55	DeMars 1934	Hargrave 1936
1	W.S. 4	Unit I-J
2	W.S. 3	Unit I-K
3	W.S. 1	Unit I-I
4	W.S. 2	Unit I-I
5	W.S. 5	Unit I-A
6	a	Unit I-B
7	a	Unit I-C
8	W.S. 6	Unit I-D
9	W.S. 7	Unit I-F
10	W.S. 8	Unit I-G
11	a	a
12	W.S. 9	Unit I-H
13	W.S. 10	Unit II-A
14	W.S. 11	Unit II-B
15	a	Unit II-S
16	W.S. 12	Unit II-C
17	W.S. 13	Unit II-D
18	W.S. 14	Unit II-F
19	W.S. 15	Unit II-G
20	a	a
21	W.S. 17	Unit III-A
22	W.S. 16	Unit III-B
23	a	a

Table 42--Continued

Figure 55	DeMars 1934	Hargrave 1936
24	W.S. 18	Unit III-C
25	W.S. 19	Unit III-E
26	W.S. 19	Unit III-D
27	W.S. 20	Unit III-G
28	a	a
29	W.S. 21	Unit III-H
30	W.S. 22	Unit III-I
31	W.S. 23	Unit III-J
32	W.S. 24?	Unit III-K
33	W.S. 25	Unit III-L
34	W.S. 26	Unit III-M
35	a	a
36	W.S. 27	Unit III-N
37	W.S. 28?	a
38	C.S. 3	R-1
39	C.S. 2	a
40	a	a
41	C.S. 3	a
42	C.S. 4	R-4
43	C.S. 5	R-5
44	C.S. 6	R-6
45	a	a
46	C.S. 7	R-3

Table 42--Continued

Figure 55	DeMars 1934	Hargrave 1936
47	C.S. 8	R-2
48	a	a
49	E.S. 1	R-A
50	a	a
51	E.S. 2	R-B
52	E.S. 3	R-C
53	a	a
54	E.S. 4	R-D
55	E.S. 5	R-E
56	a	a
57	E.S. 6	R-H
58	E.S. 7	R-F
59	E.S. 8	R-G
60	a	a
61	E.S. 9	R-J
62	E.S. 10	R-I
Kiva 1	Kiva 3	Unit I-E
Kiva 2	Kiva 1	Unit II-E
Kiva 3	Kiva 2	Unit III-F

W.S. - Western Section

C.S. - Central Section

E.S. - Eastern Section

a - Feature not numbered

The following discussion of Twin Caves Pueblo is based on Hargrave's and DeMars' notes, DeMars' map, published and unpublished photographs, and limited personal observation. The high degree of preservation, the good descriptive notes available, the relatively large number of tree-ring dates, and the fair provenience controls on the dated specimens permit a more intensive analysis of this ruin than is possible for the other Tsegi Phase sites except Betatakin and Kiet Siel. Therefore, a somewhat detailed description of the site follows.

Room typology and the association of the different types of room into room clusters at Twin Caves Pueblo is typical of the Tsegi Phase patterns. The following discussion makes this clear. Because the data recorded in the field notes are not uniform for each room, tables of architectural features are not included. The discussion is best presented in terms of the three obvious divisions of the site into the Western, Middle, and Eastern sections. The composition of each of the 12 recognizable room clusters at Twin Caves Pueblo is presented in Table 43.

Western Section

Hargrave (1936) divides the western section of Twin Caves Pueblo into three "units." Apparently these are intended to represent residence units with associated kivas. While this may be the case, the absence of such units in most other Tsegi Phase sites suggests that the associations among rooms at Twin Caves Pueblo are determined more by the layout of the cave rather than by any cultural factors. The absence of kivas in the middle and eastern sections, in

Table 43. Composition of Room Clusters
at Twin Caves Pueblo

Room Cluster	Structural Units					Total Number of Rooms
	Court-yards	Living Rooms	Granaries	Storage Chambers	Unknown	
	Room Numbers					
1	6,7	5	3,4	-	-	3
2	11	8	9	10	-	3
3	15	16	13,14	-	-	3
4	20	17	?	?	-	?
5	20	18	?	?	-	?
6	20	19	?	-	-	?
7	?	27	21?, 24?	22? 25/26?	-	6?
8	?	29	31,32	30,33	-	5
9	35	34	-	36,37	-	3
10	53	51	-	49,52	-	3
11	55	54	-	62	-	2
12	57	58	-	59,61	-	3

which space is at a premium, suggests that the village kivas were located in the western section because only this part of the cave afforded enough space. Hargrave's Unit I consists of Rooms 1 through 12 and Kiva 1; Unit II comprises Rooms 13 through 19 and Kiva 2; Unit III is made up of Rooms 20 through 37 and Kiva 3.

Although the western section of Twin Caves Pueblo is the best preserved of the three, it has suffered much erosion along the east

side. There was a retaining wall across the front, of which little remains (DeMars 1934: 3). When the retaining wall collapsed, portions of all three kivas and some rooms were carried away with it. The terrace behind the retaining wall formed a large street or plaza in which the kivas were located and onto which most of the secular rooms opened.

Rooms 1 and 2

Both these chambers are remnants of circular slab-lined structures that were sunk into the fill of the cave. Such structures are not known for the Tsegi Phase. These rooms probably belong to the Pueblo I occupation of the cave that is indicated by the presence of Kana'a Black-on-white and Kana'a Gray in the sherd collections. The date of 929 (F-3210) may come from a Pueblo I beam reused in Kiva 2.

Room Cluster 1

This cluster has two courtyards. Court 6 may have been a screened walkway connecting Rooms 3 and 4 with Court 7, which was the main courtyard associated with this cluster.

Room 5, the living room, has no doorway and was apparently entered by way of a roof hatch. Since only the primary beams remain, a roof hatch is not now discernible. Floor features are a firepit inside a ventilator in the east wall, a platform of plaster-covered trash between the firepit and the vent opening, and a slab-lined box in the southwest corner of the room. The floor is plastered.

Rooms 3 and 4 are granaries situated on a ledge overlooking Room 5. Room 4 has a doorway with a high sill and a clay coping. Room 3 is poorly preserved, but was probably identical to Room 4.

Room Cluster 2

Court 11 occupies a level area between Rooms 8 and 9 on one side and the back wall of Kiva 1 on the other.

Room 8, the dwelling, has a jacal front wall through which a doorway opens. Reeds were used in the jacal wall, which has been reduced by fire to a row of charred stubs. The firepit is connected to the doorway by a slab-lined entrybox which is closed on both sides. A low masonry bench occupies the western third of the room.

Room 9 is a granary with a high-silled grooved doorway and a floor of sandstone slabs. The front wall and ceiling of Room 10 are missing; consequently, it cannot be subclassified within the storage room category. Rooms 9 and 10 apparently shared a single roof and thus must have been built together.

The rooms that comprise my Room Clusters 1 and 2 are lumped along with Kiva 1 in Hargrave's (1936: 1-2) Unit I. While these two clusters may comprise a courtyard complex united by Courts 7 and 11, the evidence is not adequate to confirm the existence of such a unit. The association of Kiva 1 with such a unit is even more ambiguous. It seems unlikely that only two households would need a kiva all their own. On the other hand, the people of one or both households may have had some special but not exclusive relationship to the kiva.

Room Cluster 3

This cluster is focused on Court 15---a large area bounded by Rooms 13, 14, and 16 and Kiva 2.

Room 16 is the dwelling that belongs to Cluster 3. Although the firepit and most of the front wall have been destroyed, a slab deflector and entrybox complex remain in position. The entrybox is closed on both sides. Trash fill gives the entrybox a slightly raised floor.

Rooms 13 and 14, both granaries, are illustrated by Hargrave (1935a: 33). Room 13 has a high-silled ungrooved doorway that has a withe loop at either side of the doorway. When found, the room was sealed with a slab held in place by a stick shot through the loops. A heavy clay coping around the doorway conforms to the outline of the slab door, thus substituting for grooves. The floor is paved with slabs. Yucca loops hanging from the roof beams and pegs in the walls were undoubtedly used to suspend lighter materials above the floor. Room 14 occupies a small irregularly shaped space between Room 13 and the back wall of the cave. The doorway bears a heavy coping of clay, and loops are set into the wall at either side. An exterior platform abuts the doorsill. Abutments show Room 14 to postdate Room 13.

Room Cluster 4

This room cluster is somewhat unusual in that it has no storage chambers. The dwelling opens onto Court 20 which has two firepits. The firepit located just outside the doorway of Room 17 belongs to this

cluster. A battery of mealing bins outside the south corner of Room 17 is probably associated with this cluster.

Room 17, a poorly preserved dwelling, has a jacal front wall, a firepit, and a slab entrybox complex. Abutments show it to postdate Room 16.

The absence of storage chambers for this cluster is probably due to the lack of space. Room Cluster 4, as represented by Room 17, was a late addition to the village. By the time it was built there was probably no space left for additional rooms. Some of the storage rooms in the middle section of the pueblo probably belonged to this room cluster.

Room Cluster 5

Like Room Cluster 4, this cluster apparently has no associated storage chambers. A firepit in Court 20 near the back wall of Kiva 2 probably served the people of this cluster.

Room 18, the living room, is perhaps the best preserved chamber in Twin Caves Pueblo. A doorway opens through the jacal front wall. Inside is a firepit but no sign of a deflector or entrybox. A smoke hole with a slab coping is located in the roof above the firepit. The room has two wall niches, one each in the west and north wall. The interior of the room is plastered. The floor is of smoothed clay. Abutments show that Room 18 was built before Rooms 17 and 19.

The lack of storage rooms associated with Room 18 suggests that some of the storage chambers in the middle section of the ruin belonged to the inhabitants of this room cluster.

Room Cluster 6

Cluster 6 is difficult to recognize, and its composition as given in Table 43 is tentative. Court 20 is associated with this cluster as well as with Clusters 4 and 5. No firepit associated with Cluster 6 can be recognized.

The part of the front wall west of the doorway of Room 19 is masonry; the eastern part is jacal. A raised platform separates the doorway from a masonry deflector. The firepit is missing. Abutments show this room to be later than Rooms 21 and 22.

This is another cluster that apparently has no storage rooms. Again I suggest that some of the rooms in the middle section of the pueblo belonged to this cluster.

Hargrave (1936: 5-7) includes Room Clusters 3 through 6 and Kiva 2 in his Unit II. A fairly good case can be made for lumping Room Clusters 4, 5, and 6 together as a unit. They all share Court 20 and all apparently had storerooms located in the middle section of the pueblo. Thus, Room Clusters 4-6 may constitute a courtyard complex. However, because of the limited space available in this area and the consequent lack of alternative building sites, I hesitate to define such a unit. The apparent association may be an entirely fortuitous result of the physical conditions of the habitation site. The

inhabitants of one or more of these room clusters may have had some sort of special relationship to Kiva 2 or ceremonies associated with it. However, there is no concrete evidence for this.

Room Cluster 7

Cluster 7 is hard to define because this part of the ruin is particularly poorly preserved. There is no open space that conceivably could have been a courtyard; therefore, the roof of the living room, Room 27, or the roof of Kiva 3 may have served as a courtyard. The first alternative seems more likely, but there is no evidence to support either possibility.

The front wall of Room 27 was destroyed when the north side of Kiva 3 collapsed; consequently, this dwelling is poorly preserved. Since the floor of Room 27 was three feet lower than the roof of Kiva 3, the former was probably entered via a roof hatch. A firepit and large deflector constitute the only floor features in Room 27. "Room" 28 is a ventilator shaft left alongside the kiva to permit air to flow into the southeast corner of Room 27.

The storage chambers numbered 21 through 26 are tentatively assigned to this cluster. The association between these rooms and Room 27 is tenuous at best. Some of these rooms may actually be associated with Kiva 3, since the most convenient access to them is over the roof of the kiva.

Rooms 21 and 22 are situated on the west side of Passage 23. There is a slight possibility that both these rooms belong to Room Cluster 6. Room 21, a granary, has a high-silled doorway with a thick

clay coping. Room 21 was built at the same time as Room 22 and before Room 19. Room 22 is a granary apparently converted to a general store-room. Hargrave (1936: 8) notes that a high-silled grooved doorway with loops has been sealed and a new doorway with a ground-level sill knocked through the east wall. The west wall of this room is of jacal construction.

Rooms 24-26 occupy the east side of Passage 23. At present Room 24 is a granary with a doorway characterized by grooving and a clay coping. Hargrave (1936: 9) records that Rooms 24 and 26 were once a single long narrow room with a doorway in the center of the west wall. This doorway was sealed and a dividing wall built across the room. Unfortunately, Hargrave does not describe the old doorway, so there is no way of classifying the original chamber. Room 26 is apparently a granary, since DeMars (1934: 7) mentions a doorway with a "sculptured groove." Room 25, a second-story chamber above Room 26, is too poorly preserved to be subclassified within the storage chamber category.

Both Hargrave (1936: 9) and DeMars (1934: 7) note the excellent quality of the masonry of Rooms 25/26 and the ornamentation of the walls with rows of sandstone spalls. This special treatment recalls the white stripe across Rooms 44 and 45 behind Kiva 46 at Kiet Siel and may indicate some sort of relationship to Kiva 3. The apparent association of granaries with Kivas 75 and 123 at Kiet Siel is also significant in this regard. Room Cluster 7 may be associated with Kiva 3 in much the same way that Cluster 7 at Kiet Siel was inferred to relate to Kiva 46. Each of these clusters may have been the abode of

the head of a lineage, clan, or ceremonial organization that had some special relationship to Kiva 3.

Room Cluster 8

No courtyard can be recognized for this room cluster. It may have been on the roof of Room 29.

Room 29. The only floor features in Room 29 are a firepit and slab deflector against the south wall. A ventilator pierces the wall at the southeast corner. A doorway in the middle of the southeast wall has been sealed, perhaps in defense against a rising level of trash outside the room. Presumably the room was entered through the roof after the doorway was plugged.

Room 32 is a granary that can be entered only from Room 31. The south doorway of Room 32 bears a heavy coping of clay. A doorway in the east wall is the only entrance to Room 33. Room 31 is a granary, as shown by a with the loop set into the only remaining door jamb.

Rooms 30 and 33 are unclassified storage chambers. Room 30 is badly shattered. The air vent in the south wall of Room 29 opens into this chamber. Room 33 is a small storeroom created by walling up the space between Rooms 32 and 34 and can be entered only by way of Rooms 31 and 32.

Room Cluster 9

Court 35 is poorly preserved and no features remain. Room 34 has been crushed under a block of rock fallen from the ceiling. The fact that it is smoke-blackened indicates that it was a dwelling.

Room 36 is inferred to be a storage chamber because it is not smoke-smudged. Room 37 may be a walled passageway rather than a room. Its association with this room cluster is tenuous.

Hargrave (1936: 8-12) grouped Room Clusters 7 through 9 and Kiva 3 together as Unit III. There is less structural evidence to indicate that such a unit actually existed than there is for Units I and II. While there is a suggestion that Room Cluster 7 may be related to Kiva 3, there is little evidence to link Clusters 8 and 9 with either Cluster 7 or Kiva 3.

Kiva 1 and Room 12

Kiva 1 is poorly described in Hargrave's notes. The plan (Fig. 55) suggests that it has pilasters and recesses similar to those of Mesa Verde kivas. If this is the case, it is only the second such kiva, after Kiva 2 in Turkey Cave, known for the Tsegi Phase. Hargrave (1936: 1-2) notes that this Kiva 1 was remodeled by constructing a jacal wall across the north side of the chamber. He infers that the kiva was converted into a living room at the time of the alterations. The jacal wall was subsequently destroyed by fire.

Room 12 is entirely destroyed except for remnants of the south and west walls. This chamber was probably an adjunct to Kiva 1 similar to Rooms 74 and 122 at Kiet Siel.

Kiva 2

This chamber is a typical Tsegi Phase keyhole-shaped kiva (Fig. 55; Cummings 1915: 276, Fig. 54). In shape Kiva 2 is almost identical to Kiva 46 at Kiet Siel. The major difference between the two is the presence in the Twin Caves example of a bench around the inside. The top of the bench and the southeastern recess are paved with stone slabs. The rectangular inset on the south side of Kiva 2 is a large niche set 31 inches above the bench. A horizontal ventilator shaft passes beneath the southern recess and opens through the outer retaining wall. The interior orifice of the ventilator shaft is grooved to receive a slab covering. The interior of the kiva is well plastered but apparently not decorated.

No mention is made by either Cummings or Hargrave of the nature of the floor of Kiva 2. The floor features are few, but interesting. Inside and directly in front of the ventilator orifice is a massive deflector. It consists of two large upright posts set two feet apart and joined by an upright slab. Six inches toward the ventilator opening is another large sandstone slab set parallel to the first. The space between the two slabs is filled with "clean sand, corn cobs, fiber, wood splinters, etc." (Hargrave 1936: 5). Two feet inside the ventilator is a large slab-lined firepit. Eighteen inches beyond the firepit, near the center of the floor, is a large rectangular pit similar to the "magic pit" or "foot drum" in Kiva 46 at Kiet Siel. Three rows of four loom anchor staples each form a U around the "foot drum" and firepit, with the open end of the U toward the

ventilator. Each anchor consists of a bent wooden staple set in the floor plaster.

Enough of the ceiling is preserved to give some idea of the manner in which the kiva was roofed. Like Kiva 46 at Kiet Siel and Kiva 1 at Scaffold House, Kiva 2 has a large primary beam that crosses the midline of the kiva at right angles to the ventilator-deflector-firepit axis. There was at least one other primary near the juncture of the southern recess with the kiva chamber. Southeast of the major primary beam the secondary beams were laid at right angles to the primaries. Northeast of the major primary several secondaries were laid at right angles to the curved wall of the kiva rather than to the primary. Thus, these secondaries radiated fan-like from a spot near the midpoint of the large primary. Quantities of wood splints and masses of juniper bark in the fill of the kiva indicate the nature of the closing material and matting that covered the secondaries. The use of the secondary beams in this kiva is somewhat different from that in Kiva 1 at Scaffold House.

Kiva 3

This kiva is poorly preserved; large sections of wall along the north and southeast sides have collapsed. Apparently Kiva 3 was a keyhole-shaped kiva with a southeastern recess which, along with evidence for the ventilator shaft and deflector, was destroyed by the collapse of the walls. A fresh unsmudged coat of plaster over a heavily blackened undercoat led Hargrave (1936: 9) to infer that the kiva burned and was rebuilt.

The floor features are similar to those in Kiva 2. A slab-lined firepit and rectangular "magic pit" are present. A single row of four loom anchor holes parallel to the ventilator-deflector-firepit axis is located on the southwest side of the kiva.

The few remnants of the ceiling that remain in place show that the kiva was roofed in the same way as Kiva 2. The main primary beam and one of the quadrant secondaries are still in place.

Middle Section

As far as can now be determined, all the rooms in this section of Twin Caves Pueblo are storage chambers. None are smoke-blackened, and none have interior features characteristic of living rooms. Rooms 38 and 46/47 are classed as granaries, for they have doorways that are either grooved or coped with clay. There are no data on the nature of the doorways in the other rooms.

"Room" 40 is a large area that has been artificially leveled by pecking away the sloping bedrock. There is a slight possibility that this was once a dwelling. However, the lack of smudging on the walls of adjoining rooms and the absence of a firepit, deflector, entrybox, or mealing bins argue against this hypothesis. "Room" 40 was probably a walkway that provided easy access to Rooms 38 and 46/47.

This group of storage chambers with no associated dwellings is unique in Tsegi Phase archaeology. Two explanations seem possible. First, this complex could be a community storage facility analogous to the galleries at Betatakin and Batwoman House and the Scaffold at Scaffold House. Second, the storage rooms may have been built in this

relatively level spot by the people of Room Clusters 4, 5, and 6 in response to the lack of available space in the western section of the village. The second alternative seems more probable, but the first cannot be ruled out.

Eastern Section

The rooms in this part of the site are poorly preserved because of greater exposure to the elements. Nevertheless, some of the chambers can be classified and grouped into room clusters. Striking features of this section of the site are the number and size of outdoor work areas and the number of mealing bins present. A retaining wall that once existed across the front of this section has collapsed, leaving only isolated remnants. There is neither a kiva present nor sufficient room to have accommodated one. Thus, the people who lived in this part of the village must have utilized one or more of the kivas in the western section. This situation indicates that the kivas were community rather than sub-community units.

Room Cluster 10

Court 53 possesses a firepit and four metate bins. In contrast to the usual situation, one metate still remains in its bin.

Room 51, the dwelling, is made entirely of jacal, except for the north wall which is formed by the cliff face. Most of this room was destroyed when the retaining wall collapsed. Inside a doorway in the east wall are a firepit and two mealing bins.

Rooms 49 and 52 are unclassified storage chambers. Room 49 is probably a granary, but this statement cannot be confirmed. A "normal"

(Hargrave 1936: 16) doorway opens through the east wall. Room 52 apparently opened onto Court 53.

Room Cluster 11

Court 55, a large rectangular platform behind a low retaining wall, contains a number of interesting features. Apparently a jacal wall screened off the south side. Two entrances are indicated by breaks in the retaining wall: one at the west end and one at the east end. A vent opens through the south side of the retaining wall. Floor features are a firepit near the middle of the courtyard and a pair of mealing bins in the southeast corner. A series of steps outside the east doorway gives onto the lower Court 56---a walkway connecting Court 55 with Room 62.

Room 54 opens directly onto Court 55. A slab entrybox, closed on both sides, is set just inside the doorway. A firepit is located near the middle of the room.

Room 62, a probable granary, is too poorly preserved to be positively classified. It is not smoke-blackened.

Room Cluster 12

This cluster has been largely destroyed as a result of the collapse of the front retaining wall. Therefore, its units are difficult to classify. Court 57 is quite fragmentary. Its only feature is a mealing bin. Hargrave (1936: 17) states his belief that this area was not roofed. The only remaining feature of Room 58, the dwelling, is a large slab-lined firepit. A small wall remnant is all that remains of Room 59. The absence of smoke-blackening indicates

a storage function. Room 61 faces Room 59 across a narrow walkway, Court 60. The doorway of Room 61 is present but not described in sufficient detail to permit the room to be subclassified.

Estimate of Maximum Population

The 12 recognizable room clusters are probably all that were ever present in Twin Caves Pueblo. There simply is no room in the cave to accommodate more structures. This would indicate a maximum population of about 60 individuals. The tree-ring dates suggest that the population peak was reached around 1280 (see below). Three-fourths of the population---about 45 people---lived in the western section of the village; one-fourth---about 15 persons---lived in the eastern sector.

CERAMICS

The Museum of Northern Arizona and the Arizona State Museum have samples from Twin Caves Pueblo in their survey collections. The pottery types represented in these collections are: Kana'a Gray, Tusayan Corrugated, Moencopi Corrugated, Kiet Siel Gray, Kana'a Black-on-white, Flagstaff Black-on-white, Tusayan Black-on-white, Kayenta Black-on-white, Tusayan Black-on-red, Tusayan Polychrome, Kayenta Polychrome, Kiet Siel Polychrome, Tsegi Orange, and Tsegi Black-on-orange.

Except for Kana'a Black-on-white, Kana'a Gray, and Flagstaff Black-on-white, these types are typical of the Tsegi Phase. The Kana'a Gray and Black-on-white pottery obviously relate to the circular slab-lined pit structures, Rooms 1 and 2. These typically

Pueblo I structures along with the Pueblo I pottery types indicate at least a small occupation of the rock shelter sometime between A.D. 850 and 1000. Flagstaff Black-on-white may have been brought in by the Tsegi Phase villagers or it may indicate a slightly earlier occupation of the cave. The absence of pottery types contemporaneous with Flagstaff Black-on-white supports the first alternative.

TREE-RING DATA

There are 90 numbered tree-ring specimens from Twin Caves Pueblo in the collections of the Laboratory of Tree-Ring Research. Identification of duplicate specimens reveals the presence of only 69 individual trees in the sample. The 90 numbered specimens belong to the Museum of Northern Arizona collection. Twenty-one specimens with numbers between F-3174 and F-3210 were collected by Hargrave's 1933 Rainbow Bridge--Monument Valley Expedition survey party. Tree-Ring Laboratory records suggest that Hargrave's 1934 party collected specimen F-3330. The remaining 68 specimens (F-3516 through F-3583) were also collected by Hargrave, probably in 1936.

Dates from Twin Caves Pueblo have been published several times. McGregor (1934: 8) lists seven dates ranging from 1208 ± 3 to 1276 ± 2 . McGregor (1936a) gives a range of $1110 \pm X$ to 1280 ± 2 from eight newly dated specimens. McGregor (1938) combines the two previously published sets of dates with two newly derived dates and lists 17 dates that range from $1110 \pm X$ to 1280 ± 2 . Douglass (1938) gives a range of $1110 \pm X$ to 1280 for 15 specimens. Smiley (1951) lists a range of 1102 to 1280 for 16 specimens.

The 33 dates derived as a result of a recent reworking of the Twin Caves Pueblo collection are listed in Table 44. The dates are arranged according to the section of the site from which they come. Specimens from the western section are grouped according to Hargrave's three "units." Within each of these units the dates are presented in order of decreasing provenience control. Few of the sampled beams were actually in place; consequently, most of the dates are from loose logs. While the room provenience of many of these loose timbers is known, this information is less valuable than it might at first appear. The sampling was done after Cummings excavated the site. Since the loose timbers undoubtedly got shuffled around during the course of the excavations, the rooms in which they were found 20 years later would not necessarily bear any relationship to the rooms in which they originally occurred.

Table 44. Dated Tree-Ring Specimens from Twin Caves Pueblo

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
WESTERN SECTION							
<u>Unit I</u>							
Room 5 or 6							
Loose Log	F-3528	JUN	Wood			1211 _p -- 1274v	Count from pith to 1225
Room 8							
Loose Logs	F-3522	DF	Wood	C	X	1104p -- 1272rL	
	F-3182 F-3523	PNN	Wood			1097p -- 1248++vv	Count beyond 1235
	F-3526	JUN	Wood			(1197 _p -- 1272vv)	Tentative date; Count from pith to 1250
	F-3527	DF	Wood	I	X	1176p -- 1270r	
Kiva 1							
Jacal Wall Post	F-3518	PNN	Wood	C		1138p -- 1263+B	(3)
Loose Log	F-3517	PNN	Wood	C	X	1182p -- 1277B	

Table 44--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Unit I</u> (cont.)							
General and Unknown	F-3521	DF	Wood	C	X	1236p -- 1278B	
	F-3185	DF	Wood			1222p -- 1272v	
	F-3186	DF	Wood	C	X	1102p -- 1272r	
<u>Unit II</u>							
Room 16?							
Loose Log	F-3529	DF	Wood	C	X	1224p -- 1272cL	
Kiva 2							
Upright Posts in Wall	F-3210	DF	1"core			858p -- 929vv	
	F-3174	JUN	Wood	C	X	1077 ₊ p -- 1272r	Count from pith to 1110
Deflector Posts	F-3207	DF	Wood			1229 -- 1272v	
	F-3530	JUN	Wood			1064 -- 1279vv	
Loose Logs	F-3532	DF	Wood	C	X	1180p -- 1273r	
	F-3541	DF	Wood frag.			1048 -- 1110v	Wood splint, probably roof closing material

Table 44--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Unit II (cont.)</u>							
Loose Logs	F-3554	DF	Wood frag.			1072 -- 1176vv	Wood splint, probably roof closing material
	F-3558	DF	Wood frag.			1027 -- 1137vv	Wood splint, probably roof closing material
	F-3559		Wood frag.				
<u>Unit III</u>							
Room 27							
Loose Logs	F-3572	DF	Wood	C	X	1242p -- 1272r	
	F-3577	JUN	Wood	C	X	1184 -- 1280rB	
Room 29 or Kiva 3							
Loose Log	F-3564	DF	Wood	C	X	1253 -- 1273r	
Room 34							
Loose Log	F-3568	DF	Wood	C	X	1171p -- 1256rB	

Table 44--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
<u>Unit III (cont.)</u>							
Room 36							
Loose Log	F-3569	JUN	Wood frag.	C	X	1084p -- 1280rB	
Unknown	F-3581	DF	Wood	C	X	1165p -- 1273rL	
<u>General and Unknown</u>	F-3188	DF	Wood			1194 -- 1271v	
	F-3175	DF	Wood	C	X	1160 -- 1273B	
	F-3190		Wood				
EASTERN SECTION							
General and Unknown	F-3189	DF	Wood			1222 -- 1275v	
	F-3179	DF	Wood	C	X	1216p -- 1272rL	
	F-3196	PNN	Wood			1050p -- 1240+v	(3)
	F-3187	DF	Wood			1222p -- 1272v	
	F-3197	DF	Wood			1234p -- 1274v	

Table 44--Continued

Provenience	Catalogue Number	Species	Form	TR	CD	Dates	Remarks
Provenience Unknown	F-3205	PNN	Wood			1118p -- 1277v	
	F-3330	DF	Wood	C	X	1223p -- 1272CB	

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

The number of specimens and fair provenience data from Twin Caves Pueblo permit a somewhat more intensive analysis than is possible for the other sites considered in this chapter. Because the dates from loose logs may not be applicable to the room from which they come, only dates from in situ timbers are considered in the following room analysis.

The single in situ date from Kiva 1 probably represents a reused timber. The specimen comes from the jacal wall that Hargrave infers to be part of a late remodeling of the kiva. Since most of the dates from the site fall in the 1270's, a date of 1263 from a late addition to a structure supposedly built at the time of the Tsegi Phase occupation seems a bit too early. The possibility that Kiva 1 was built during an earlier occupation of the cave is slight. The only known pre-Tsegi Phase occupation occurred in the Pueblo I period, a time in which large pilastered kivas were not common.

The dates from Kiva 2 are difficult to interpret because of the lack of clustering. The date of 929 probably comes from a beam originally associated with the Pueblo I structures, Rooms 1 and 2. Hargrave (1936: 4) records that the post from which this date comes appears to be older than the other timbers in the kiva. The dates from other in place timbers range from 1272 to 1279. So few dates make interpretation difficult, but two equally possible alternatives fit the data. First, the kiva could have been built in 1279 using timbers stockpiled in 1272. Second, the kiva could have been constructed in 1272 and the deflector built or remodeled in 1279.

Three of the many wood splints found in Kiva 2 give dates much too early for the Tsegi Phase structure in which they occur. This case is another example of the use as closing material of splints torn off long-dead and partially rotten logs. A similar situation was inferred with reference to the early-dated splints from the roof of Room 92 at Kiet Siel.

There appears to be no significant differences between the dates from the eastern section of the pueblo and those from the western section. The five dates from the eastern section range from 1240 to 1275, while the representative dates from the western section range from 1270 to 1280. About the only conclusion to be drawn from this situation is that construction ceased earlier in the eastern section than in the western sector. That is not surprising, in view of the severely limited space available in the eastern section.

Somewhat more concrete results may be obtained through an analysis of the clustering of cutting dates from the whole site. As a matter of fact, there is only one significant cluster. This cluster falls at 1272-73 and includes 11 of the 17 cutting dates. In addition, two "probable cutting dates" (F-3185 and F-3207) fall at 1272 and strengthen the cluster. Only four cutting dates fall after 1273---one each at 1277 and 1278 and two at 1280. The two cutting dates before 1272---one each at 1256 and 1270---are of little interpretive significance.

In the absence of any evidence for the early use of a non-datable species such as was present at Kiet Siel, the dates may be interpreted as indicating a single period of intensive construction

activity followed by an eight-year period of rather desultory building activity. The 1272-73 building period probably represents the immigration of a fairly large number of people into Twin Caves. While there may have been someone already in residence in 1272, their numbers were few. After the original influx of people the village apparently grew slowly either because new households moved into the village, or new households were created by marriage, or both. Apparently construction ceased after 1280. This could have been due to the fact that there literally was no space left in which to build. The village was probably abandoned by 1300.

NAGASHI BIKIN

Nagashi Bikin is located in an immense cave that overlooks the confluence of Nagashi Biko and Dogoszhi Biko (Fig. 1). "The name Nagashi Bikin was supplied by Ben Wetherill and translated means, Mountain Sheep House" (Hargrave 1935a: 34).

The discovery of Nagashi Bikin has not been recorded. Since the rooms can easily be seen from the canyon floor, the first traveler to penetrate this far up Dogoszhi Biko was probably the discoverer of the site. Unfortunately, the name of this "first traveler" is unknown. Fewkes apparently did not proceed beyond Twin Caves Pueblo (Fewkes 1911).

Cummings' 1914 field notebook (Lindsay 1963b) records excavations at Nagashi Bikin. Cummings called the site Baby Mummy Cave in honor of two dessicated infant burials that he unearthed. Whether or not this was Cummings' first visit to the site is unknown.

In addition to clearing the Tsegi Phase rooms in the cave, Cummings excavated a large subterranean kiva, at least two early pit structures, and seven burials.

Hargrave's Rainbow Bridge--Monument Valley Expedition survey party visited the ruin in 1933 and gave it the name that it now bears and the number NA-2629. The site is listed as Arizona D:3:5 in the Arizona State Museum Survey system.

ENVIRONMENTAL SETTING

The local environment of Nagashi Bikin is somewhat different from those of the other Dogoszhi Biko sites, primarily because there is more surface water in this part of the canyon. Nagashi Biko carries a perennial stream fed by a number of springs. A short distance below the confluence of Nagashi Biko with Dogoszhi Biko the waters contributed by the former are swallowed up in the sand of the arroyo bottom.

The vegetation in the vicinity of Nagashi Biko is similar to that in the head of Betatakin Canyon. Large well watered coves shelter stands of quaking aspen and Douglas-fir trees. The streambed above Nagashi Bikin is choked with a thick growth of reeds, ferns, and boxelder trees. The alluvial terraces support a good cover of grass. Gambel oaks fringe the talus slopes, and pinyons and junipers cover the Kayenta bench.

A broad alluvial terrace at the junction of the two canyons just below the site would have provided ample farming area for the people of Nagashi Bikin. At present there is no spring in Nagashi

Bikin Cave. However, there is evidence for an extensive seepage zone about 200 feet below the cave. This zone could have been developed to provide sufficient water for the inhabitants of the site, or water could have been transported from the stream below.

DESCRIPTION OF THE SITE

The Tsegi Phase occupation of Nagashi Bikin utilized only a fraction of the space available in a huge overhang (Fig. 56 a). Figure 57 illustrates only the portion of the cave that possesses Tsegi Phase remains---about one-third of the total expanse of the shelter. The site is reached after a long but not too difficult climb up an 800-foot talus slope. Again, the location of the site in a relatively inaccessible spot is probably a result of proximity to farmland and water and not of defensive needs.

There is considerable evidence for a heavy pre-Tsegi Phase occupation of Nagashi Bikin Cave. Most of the early material is located in the eastern two-thirds of the cave which is not shown in Figure 57. Three depressions mark the locations of three pithouses, at least two of which were excavated by Cummings. One of these is still well enough preserved to show that it consisted of a shallow slab-lined pit with upper walls of jacal construction. Hargrave (1935a: 39) illustrates this structure. Ceramics associated with these structures show them to date to the Pueblo I period, probably between A.D. 850 and 1000. These structures, along with Rooms 1 and 2 in Twin Caves Pueblo, indicate a fairly heavy Pueblo I occupation of Dogoszhi Biko.

a

b

Fig. 56. General views of Nagashi Bikin. a, Nagashi Bikin Cave. The Tsegi Phase structures occupy a rock shelf at the left side of the arch. b, Rooms 5 and 6.

The Tsegi Phase remains at Nagashi Bikin are concentrated in the western part of the cave. The masonry is characterized by its variability. Much of it is crude, even by Tsegi Phase standards. On the other hand, the wall of Room 5 (Fig. 56 b) is perhaps the most meticulously executed wall in Tsegi Canyon. Wall footings of upright slabs, such as those in Rooms 5 and 6 (Fig. 56 b), are not known to occur in any other Tsegi Phase sites.

Four room clusters may be identified at Nagashi Bikin. One of these, Room Cluster 1, may actually be a ceremonial complex. The composition of these four clusters is presented in Table 45.

Table 45. Composition of Room Clusters
at Nagashi Bikin

Room Cluster	Structural Units				Total Number of Rooms
	Court-yards	Living Room	Granaries	Storage Chambers	
	Room Numbers				
1	13	1 or 4	2,5,6	3	6
2	12,13	7	8,9	10,11	5
3	20	14,15	?	-	2?
4	21	17	-	16,18	3

Room Cluster 1

This cluster is centered on the large Court 13 which has at least two firepits.

Room 1 may have been a dwelling or an above-ground kiva, or it may have served both functions. The room is nearly square. The

interior is well plastered and heavily smoke-blackened. A firepit is set into the floor just inside a floor-level vent. A large masonry block deflector once stood between the vent and the firepit. A niche in the north wall is the only other notable interior feature. The roof is perfectly preserved, as may be seen in a photograph published by Hargrave (1935a: 36). A hatchway has been cut through the roof above the firepit. Sealed doorways in the east and west walls indicate that Room 1 underwent some alterations after it was constructed. The sealing of the doorways may be connected with the construction of the roof hatch.

While the above traits are typical of Tsegi Phase living rooms, a number of features suggest a ceremonial function for Room 1. The positional relationship of the two granaries (Rooms 5 and 6) to Room 1 is similar to the relationships of Rooms 44 and 45 to Kiva 46 and of Rooms 72 and 73 to Kiva 75 at Kiet Siel. The extra care lavished on Rooms 5 and 6 (Fig. 56 b) is reminiscent of the superior masonry used in Rooms 44 and 45 at Kiet Siel and of the especially well made and decorated walls of Rooms 25/26 that may be associated with Kiva 3 at Twin Caves Pueblo. The floor of Court 13 has been raised to within 18 inches of the rooftop of Room 1 by banking dirt against the back wall of the room. Finally, the presence of a U-shaped, jacal-walled chamber (Room 4) adjacent to Room 1 suggests a ceremonial function. Room 4 is similar in placement, orientation, and configuration to a number of other chambers that are inferred to be ceremonial adjuncts to true kivas: Rooms 74 and 122 at Kiet Siel and Room 12 at Twin Caves

Pueblo. In light of these factors, the change from lateral entry to roof entry assumes added significance.

Room 1 was probably constructed as a living room with two doorways. Subsequently, it was converted into a kiva. The doorways were plugged, a hatchway cut through the roof, and Room 4 butted onto the east side. What became of the family resident in Room 1 is conjectural. It is possible that they continued to live there and that the room then served a dual function. Or the family may have moved into Room 4 and reserved Room 1 for ceremonial purposes.

Room 4 is a ceremonial adjunct to the kiva, a living room, or both. It probably had a jacal front wall. Its only feature is a firepit just inside the projected line of the front wall.

Rooms 2 and 3 are small storage chambers. Room 2 is a granary, as shown by its grooved doorway. Room 3 cannot be subclassified. Originally it was entered directly from Room 1. After the west doorway of Room 1 was plugged, Room 3 could have been entered only by means of a roof hatch which has been destroyed along with the roof.

Rooms 5 and 6 are granaries that exhibit a number of interesting features (Fig. 56 b). Not the least of these is the unusual slab footing and excellent masonry of the front wall. Every effort was expended to make it smooth and regular. The doorways of both rooms exhibit a precise rectangularity uncommon in Tsegi Phase sites. The doorway grooves were ground with unusual precision. At either side of the doorway of Room 5 carefully executed geometrical designs have been incised into rectangular panels of smoothed mortar. It seems clear

that these two rooms were constructed with some special purpose in mind. A logical inference is that they were used to store grain that belonged to the social unit associated with the kiva. Since these granaries are in addition to household granaries, the inferred social unit was probably composed of members of more than one household.

Room Cluster 2

Originally this cluster was focused on Court 13. Later its orientation changed toward Court 12. One of the firepits in Court 13 may have been associated with this cluster. Because of its shift away from Court 13, I infer that this cluster was not joined with Cluster 1 in a courtyard complex. Wall abutments seem to indicate that Room Cluster 2 is earlier than Cluster 1.

Room 7 originally opened onto Court 13 by means of a doorway in the west wall. After this doorway was sealed, entrance could have been only by way of a hatch in the roof. The roof is now absent.

Rooms 8 and 9 are granaries. The doorway of Room 8 is unusual in that it is fully lined with slabs. The doorway of Room 9 is grooved, and doorloops are set into the wall on either side. Rooms 10 and 11 are unclassified storage chambers. A doorway in the west wall of Room 10 has been sealed and a new doorway broken through the east wall. The relocation of the doorway of Room 10 is probably a manifestation of the shift in orientation from Court 13 to Court 12.

Room Cluster 3

This cluster is poorly defined in that no associated storage chambers can be identified. One or two such rooms may lie buried

beneath scale that has flaked off the cave roof. Court 20 has no features. Room 14 has the standard living room features: a firepit, slab entrybox, and low-silled doorway. The interior is smoke-blackened. The only feature in Room 15 is the firepit. The inside of this room is smudged also. Abutments show that Room 15 was added to the cluster after Room 14 was built.

Room Cluster 4

This cluster faces Court 21. The dwelling, Room 17, was entered through the roof, for no doorway is present. The interior of the room is smoke-blackened. Rooms 16 and 18 were originally entered by means of a roof hatch. The roofs of all three rooms in this cluster are missing.

Kiva(?) 19

This somewhat enigmatic subterranean chamber was cleared by Cummings, but has since filled up again with his back dirt and scale from the ceiling of the cave. Few constructional details can now be observed. The upper two feet of the walls are of standard Kayenta masonry. A different type of construction that characterizes the lower walls of the chamber is obscured by a smoke-blackened coat of plaster. A sealed opening of some sort is situated in the east wall. The base of this opening is covered with fill; the top is arched. Floor features cannot be observed, but Cummings describes them briefly in his field notes (Lindsay 1963b: 15). There was no deflector, but a ventilator, firepit, and rectangular pit were present. Two ridges of clay extend from the firepit to points on either side of the ventilator.

Kiva(?) 19 appears to be a composite structure. Many of its features are characteristic of the Tsegi Phase. Others, such as the lower walls and the floor ridges, are typical of earlier periods. Kiva(?) 19 was probably built on the foundations of an older structure by the Tsegi Phase people of Nagashi Bikin. Some of Cummings' statements suggest that he reached the same conclusion. He states: "Room 20 is evidently an old kiva and probably used by the later Cliff Dwellers" (Lindsay 1963b: 15). Only re-excavation will show whether this is the correct interpretation.

If Kiva(?) 19 was used during the Tsegi Phase, the question arises as to why four households would need two kivas. Two possible answers to this question exist. First, the kiva may date prior to the Tsegi Phase. However, there is no evidence for a pre-Tsegi Phase occupation that could account for the Kayenta-type masonry walls. Second, the two kivas, Kiva(?) 19 and Room 1, may not have been used simultaneously. Room 1 may have been converted to a kiva after Kiva(?) 19 fell into disuse. The latter alternative seems the more likely, but the evidence presently available does not rule out the first.

The Tsegi Phase population of Nagashi Bikin could never have been very large. The five living rooms indicate the presence of five nuclear families, which would produce a maximum population of about 25 persons.

CERAMICS

Pottery types represented in the Museum of Northern Arizona and Arizona State Museum survey collections from Nagashi Bikin are: Lino Gray, Obelisk Gray, Kana'a Gray, Tusayan Corrugated, Lino Black-on-gray, Kana'a Black-on-white, Black Mesa Black-on-white, Dogoszhi Black-on-white, Tusayan Black-on-white, Kayenta Black-on-white, Bluff Black-on-red, Deadmans Black-on-red, Tusayan Black-on-red (Dogoszhi variety), Tusayan Polychrome, and Kiet Siet Polychrome.

These pottery types indicate occupations from Basketmaker III through early Pueblo II and during the Tsegi Phase. The distribution of these types within the cave is significant. Most of the Basketmaker III sherds come from the talus at the extreme eastern end of the shelter. Most of the Pueblo I sherds are directly associated with the three pit structures in the eastern part of the cave. All the Tsegi Phase sherds come from the southwestern end of the cave in association with the Tsegi Phase structures.

TREE-RING DATA

There are 27 individual tree-ring specimens from Nagashi Bikin in the Tree-Ring Laboratory's collections. Of these, 17 were collected by Hargrave in 1933 and are in the Museum of Northern Arizona collection (F-series). Ten specimens in the Douglass Collection (NB-series) were collected during two trips that I made to Nagashi Bikin; NB-1 through NB-7 were collected in 1963, and NB-8 through NB-10 were collected in 1964.

No dates from Nagashi Bikin have previously been published. Five dates recently derived from the site are presented in Table 46. Since no dates require comment, the Remarks column is omitted from the table.

Table 46. Dated Tree-Ring Specimens
from Nagashi Bikin

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>Room 1</u>						
Secondary Beams						
Beam 6	NB-3	DF	Core	C	X	1163 -- 1218rL
Beam 9	NB-5	DF	Core	C	X	1221 -- 1276rL
Beam 11	NB-6	DF	Core	C	X	1199p -- 1268B
"Ceiling"	F-3276	DF	Wood frag.	C	X	1212p -- 1274rL
<u>Kiva(?) 19</u>						
Loose Log	F-3180	DF	Chd. Wd. sec.	C	X	503p -- 575rLG

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

The date of 575 from Kiva(?) 19 obviously does not apply to the Tsegi Phase. If the timber is genuinely associated with the kiva it must have been reused from an earlier structure. This earlier structure might be the older pithouse that was remodeled during Tsegi

Phase times. The beam itself probably was originally used in the Basketmaker III period.

The dates from Room 1 are scattered. However, under Assumption 7 (Chapter 2), the room should be dated at 1276. Beam 11 and F-3276 may be stockpiled beams or timbers left over from earlier Tsegi Phase construction activity. Beam 6 may have been reused from a pre-Tsegi Phase structure, or it may have come from a long-dead tree. Its external appearance does not differ from that of the other beams in the ceiling.

Little can be said about the total time span of the Tsegi Phase occupation at Nagashi Bikin. The date from Beam 11 in Room 1 suggests that Tsegi Phase construction was under way as early as 1268. Construction continued until at least 1276 when Room 1 was built. There are no data bearing on the date or events of the abandonment of Nagashi Bikin. As in the case of the other Tsegi Phase sites, it is inferred that Nagashi Bikin was abandoned by 1300.

CALAMITY CAVE

Calamity Cave is located near the head of the south fork of Nakai Canyon (Fig. 1). It is just over the divide between the headwaters of the Tsegi and Nakai drainages. Despite its location outside the Laguna Creek drainage, Calamity Cave is a typical Tsegi Phase cliff pueblo.

The discoverer of Calamity Cave is unknown. The site was visited by one of the Bernheimer Expedition parties, perhaps as early as 1923. Bernheimer named the ruin Wild Rose Cave for reasons that

are obvious. Cummings is reported to have partially excavated the site in 1926 (Hargrave 1935a: 38; Turner 1962: 4). Hargrave's 1933 Rainbow Bridge--Monument Valley Expedition party visited the site which they designated NA-2637. William Y. Adams surveyed Calamity Cave in 1951 as part of the Pueblo Ecology Study. The ruin was designated PE-10 in the Pueblo Ecology Study survey system.

Since I have not visited Calamity Cave, detailed descriptions of the environment and of the site cannot be given here. Hargrave's (1935a: 38-9) discussion of Calamity Cave is brief and superficial. Adams (1951: 33-9) gives a more comprehensive description that forms the basis for the following comments.

DESCRIPTION OF THE SITE

The ruin consists of 16 to 18 rooms strung single file along the back wall of the cave. An extensive and deep accumulation of trash, fallen timbers, and masonry occupies the area in front of the rooms. The size of the trash mound suggests a longer occupation of the cave than that represented by the Tsegi Phase village. Adams (1951) notes that the architectural features of the rooms are similar to those of other ruins in the same area. On the basis of the available data it is not possible to classify the rooms as to function.

Adams (1951) also reports the presence of four kivas. Two of these are circular subterranean structures. One of the circular kivas is located in front of the secular rooms and has been excavated, probably by Cummings. The other circular kiva abuts the back wall of the cave and has not been excavated. Its roof is intact, and a ladder

protrudes from the hatch. The other two kivas identified by Adams are rectangular and abut the cliff face. One is subterranean and has been excavated. The second rectangular kiva is fully above ground. It was entered by means of a hatchway in the roof which is in an excellent state of preservation. Adjoining the above-ground rectangular kiva is a U-shaped room with a jacal front wall---yet another instance of this typical Tsegi Phase pattern.

Calamity Cave has an inordinately large number of kivas for a site with a total of only 18 rooms. Two factors may account for this. First, a number of rooms along the outer margins of the cave may have been destroyed by erosion. Second, Calamity Cave may have served as a ceremonial center for people living in small household-size sites nearby.

CERAMICS

Pottery types present in the Museum of Northern Arizona survey collection from Calamity Cave are: Moencopi Corrugated, Tusayan Corrugated, Dogoszhi Black-on-white, Tusayan Black-on-white, Kayenta Black-on-white, Deadmans Black-on-red, Tusayan Black-on-red, and Tsegi Red-on-orange. With the exception of Dogoszhi Black-on-white and Deadmans Black-on-red, these types commonly occur in Tsegi Phase contexts.

TREE-RING DATA

The 25 numbered tree-ring specimens from Calamity Cave were collected by Hargrave in 1933 and are now in the Museum of Northern

Arizona collection at the Tree-Ring Laboratory. Identification of duplicate specimens reveals the presence of only 11 trees in this collection.

A single date from Calamity Cave, listed either as 1274 or 1275, has been published by McGregor (1936a: 37; 1938: 6), Gladwin (1957: 277), and Smiley (1951). Dates derived from a recent reworking of the Calamity Cave collection are presented in Table 47. The Remarks column has been omitted from the table, since none of the dates require comment.

Table 47. Dated Tree-Ring Specimens
from Calamity Cave

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>"Room 14"</u>						
"Major Beam"	F-4191	DF	1"core			1238p -- 1274v
<u>"Trash heap in front of Room 2"</u>						
"Poles"	F-3236	DF	Wood frag.	I	X	872 -- 977G
	F-3250	DF	Wood frag.			717 -- 826v

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Three dates permit little to be said about a ruin of this size. "Room 14" may have been built in 1274, although the lack of comparative

dates renders this a tentative pronouncement. The 1274 date does indicate that some construction took place at Calamity Cave in that year and agrees well with the dates from Tsegi Phase sites over the divide in Tsegi Canyon.

The two early dates are somewhat surprising, for the ceramics give no hint of such an early occupation. Hargrave's (1935a: 38) statement that the trash mound "would be a good prospect for early periods" is borne out by the tree-ring data. The early dates suggest a Pueblo I time period. The absence of early pottery types in the ceramic collections may be a result of burial under later trash and collapsed structures. Whatever the case, Calamity Cave would repay excavation, in terms of both the earlier material to be recovered and the almost unique opportunity to study a Tsegi Phase site that has not been completely cleaned out. Such a study, utilizing the most up-to-date methodology possible, is desperately needed to fill the many gaps in our knowledge of the phase. The indiscriminant excavation of every known Tsegi Phase cliff dwelling has so depleted this archaeological resource that Calamity Cave offers one of the few remaining opportunities for an intensive analysis of a well preserved cliff pueblo.

LONG HOUSE

Long House is the only dated Tsegi Phase surface pueblo. It is located on top of a large baldrock ridge in Long House Valley four miles southwest of the mouth of Tsegi Canyon (Fig. 1). The ruin can be

seen from afar and as a result has a long history of visitation and speculation.

The first recorded visit to the site was made by Captain J. G. Walker's command of mounted rifles in 1859 (Bailey 1964b: 84). The reconnaissance party camped at the site on the night of September 12. In addition to the official report of the patrol, a record of Walker's visit was left at the ruin in the form of a number of names and the date incised in the stones of the walls.

Richard Wetherill, in the records of his 1897 trip to the Marsh Pass region, mentions a site called Moqui Rock that was located north and west of Black Mesa (McNitt 1957: 160-1). The location and his description of the site fit Long House, and he probably was referring to this site. Moqui Rock figured in the bizarre incidents centered around the kidnapping of Bowles and Whitmore---the sponsors of Wetherill's 1897 trip---by a band of Indians. The two men were held prisoner at Moqui Rock for three days while a messenger journeyed to Mancos to raise several hundred dollars ransom money (McNitt 1957: 162).

Several visits to Long House in the late 19th and early 20th centuries are indicated by names and dates scratched on the walls. The next recorded visit to the site was made in 1908 by Cummings (Turner 1962: 1), who describes the site as a fort (Cummings 1910: 28-9). In 1910 Fewkes stopped briefly at the site which he designated Ruin A (Fewkes 1911: 10, Pl. 4). Kidder and Guernsey visited Long House in 1914 and excavated some burials from the trash below the site and a kiva in the alluvium nearby (Kidder and Guernsey 1919: 61-6,

Pl. 22). Since 1914 the ruin has been visited countless times but never excavated. Long House is included in the site survey systems of the Museum of Northern Arizona (NA-897), Gila Pueblo (Marsh Pass 6:8), the Arizona State Museum (Arizona D:7:5), and the Laboratory of Anthropology in Santa Fe (LA-629, LA-1056).

ENVIRONMENTAL SETTING

Long House Valley is a short north-south trending valley that lies between the head of the Klethla Valley and Marsh Pass. Its eastern boundary is formed by the terraced scarps of Black Mesa. On the west, rolling ridges of deeply fissured Navajo sandstone delimit the valley. The valley floor is formed by deep deposits of Recent alluvium.

The vegetation of Long House Valley is similar to that of the canyons. Sagebrush and grasses cover the alluvial flats, and pinyon and juniper trees dot the flanks of Black Mesa on the east and the Shonto Plateau on the west. Douglas-firs are absent, although they do grow in the shelter of nearby canyons.

The wide alluvial floor of the valley is admirably suited for agriculture. About a mile below Long House the stream has been blocked by a modern earthen dam that has had a profound effect on the valley. Below the dam an arroyo 80 feet deep wends its way northeast to join Laguna Creek in Marsh Pass. Above the dam arroyo cutting is minimal and localized. This situation provides a unique opportunity to assess the exploitative potential of this area for the Tsegi Phase people who lived here before the cutting of the Tsegi-Naha arroyo.

At present there is no flowing stream in Long House Valley. However, during summer, fall, and winter a small lake often exists just behind the dam. After heavy rains, water stands for weeks in low areas in the valley. At times like these it is easy to see how Marsh Pass got its name. The valley is one of the major Navajo farming areas in the Kayenta area. Large fields of corn germinate and mature with only a minimum of artificial watering, if any. The valley probably produced an equally abundant harvest for the Tsegi Phase farmers who utilized somewhat more advanced water control techniques than do the Navajos.

There are no springs at Long House, although there are several good ones a mile or so up Kin Biko, a small canyon that debouches into Long House Valley a few yards south of Long House. These springs may have been strong enough to produce a permanent flow in Kin Biko Creek during Tsegi Phase times. Failing this, the many large solution pits in the Navajo sandstone would have provided water for the people of Long House just as they did for the 1915 field camp of Kidder and Guernsey (1919: 74). In addition, certain techniques of water control enabled the people of Long House to supplement the natural supply of water.

DESCRIPTION OF THE SITE

The ruin of Long House occupies the summit of a relatively small baldrock knob that stands isolated from the sandstone ridges of the Shonto Plateau that rise behind it (Fig. 5 a). The ruin itself has been described in some detail by Cummings (1910: 28-9), Fewkes

(1911: 10), and Kidder and Guernsey (1919: 61-4); therefore, note is made here only of significant features not mentioned by these writers.

First, in addition to "the" Long House (Fig. 58), whose walls stand at least ten feet high, many other walls have been reduced to a low mound that covers the summit of the ridge. Some of these walls appear to be related to Long House, others do not. It is quite possible that there are two sites here, or at least one site of long occupancy with stratigraphically separable building units. This architectural evidence is supported by the long time span represented by the ceramic assemblage of the site.

The Long House itself (Fig. 59) consists of two parallel walls 90 feet long that enclose a space only ten feet wide. A doorway opens through the southeast wall. Another may have been located in an area where the wall has fallen. The walls rise to a height of about 12 feet, and beam sockets indicate a second-story floor level (Fig. 59 a). Beam stubs remain in some of the sockets, and two beams are still in place (Fig. 59 b). A few holes pierce the walls. Some of these are at floor level and were probably ventilators. Holes higher in the walls may have been designed to provide ventilation, light, a view outside, or all three. Colton's (1965: 34-5) contention that these are loopholes and implication that Long House is a historic period fort seem unlikely (Adams 1966: 89).

The masonry of Long House differs considerably from that found in Tsegi Phase cliff pueblos (Fig. 6 c). The wall stones are more massive than the tabular blocks most often associated with cliff pueblos, and mortar was much less profusely used. The walls consist

a

b

Fig. 59. General views of Long House. a, the ruin viewed from the southeast. Note the low doorway in the center. b, the northeast end of the building. Note the adobe core, the regular coursing, and the carefully squared corners of the masonry.

of a core of adobe and spalls faced with a veneer of masonry (Fig. 59 b). The corners are squared with a precision rarely found in cliff pueblo masonry (Fig. 59 b). Adams' (1966: 88) statement that the walls of Long House "are built of typical Kayenta Pueblo III masonry: roughly dressed, rather small blocks of sandstone set in heavy mortar" is inaccurate. The walls bear very little resemblance to "typical" Kayenta masonry (Fig. 6 a). Possible reasons for the use of different types of masonry in different types of site are presented in Chapter 5.

One of the most notable features of Long House is the evidence for a number of water control devices in the immediate vicinity. A series of check dams in Kin Biko and other check dams nearby such as those noted by Kidder and Guernsey (1919: 64, Pl. 23 a) are probably related to the occupation of Long House. Whether they are confined to the Tsegi Phase alone is not known. Immediately behind Long House looms a long baldrock slope which is almost completely devoid of vegetation (Fig. 5 a). Between the ridge on which Long House is located and the slope behind it is a large basin completely enclosed by Navajo sandstone ridges. During rainstorms sheets of water flow down the baldrock slope and into the basin that is drained by a narrow slot in the rock due east of and below the northeast end of Long House. In prehistoric times a dam was built across this slot to impound water in the basin behind. All that remains of this dam are a fragment of a massive cored wall on the north side of the slot and a number of footing grooves pecked into the bedrock on the opposite side. Thus, the inhabitants of Long House had a sizable

reservoir from which to draw water. A row of bedrock mortars marks the high water mark on the north side of this reservoir. Silting of the reservoir would have been minimal, because the area from which the water came was devoid of soil.

Room classification and the identification of room clusters and other sub-village architectural units cannot be attempted at Long House without a major program of excavation. Therefore, further analyses of the site are unnecessary.

CERAMICS

A sample of pottery from Long House in the survey collections of the Arizona State Museum contains the following types: Tusayan Corrugated, Black Mesa Black-on-white, Sosi Black-on-white, Dogoszhi Black-on-white, Flagstaff Black-on-white, Tusayan Black-on-white, Betatakin Black-on-white, Kayenta Black-on-white, Deadmans Black-on-red, Tusayan Black-on-red, Tusayan Polychrome, Kayenta Polychrome, Tsegi Orange, Tsegi Red-on-orange, and Tsegi Black-on-orange.

These types indicate occupations of the site spanning the period from about A.D. 1000 to 1300. Without excavation it is impossible to isolate architectural remains that belong to different occupations or to different time periods. Two sherds of non-Kayenta pottery represent trade from the northeast and the south. One sherd each of Mesa Verde Black-on-white and Pinedale Polychrome indicate that the trade occurred during the Tsegi Phase. Considering that Long House is located so near to Marsh Pass, the lack of more evidence for trade from an easterly direction is surprising. The scarcity of trade

wares in Tsegi Phase sites indicates that Tsegi Phase trade with other areas did not involve the importation of pottery.

TREE-RING DATA

There are 13 numbered tree-ring specimens from Long House: six in the Douglass Collection (LH-series) and seven in the Gila Pueblo collections (GP-series). The identification of duplicates shows that the 13 specimens represent only seven different trees. Ben Wetherill collected GP-547 and GP-548 at an unknown date, perhaps in 1932. Deric O'Bryan collected GP-4246 through GP-4250 in 1941. I collected LH-1 through LH-6 in 1963. Dates from Long House have not previously been published. The four dates derived in 1964 are presented in Table 48. None of the dates need comment; consequently, the Remarks column is omitted from the table.

Table 48. Dated Tree-Ring Specimens
from Long House

Provenience	Catalogue Number	Species	Form	TR	CD	Dates
<u>Beam across</u> <u>NE end</u>	LH-4	DF	Core			1201p -- 1272v
<u>Loose Logs</u>	LH-2	DF	Core	C	X	1235 -- 1273rL
	GP-4247		$\frac{1}{2}$ sec.			
	LH-5	DF	Wood	C	X	1182p -- 1274r
	LH-6		secs.			
	GP-4246					
	GP-4249					
	GP-4250					
<u>Unknown</u>	GP-4248	DF	$\frac{1}{2}$ sec.			1213p -- 1273v

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

Although only one beam is in situ, all the timbers undoubtedly came from the Long House itself rather than from some of the less well preserved rooms. Long House was built very near 1274 and is contemporaneous with population influxes in a number of the Tsegi Canyon cliff pueblos. This dating places Long House squarely in the Tsegi Phase and removes it from consideration as a possible historic period fort as suggested by Colton (1965). The dates of the other structures associated with Long House are unknown. They may or may not be contemporaneous with the large structure.

RUIN 8

Ruin 8 is a small cliff pueblo located in a short canyon that opens onto Long House Valley about a mile downstream from Long House (Fig. 1). Fewkes made the first recorded visit to the site, which he called Cliff-House B, in 1910 (Fewkes 1911: 10-12, Pl. 5). The ruin was partially excavated by the Peabody Museum Expedition of 1914 (Kidder and Guernsey 1919: 56-61).

The local environment is identical to that of Long House. Abundant farmland was available in Long House Valley below the site. A seepage zone along the back wall of the cave could have been developed to provide water for the inhabitants of the site.

DESCRIPTION OF THE SITE

Ruin 8 has been fully described by Kidder and Guernsey (1919: 56-61) and only a few salient features require comment here. The site

consists of about 13 rooms and two kivas situated near the front of a rather deep low-vaulted cave. Seepage of water throughout the fill of the cave has so weakened the walls that Kidder and Guernsey felt safe in excavating only a few of the rooms. Because not all the rooms were cleared, it is impossible to classify the chambers or to identify room clusters. It is important to note that Kidder and Guernsey (1919: 57-9) report the existence of evidence for perhaps two occupations of the cave. They noted the stratigraphic superposition of walls and were able to distinguish two different styles of masonry.

The two excavated kivas are located so near the front of the site that their outer walls have fallen away, destroying any evidence of deflectors, ventilators, and recesses. Features that were present in one or the other or both of them include firepits, isolated stone slabs set into the plaster floor, a sipapu, a bench, and rows of loom anchor loops. Both kivas were pseudo-subterranean, if not fully underground. Each has at least one straight wall as well as curved walls. Abutting Kiva 1 is a room (Room 3) with one curved side wall and a straight wall of jacal construction. This is yet another example of the common Tsegi Phase trait of a ceremonial adjunct to a kiva.

The most conspicuous feature of Ruin 8 is a three-story rectangular tower (Room 9) that rises 19 feet from the floor to the ceiling of the cave. This tower and the possible towers at Poncho House and Kiet Siel are the only such structures known from Tsegi Phase sites. The similarity of these towers to those of the Mesa Verde is obvious. Since towers are common in Mesa Verde sites and rare in

Tsegi Phase sites, it seems logical to infer that the concept of towers was borrowed by Tsegi Phase people from Mesa Verde Branch peoples. However, towers never became fully integrated into the Tsegi Phase architectural pattern.

The 13 secular rooms in Ruin 8 seem insufficient to have housed enough people to require two kivas. This situation becomes even more anomalous if the tower is considered to be a ceremonial structure. It is possible, of course, that both kivas were not used simultaneously and that the tower was a secular structure. An alternative hypothesis is that Ruin 8 was essentially a ceremonial complex associated with one of the large surface pueblos that Fewkes (1911: 11-12) reports from Long House Valley near the mouth of the canyon that contains Ruin 8. Neither of these alternatives is supported by any concrete data.

CERAMICS

No sherd collections from Ruin 8 are available. Kidder and Guernsey (1919) illustrate only three sherds from the site: two of Kayenta Black-on-white (Fig. 54 a, b) and one of Deadmans Black-on-red (Fig. 56 i). This is not much evidence on which to base conclusions, but it does suggest a full Tsegi Phase occupation as well, perhaps, as an earlier one.

TREE-RING DATA

The 36 Gila Pueblo collection specimens (GP-4298 through GP-4331) from Ruin 8 were collected by Deric O'Bryan in 1941. Five dates derived from this collection are presented in Table 49. Since

none of these were cutting dates or had terminal rings, these columns are omitted from the table.

Table 49. Dated Tree-Ring Specimens
from Ruin 8

Provenience	Catalogue Number	Species	Form	Dates	Remarks
<u>General</u>					
Surface	GP-4298	DF	Wood frag.	(1100 -- 1135v)	Tentative date
	GP-4299	PNN	Wood sec.	1190 -- 1279v	
	GP-4310	PNN	Wood frag.	1139p -- 1173vv	
	GP-4317	PNN	Chcl. frag.	1103+ -- 1197vv	Ring count to 1120
	GP-4318	DF	Wood frag.	1180 -- 1204v	

For key to headings and symbols, see Chapter 6.

ANALYSIS OF THE DATA

The lack of provenience control, cutting dates, and clustering render this assemblage of dates difficult to interpret. The scatter of dates may reflect the multiple occupations of the cave. On the other hand, it may have resulted from the use of dead wood for construction. The 1279 date undoubtedly relates to the Tsegi Phase occupation of the cave, but it cannot be associated with any particular structure.

SUMMARY

The data from the 11 Tsegi Phase sites discussed in this chapter supplement and amplify the much more detailed data from Betatakin and Kiet Siel. Although there are many minor differences and local variations, all the sites conform to the general pattern that characterizes the Tsegi Phase. This pattern is manifested in settlement pattern, architecture, ceramics, population dynamics, and inferred aspects of the social organization. The analyses of the tree-ring dates from each site have revealed that all 13 sites conform to a tight chronological pattern that also is typical of the Tsegi Phase.

In the next chapter the data from all the sites are drawn together and compared to produce a culture-historical synthesis of the Tsegi Phase.

CHAPTER 10. COMPARISONS AND CONCLUSIONS

Archaeological and chronological data on 13 Tsegi Phase sites located in the area of Tsegi Canyon in northeastern Arizona (Fig. 1) have been presented in the preceding chapters. The purpose of this chapter is to combine, compare, and synthesize these data into a comprehensive characterization of the Tsegi Phase. The primary objective is a better understanding of the processes that operated to produce and maintain the culture of the people who left behind them the assemblage of material remains that constitute the Tsegi Phase. The nature of the goal requires a level of analysis above the plane of the material items that comprise the data upon which the definition of the Tsegi Phase is built. The basic units of this analysis are abstractions based on these data, inference about social structure, behavioral patterns, and the interaction of Tsegi Phase man with his environment.

Secondary objectives include assessments of the implications of the preceding analyses for the archaeology of the Tsegi Phase and the Kayenta Branch, for the archaeological interpretation of tree-ring dates, for the concept of phase, and for culture-historical interpretation of archaeological and dendrochronological data.

In order to accomplish these objectives in the most economical manner, the chapter is divided into several sections. The first of these consists of a summary of the work and a brief consideration of the conclusions that were drawn on the basis of the data from the

individual sites. The second section includes inter-site comparisons designed to isolate differences and similarities in the chronological development of the several villages. A third section combines the different types of data from all the sites in an interpretive history of the Tsegi Phase. Finally, the theoretical implications of the results of the analyses are explored.

SUMMARIES

Analysis of 386 dated tree-ring specimens from 13 Tsegi Phase sites has produced a considerable body of detailed chronological information relevant to each site and to the phase. Each of the sites is placed against the scale of absolute time---a procedure that permits them to be compared on the basis of absolute rather than classificatory contemporaneity. Intensive analyses of 299 dates coupled with detailed architectural studies at the major sites of Betatakin and Kiet Siel yield much more than just chronological information. Precise provenience controls and the large number of dates from each site permits refined analyses of intra-site chronological relationships, which in turn provide the basis for a number of inferences about nonmaterial aspects of culture such as social units, social organization, leadership structure, village integration, and village homogeneity. Analyses of certain aspects of 533 undated and the 299 dated specimens from Betatakin and Kiet Siel are relevant to a variety of non-chronological problems. These problems are divided into two types: those concerned with the prehistoric environment and those of a cultural-historical nature.

CHRONOLOGICAL RESULTS

Thirteen Tsegi Phase sites are absolutely dated in terms of the Christian calendar. The quality of the dating varies with the nature of the sample. Betatakin, Kiet Siel, Scaffold House, and Twin Caves Pueblo are well dated because the sample of dated specimens is large in relation to the size of the site. By the same token, Betatakin and Kiet Siel are the most securely dated of the four, because the samples from these two sites are larger and better controlled. The dating of the nine other sites is less secure because the samples are less adequate. Despite the inadequacies of the latter group of sites, all 13 form a tight chronological package that falls between 1250 and 1286.

Comprehensive and finely controlled samples from Betatakin and Kiet Siel permit the identification of extremely short-range intra-site chronological relationships. The dating of individual chambers and room clusters not only reveals sequences of construction, but also the interval at which various structural units were added. Thus, the nature and rate of growth of each village can be reconstructed with some degree of confidence. The spatial and temporal relationships of the various intra-site structural units provide the basis for a number of inferences about population growth, localized and nonlocalized sub-village social units, and the social nature of the village as a functioning community. The internal chronological relationships also provide clues to the nature and rate of the processes by which the villages were founded, populated,

and abandoned. In addition, a number of important events in the history of each village are revealed.

ENVIRONMENTAL SUMMARY

The chief basis for environmental inferences is the change in the distribution of tree species through time. Comparisons of the tree species assemblages at Betatakin and Kiet Siel with the species growing locally today show that the local environment of Betatakin has not changed since 1300, while that of Kiet Siel has changed considerably. Differential susceptibility of the local water tables to the cycles of erosion and deposition in the Laguna Creek drainage best explain the observed differences.

The distribution of tree species relative to the years in which trees were cut at Kiet Siel reveals a marked environmental change in prehistoric times. These data indicate a progressive deforestation of the area as trees were cut for constructional purposes. In order, the aspen, Douglas-fir, juniper, and white fir populations were decimated as the prehistoric builders were forced to exploit species that grew in increasingly inaccessible sites.

SUMMARY OF CULTURAL-HISTORICAL INFERENCES

Data derived from the analysis of dated and undated tree-ring specimens from Kiet Siel and Betatakin serve as the basis for inferences about a number of cultural practices. One such practice was the use of certain species of tree for particular constructional tasks. The people of Betatakin preferred to use pinyon for vertical posts, while Douglas-fir and aspen were favored as roofing beams.

Related to this is the preferential selection of certain species to the detriment of others. The people of Betatakin went to no little extra effort to procure Douglas-fir timbers in preference to more accessible aspens.

The wholesale stockpiling of timbers for later use is recognized at Betatakin. In this case a small group of people felled a number of trees to be used several years later by a large group of new arrivals. In addition to being felled and transported into the cave for storage, the trees were cut into two standardized lengths: one for primary beams and one for secondary beams.

The Betatakin data also contribute to an assessment of tree-cutting activities at the site. Analysis of the terminal rings on specimens of tree species with known growing seasons indicate that tree cutting at Betatakin was seasonally patterned. Most of the trees, no matter in what year they were felled, were cut in the late summer. Comparatively few trees were cut at other times of the year. The large number of trees cut in a short period of time suggests that tree felling was a communal affair rather than something that was normally undertaken by a single household. The Kiet Siet data exhibit no such patterning. Presumably, trees were cut by individual households or by small groups of households at any time of the year that construction timbers were needed.

Two practices indicated by the clustering of dates are the reuse of building timbers from older structures and the use of long-dead trees for constructional purposes. The identification of reused timbers at Betatakin indicates the former presence of structures that

were completely destroyed by the construction of the post-1267 village. Reused beams at Kiet Siel help assign approximate dates to pre-Tsegi Phase occupations of the cave. At Kiet Siel and at Twin Caves Pueblo long splinters of wood, broken rather than cut with stone axes, date 100 to 150 years earlier than the site itself. The inference that these splints were torn off half-rotten deadfalls is supported by the presence today in the canyons of logs that died as long as 350 years ago.

SOCIO-CULTURAL INFERENCES

The combined use of architectural data, the several types of tree-ring data, and the reconstructed histories of Betatakin and Kiet Siel lead to a number of inferences about nonmaterial aspects of the culture of the Tsegi Phase people. These inferences are summarized below. I want to stress that they are offered as hypotheses for further testing and not as final conclusions. Although the inferences are founded in the data, the data are not always complete enough to permit alternative hypotheses to be conclusively rejected. I doubt that information now in hand is adequate to permit rigorous testing of the hypotheses. Only additional problem-oriented excavation and analysis will provide the necessary information.

Processes of Village Growth

Concrete evidence for two different types of village population growth may be perceived in the data from Betatakin and Kiet Siel. Although both types of growth may logically be inferred for any fairly large archaeological site, only rarely can they be distinguished with

the clarity afforded by the Tsegi Phase data. The two processes involved are, of course, immigration and natural increase.

Several examples of population growth caused by immigration are evident in the Tsegi data. The most obvious of these are the immigrations that resulted in the founding of the villages. Such immigrations took place about 1250 at Kiet Siel, in 1267 at Betatakin, and in 1272 at Twin Caves Pueblo. Later immigrations into established villages can also be identified. Such influxes of population occurred in 1272-75 and 1283-86 at Kiet Siel and in 1275-77 at Betatakin. Immigrations of two different types are recognized. Some, such as the one that established Betatakin, involved the movement of previously existing communities. Others involved the apparently independent movement of single households in and out of villages. The latter type characterized the history of Kiet Siel.

The second process of village growth, natural increase, cannot be directly observed in the archaeological data. However, it is implied by the creation of new nuclear families by marriage---an event which can often be recognized in the archaeological data. For example, the addition of a new living room to a room cluster or the conversion of one of a cluster's storage chambers into a dwelling often indicates the addition of a new family to the household group. Many instances of this type of situation occur at Betatakin and Kiet Siel.

The population decline that resulted in the abandonment of Tsegi Canyon involved the reverse of one or both of the processes that caused the villages to grow. Evidence relative to this problem is limited. Kiet Siel underwent a gradual decline in population as

individual households drifted away. Although there is no concrete supporting evidence, it may be inferred that the abandonment of Betatakin, like its founding, was an orderly planned action involving the community as a whole. An adverse birth to death ratio also may have been involved in the depopulation of the Tsegi. However, the evidence presently available does not permit the positive identification of the effects of this particular factor.

The Social Organization of Tsegi Phase Villages

The combined use of many different lines of evidence permits an inferential reconstruction of some aspects of the social organization of the Tsegi Phase villages. The types of data that contribute to this reconstruction include: settlement pattern, architectural forms, relationships among different types of structures, the reconstructed village histories of Kiet Siel and Betatakin, intra-site chronological relationships, and analogy with the social organization of the modern descendants of the Kayenta peoples---the Hopis. The social organization of the Tsegi Phase villages as reconstructed here is quite similar to that of the Hopis, as described by Eggan (1950). That this reconstruction at least approximates reality is indicated by the following known similarities and relationships between the Kayenta peoples and the Hopis: the internal arrangement and structural relationships of Kayenta and Hopi villages are quite similar; the two groups are known to be historically and culturally related; given the known relationships between the two groups, similar social adaptations might be expected to develop from similar situations.

The basic structural unit of the Tsegi Phase village was the matrilocal extended household, which, as the only localized sub-village social unit, occupied a room cluster. The larger sites generally grew by the accretion of households rather than larger social units. The household was at least a semi-independent unit that came and went without reference to the actions of other such units. The semi-independent households were probably grouped into matrilineal lineages and perhaps clans, neither of which were localized within the village. The freedom of the household to move from one village to another made it impossible for lineages or clans to maintain any degree of localization, since their composition at any one village changed relatively rapidly. The development of nonlocalized lineage and clan organization probably came about in response to the unstable population conditions and the concomitant necessity to integrate into the total village organization newly arrived households that had no previously defined structural position in the village (Eggan 1950: 129-30).

By itself, lineage and clan organizations would tend to fragment rather than unify the village. It is probable that, as among the Hopis, other organizational principles crosscut those of lineage and clan to provide village-wide integration. Considerable evidence ranging from communal structures to inferred communal activities indicates that the people of a village were organized to the extent that they could be mobilized and their activities coordinated to further community projects. The spatial distribution within the villages of kivas and their association with other structures suggest that the kivas were community rather than

sub-village facilities. The kivas may have been associated with lineages and clans as they are among the Hopis. However, it seems likely that at this stage of Kayenta Branch development ceremonial units whose membership crosscut that of the kinship units served to bind the village together in a system of overlapping ceremonial rights and obligations deemed necessary to the well-being of the community as a whole. The absence of great kivas and evidence for a pan-village religious unit such as the Katsina cult argues against the hypothesis that each village was integrated by an overall ceremonial organization.

The foregoing discussion suggests that the typical Hopi type of village organization had evolved or was in the process of evolving at least 50 years earlier than the date postulated by Eggan (1950: 129-30). The Tsegi Phase data indicate that this was the case in the Tsegi Canyon-Marsh Pass area. The related problems of whether these developments occurred at the same time and in the same way in the Hopi Mesa and Navajo Mountain centers of Kayenta population offer intriguing possibilities for research.

Inter-Village Integration

There is no evidence for the existence of formal social ties joining two or more villages into a larger unit. There are no great kivas, no structural or spatial relationships among sites, and no apparent inter-village cooperation. Although the inhabitants of some of the smaller sites may have been integrated into the social and ceremonial life of larger villages nearby, this situation does not

constitute a formal relationship between two independent villages. Despite the lack of formal structural relationships, the Tsegi Phase villages were undoubtedly linked in a network of informal ties based on trade, interpersonal relations, intermarriage, and contiguity. The canyon itself would have channeled communication in such a way that the villages would be in more intimate contact with each other than with settlements outside the canyons. The villages of Tsegi Canyon probably constituted a loosely defined "community" based on a relatively high frequency of interaction among the inhabitants of the villages.

INTER-SITE CHRONOLOGICAL COMPARISONS

The distribution of dates from each of the 13 dated sites (Fig. 60) clearly shows that all these sites were constructed between 1250 and 1286. The few undated Tsegi Phase sites were undoubtedly built at this time also. This situation reflects a substantial population increase in a relatively short span of only 36 years. Some of the dynamics of this increase are revealed by a consideration of the internal development of individual villages.

The reconstructed histories of Kiet Siel and Betatakin suggest the hypothetical population curves presented in Figure 61. Two significant similarities characterize these curves. The first is the sharp increases in the number of inhabitants caused by immigration in the 1270's---a time at which most of the other villages were begun. Thus, a major population increment throughout the Tsegi in the period between 1270 and 1280 is indicated. Indeed, the majority of the Tsegi Phase inhabitants of the canyon did not arrive until after 1270.

Fig. 60. Ranges and distribution of tree-ring dates from the 13 Tsegi Phase sites. Horizontal lines indicate the range of outside dates; vertical lines represent single outside dates; heavy vertical bars indicate significant clusters of dates. Dates that fall earlier than 1200 are omitted from the chart.

Fig. 61. Inferred population trends through time at Betatakin and Kiet Siel. Open circles indicate the points at which definite estimates of maximum population could be made. Solid lines connect the points at which definite estimates were made and represent estimates of the population trends. Dashed lines indicate inferred population trends projected beyond the points of population estimation.

The second important similarity between the two population curves is that both villages reached their population peaks simultaneously---sometime between 1280 and 1287. While the evidence from the other sites is not conclusive, it favors the inference that the number of Tsegi Phase people resident in the canyon reached a peak around 1285. An estimate of the maximum Tsegi Phase population may be achieved by adding the figures inferred for the ten sites that lie within the canyon. This procedure yields a maximum figure of 555 persons. Most of the undated Tsegi Phase sites not considered in this report are small and in combination probably sheltered no more than 150 people. Therefore, the maximum Tsegi Phase population of the canyon probably did not exceed 700 persons.

The withdrawal of the Tsegi Phase population from the canyon cannot be so reliably dated as the events that accompanied the buildup of population between 1250 and 1286. The tree-ring dates indicate only that construction activity ceased after 1286 and contribute nothing to an attempt to reconstruct or date the events associated with the abandonment of the region. Ceramic data indicate that the withdrawal from the canyon was well under way if not already accomplished by 1300.

Although the Tsegi Phase villages are inferred to have been politically and socially independent of one another, the population data indicate that many events in the histories of the several villages were related. For example, the population influx of the 1270's affected nearly all the villages. In addition, the majority of the villages appear to have achieved their population maxima

simultaneously. Thus, the movement of people into the various villages appears to have taken place as a single event or a related series of events. In the absence of formal structural relationships among the groups of people involved, some sort of external controlling factor or factors must have caused these independent social units to behave in the same way. A number of possible causal factors come to mind. Climatic changes, environmental conditions, population pressures, and attacks by enemies are but a few of these.

THE HISTORY OF THE TSEGI PHASE OCCUPATION OF TSEGI CANYON

Although Tsegi Canyon was continuously occupied from Basket-maker II through Pueblo III times (about A.D. 1 to 1300), it was only sparsely populated just prior to the beginning of the Tsegi Phase (Colton 1939: 50; Beals, Brainerd, and Smith 1945: 19, Table 1). Between 1200 and 1250 the Kayenta population resident in the vicinity of Tsegi Canyon was concentrated in the broader valleys to the east and west. The Klethla Valley, Laguna Creek Valley, Long House Valley, and Monument Valley possess a number of sites, large and small, that date to this period. The existence of only a few small sites in the Tsegi itself indicates the relative scarcity of people at this time.

Around 1250, or perhaps a few years before, a movement of peoples began that soon grew into a large-scale immigration into the Tsegi. Apparently, the first newcomers to augment the small resident population were transient farmers who established fields in the canyon

and lived near them during the farming season but maintained permanent residences outside the canyon. The part-time residents were soon followed by permanent inhabitants who deserted their old villages to establish new communities in the caves and rock shelters of the canyons.

The rate of immigration into the Tsegi reached a peak in the 1270's when a number of new villages were founded and many of the established ones were expanded to accommodate new arrivals. The population of the canyon continued to grow until the mid-1280's when it reached a peak of about 700 persons. In less than 40 years the number of people resident in the canyon had increased tremendously, perhaps by a factor of five, or even more. The geographical sources of these 700 people are not hard to identify. A recent archaeological survey established that Monument Valley was almost completely abandoned by 1250; the population of the Klethla Valley declined sharply after 1250; several large pre-Tsegi Phase sites in the valley of Laguna Creek were abandoned around 1250.

People were moving in droves from the broad valleys along the middle reaches of the streams into the narrow canyons nearer the heads of the drainages. Here they joined with a small resident population to found a number of villages. They located their communities with reference to permanent supplies of water, proximity to farmland, and shelter. These factors produced the typical Tsegi Phase settlement pattern of sites located near the heads of short side canyons that opened onto the main canyon in areas where the latter is widened by the confluence of one or more tributaries. In

these areas Tsegi Phase farmers could apply their agricultural technology to the best and most extensive farmland available in the narrow gorges.

About 30 years after the major immigration, the process of withdrawal was well under way, if not complete. As few as 15 to 20 years may have elapsed between the time of maximum population in 1285 and the complete abandonment of the canyons by about 1300. In not much more than 50 years nearly 700 people moved into the Tsegi, established and occupied a number of villages, and moved out again, bringing to a close more than 1000 years of Anasazi habitation in the canyon.

The late 13th century was a time of rapid social change during which the Kayenta peoples faced problems of social integration on a scale they had not previously experienced. The rapid movement of small social units from one area to another and from one village to another presented problems that, when successfully solved, produced an essentially new type of social organization that constituted a higher level of socio-cultural integration. The archaeology of the period just preceding the Tsegi Phase is too poorly known to rule out the possibility that these developments began even earlier than 1250. However, they seem to have reached a climax during the Tsegi Phase when, paradoxically, population mobility was great and larger villages than ever before existed. The hypothesis that the Tsegi Phase was a time of rapid and significant social change among the Kayenta Anasazi contradicts Jennings' (1966: 58) argument against any significant change in social organization from Pueblo II to Pueblo

III times. To be sure, the changes inferred to have taken place about 1250 did not occur at the break between Pueblo II and Pueblo III as it is traditionally defined. That these changes took place in the middle of Pueblo III times does not alter the fact that a shift from localized independent household and lineage organization to the integration of households into nonlocalized interdependent lineages and clans is a significant change in social organization. This change made possible the existence of large, reasonably stable villages among the Tsegi Phase people.

The population movements of the latter 13th century that resulted in the Tsegi Phase occupation and abandonment of the Tsegi Canyon system are but local incidents in a series of Kayenta Branch population movements that began long before 1250. During the 12th century Kayenta peoples achieved their maximum northward expansion, pushing into the canyons flanking the north bank of the San Juan River and beyond. By about 1200 expansion had given way to withdrawal as Kayenta influence and population began to contract southward, and the area north of the San Juan was abandoned. About 1250 in the Tsegi and near Navajo Mountain the Kayenta populations began concentrating in large villages such as Betatakin, Kiet Siet, Long House, Red House, and Yellow House. By 1300, in a continuation of the general trend, the large late Pueblo III communities were abandoned as the people migrated even further south to take up residence among their relatives on the Hopi Mesas.

Any explanation of the Tsegi Phase population movements in and around Tsegi Canyon must take into account the relationship of

these movements to those that came before and after, as well as the data concerning the events of 1250-1300 in the Tsegi. The sparse population of the Tsegi just prior to 1250 indicates that the canyon was less desirable for habitation than were the broader valleys of Laguna Creek, the Klethla Valley, and Long House Valley, all of which were heavily populated. The canyons were narrow and afforded much less suitable farmland than did the open valleys. Furthermore, the Tsegi was probably swampy and choked with dense stands of oaks and aspens. Large-scale clearing operations would have been necessary to ready the canyon floor for agricultural use. Clearly, the Tsegi itself was a rather marginal area for farming at the technological level of the Pueblo III Kayenta Branch people. Yet a mass immigration into this area began about 1250 and continued for 30 years. The conclusion is inescapable that some rather powerful influence caused the people to move from the broad valleys into the narrow canyons.

A number of theories have been advanced to explain the general Anasazi withdrawal from the San Juan River basin after 1300. These theories have been applied across the board to all Anasazi populations, including those of Mesa Verde, the Tsegi, Navajo Mountain, and even the Chaco---an area that was abandoned long before 1300. These explanations of the general Anasazi withdrawal from the north involve a variety of causal factors that range from climatic changes to the depredations of "enemy peoples." Before advancing my own hypothesis regarding this problem, I propose to briefly consider some of the more popular abandonment theories as they apply to the Tsegi

Phase situation. My purpose is to test each of the general theories against a specific well documented instance of abandonment in order to eliminate those that do not fit the empirical data. This procedure reverses that of Jett (1964), who tests the various abandonment theories against almost every known "migration" that took place in the Southwest after A.D. 900.

Disease is frequently mentioned as a possible factor in the abandonment of the San Juan drainage. This hypothesis is usually attributed to Harold S. Colton; however, Colton (1936; 1960: 113-14) advances disease as a cause for declines in population and not large-scale migrations. While extremely unsanitary conditions must have prevailed in the Tsegi Phase villages as they did in the historic Hopi towns (Colton 1960: 113-14), there is no concrete evidence that disease was an important causal factor in the abandonment of Tsegi Canyon. Jett's (1964: 297) general objections to the "disease theory" apply to the Tsegi situation.

A number of abandonment theories involve the idea that climatic changes adversely affected the economy of the Pueblo farmers and caused them to migrate to more favorable areas. The most well known of these theories involved the "Great Drought," which lasted from 1276 to 1299. Jett (1964: 282-5) presents a number of generalized arguments against this theory, some of which are valid for the Tsegi Canyon situation. On the basis of intensive dendrochronological investigations, Fritts, Smith, and Stokes (1965: 119-21) show that the Great Drought on Mesa Verde was neither as long nor as severe as had been supposed and that it was exceeded in intensity by several

other droughts. They conclude that the Great Drought could not have been the sole causal factor in the abandonment of Mesa Verde around 1300.

Harold C. Fritts informs me that recent comparative analysis shows that the Great Drought was longer and more severe in the Tsegi area than on Mesa Verde. Thus, a stronger case for the drought as a cause of abandonment might be made for the Tsegi. However, as pointed out in Chapter 3, the Tsegi Phase farmers probably did not rely to any great extent on rainfall, which usually is not sufficient to support dry farming. The Tsegi Phase farmer, who depended on an ample and fairly stable supply of ground water augmented by several techniques of water conservation and control, was probably not too concerned with the amount of precipitation. Recent periods of low precipitation have not appreciably affected the flow of Laguna Creek which is dependent on the ground water in the canyon. Thus, the Great Drought seems an unlikely cause for the abandonment of the canyons by the Tsegi Phase people.

One of the most popular of the abandonment theories involves the depredations committed against the peace-loving Pueblo farmers by "enemy peoples." Usually the enemies are thought to be rapacious nomads such as Navajos or Paiutes, but occasionally less peace-loving Pueblo people are thought to have been involved. The most ardent proponents of this theory are Gladwin (1957) and Jett (1964). The idea that the Tsegi Phase cliff pueblos were defensive was refuted in Chapter 5. The lack of concern for protection of the fields and the complete lack of evidence for violence at the sites argues against

warfare. The fact that many of the doorways at Kiet Siel were sealed when the village was abandoned suggests that some people may have contemplated a return. Furthermore, the events connected with the settlement of Betatakin and the gradual abandonment of Kiet Siel are incompatible with the idea that armed conflict with other people caused the people to move.

The Navajos are the principal claimants to the title of Enemy People in the Tsegi, and indeed throughout the northern Southwest (Gladwin 1957; Jett 1964: 290-5). In view of this fact, it might be prudent to examine the available data in order to establish the presence or absence of these people in the Tsegi--Marsh Pass region in the 13th century. There is no archaeological evidence whatever to place Navajos in the canyon at that time. Historical records indicate that permanent Navajo occupation of the Shonto Plateau did not begin until after 1860 and that such occupation was a result of pressure exerted by Kit Carson's 1863-64 campaign in the Canyon de Chelly area (Hill 1936: 4; Bartlett 1945: 43; Spier 1928: 95). Captain Walker, in 1859, was told by his Navajo guide that the area north and west of Black Mesa was Paiute country (Bailey 1964b: 89) and that the Tsegi itself was then occupied by a band of Paiutes (Bailey 1964b: 85). The Navajos at that time were concentrated in the Chinle Valley and farther east and south. Adams (1963: 37-9) presents ethnographic evidence indicating that permanent Navajo occupation of the Shonto Plateau took place after 1860. Navajo Land Claim tree-ring dates from areas around the Tsegi---Oljato Wash and the Navajo Mountain area---tend to cluster in the late 1800's (Stokes and Smiley 1964: 15-16). Several independent

lines of evidence indicate that the Navajos arrived in the Tsegi Canyon region nearly 600 years after its abandonment by the Tsegi Phase people. Therefore, depredations by raiding Navajos could not have caused the Pueblo emigration of 1300.

A slightly better case may be made for Paiutes as the Enemy People; at least they seem to have been present in nearby areas at the right time. Paiutes were living in the Tsegi before the arrival of the Navajos, and there is good evidence that Paiutes began moving into the western margins of the Pueblo area in Nevada and Utah as early as 1150 (Euler 1964). This date coincides with that of the beginning of the withdrawal of Kayenta people from the northern periphery of their maximum range. However, there is no evidence for the presence of Paiutes in Tsegi Canyon in the 13th century. It seems probable that Paiutes moved into the area after it had been deserted by the Kayenta Anasazi.

The remote possibility of strife with Pueblo people exists. The movement of Mesa Verde peoples up the Chinle Valley, which began about 1200, may have displaced some Kayenta peoples westward toward the Marsh Pass region. However, there is no evidence that the contact between Mesa Verde and Kayenta peoples in the Chinle was hostile, and it is not likely that these rather remote events could cause the Kayenta farmers to abandon the broad alluvial valleys for the canyons. It is doubtful that intra-Kayenta hostilities caused the abandonment of the Tsegi Canyon. The fact that the people who inhabited the several Tsegi Phase villages moved about at the same time and in the same directions indicate a lack of internal strife.

If internal conflict had caused the population movements, it is not likely that the disputing factions would have moved together. There is no evidence that victorious people stayed behind to enjoy the fruits of their supremacy over their departed neighbors.

To summarize, the evidence from Tsegi Canyon permits the rejection of disease, the Great Drought, and conflict with enemies as primary factors in the final Kayenta Anasazi withdrawal from the area. None of these factors satisfactorily accounts for the movement into the canyon in 1250 and the movement out only 50 years later.

It now remains to construct a hypothesis that explains both the colonization of the canyon and its subsequent abandonment. Rather than invoking wide-spread catastrophic causes, this hypothesis is concerned with factors known to have operated locally in the 13th century. The most important consideration here is the interaction of the culture of the people actually living in the canyon with specific environmental factors. The hypothesis owes much to Hack's and Cooley's discussions of geologic factors and Adams' (1951) analysis of some of the cultural factors.

The major environmental factor in this hypothesis is arroyo cutting---itself an old workhorse in Pueblo abandonment theories. Before arroyo cutting may be advanced as an explanation, several conditions must be met. First, it must be shown that such erosion actually occurred in the right place at the right time. Hack's (1942, 1945) and Cooley's (1962) studies show that this condition is satisfied. Second, the actual concomitants of arroyo cutting must be assessed locally, since variations in geology and topography are important in

determining the nature and effects of the erosion. Hack (1945) and Chapter 3 of this report fulfill the second requirement. Third, the agricultural practices of the people supposedly affected by the erosion must be considered. Arroyo cutting would have more disastrous consequences for certain types of agriculture than others. This aspect of the problem is analyzed in Chapter 3.

The Tsegi-Naha erosion interval that began about 1150 and culminated in a fully-developed arroyo system around 1300 undoubtedly caused significant changes in the local environment. Such changes would have profound effects on the subsistence activities of the Pueblo III Kayenta farmers. In an area of so little rainfall as the Marsh Pass--Kayenta region, sufficient ground water would have been crucial to the production of adequate crops. Even a relatively minor lowering of the water table might have drastic consequences for Pueblo agriculture. The cutting of a deep arroyo system would have just such a disastrous effect. If the arroyo cutting proceeded by headward erosion, as it probably did, fields on the lower and middle reaches of the streams would be destroyed first. As the heads of the arroyos moved upstream, more and more farming areas would be rendered useless. The logical response to this threat would be to move further upstream to areas not yet affected by the arroyos. This to me is the most logical explanation for the late influx of population into the hitherto sparsely populated Tsegi. The canyon was the last resort of the Kayenta farmers short of restructuring their subsistence base or their culture.

Taking up residence in the canyons after 1250 did not solve the predicament; it merely postponed its effects for a short while. Erosion continued, perhaps hastened by the clearing of land for farming, and the arroyos progressed upstream and into the canyons. As the erosion advanced, the water table was progressively lowered and great swaths of the alluvial floor of the canyon were gouged out. Thus, much of the farmland itself was actually removed---a factor of some importance in the narrow canyon where available land was limited in the first place. Second, and probably more important, water that could have been utilized for irrigation was removed from possible use by being lowered 50 feet or more below the level of the arable land.

The effects of such changes on the agriculture of the Tsegi Phase farmers are obvious. Large fields were no longer possible, since the techniques of irrigation or ground-water farming could not be applied to the land. Thus, although land and water were available, there was no way known to the Tsegi Phase farmers of getting the two together in quantities sufficient to produce enough food to support all the people resident in the canyon.

To successfully exploit the changed environment of the 14th century, a type of adaptation radically different from that of the Tsegi Phase would have been necessary. Large villages could no longer be supported by the agricultural techniques known to the people. For even a fraction of the population to survive in the Tsegi, the villages would have had to break up into smaller, more widely scattered units---perhaps localized lineages or even household groups.

This would have constituted a radical change in the culture of the Tsegi Phase people: different exploitative techniques would have to be developed, the size and complexity of the community would have to be reduced, social ties and relationships would be broken. In short, the social structure would have to be reconstituted on a lower level of complexity. The adaptive situation had become disfunctional relative to the social organization. Processes of social cohesion and maintenance would have operated to counteract any development toward less complexity. It is unlikely that the Tsegi Phase people would look with favor on the necessity to disrupt their lives as much as the situation required. However, if there were no alternatives, they would eventually have adapted to the new environment or perished while stubbornly trying to maintain the old order.

There was, however, an alternative. The people could leave the Tsegi and move to an area where the agricultural resources were sufficient to support their village organization. This they did, and moved south to join their cultural, if not biological, relatives on the Hopi Mesas, where the land-water relationship was much more stable than that in the Tsegi, despite the lesser rainfall (Hack 1942). Once people began leaving the Tsegi, the process of withdrawal probably reached a point at which it became self-sustaining. That is, people left just to join their relatives and friends in the south and not as a direct response to the environmental situation. In this manner, after more than 1000 years of continuous occupation, the final Pueblo abandonment of Tsegi Canyon was accomplished.

IMPLICATIONS OF THE STUDY

As is the case with most archaeological studies, the analyses reported here give rise to at least as many problems as they solve. This section includes a brief discussion of some of the problems raised by the chronological analysis of the 13 sites. The implications of the study may be divided into two categories: implications for the archaeology of the Kayenta Branch and those for archaeological method and theory.

IMPLICATIONS FOR KAYENTA BRANCH ARCHAEOLOGY

As expected, this study has an important bearing on our knowledge of chronological relationships within the Kayenta Branch. The temporal limits of the Tsegi Phase have been refined to the extent that it is perhaps the best dated unit of its kind known to archaeology. The Tsegi Phase can be limited entirely to the 50 years between 1250 and 1300. Unfortunately, the precise dating of this phase is not matched by the dating of the preceding phases of the Kayenta Branch sequence. This is a major problem that can be remedied only by additional excavation designed to establish the temporal limits and artifactual content of the earlier phases. However, a revision of the phase sequence is clearly indicated by the Tsegi data. Restricting the Tsegi Phase to the post-1250 period produces a gap of 50 years in Colton's (1939) sequence. One possible solution to this problem is an upward revision of the dates given to the phases by Colton. My impression is that further research will permit the definition of an additional phase between 1150 and

1250. This would bring the Tsegi Canyon--Marsh Pass area in line with the Navajo Mountain situation (Lindsay, Ambler, Stein, and Hobler 1966: 11-12). As yet, however, the data are insufficient to indicate which of these alternatives conforms more closely to reality.

On the basis of architectural data and the tree-ring dates, a number of inferences as to the nature of aspects of Tsegi Phase social organization are offered as hypotheses for future testing. The whole subject of late Pueblo III Kayenta Branch social organization is at present rather controversial (Jennings 1966) and deserves much more attention. A program of carefully designed and conducted problem-oriented research is necessary to elucidate these problems. Many of the hypotheses offered in this report are amenable to independent testing by analytical methods other than those used here.

The contemporaneity of the Tsegi Phase cliff dwellings and large open pueblos is established by the tree-ring dates. Much less well known are the social and cultural relationships among sites of these two distinct but coeval types. Adams (1951: 60-4) offers some interesting hypotheses concerning these relationships. Further research oriented toward this particular problem is necessary.

There were at least three centers of late Pueblo III Kayenta population: the Tsegi Canyon--Marsh Pass region, the Navajo Mountain area, and the Hopi Mesas. Each of these areas presented significantly different environmental conditions to which the Kayenta people adapted with some success. Comparative studies of the Kayenta occupation of each of these distinct areas would yield more knowledge relative to

the adaptive capabilities of Kayenta Branch culture than would the most refined analysis of only one of the areas.

The scarcity of non-Kayenta traits in Tsegi Phase sites suggests a remarkable degree of isolation from contact with people of other areas. A few sherds of trade pottery and possibly the masonry of Room 68 at Kiet Siel and the "towers" at Kiet Siel and Ruin 8 are all that may be attributed to contact with Mesa Verde people. The Mesa Verde movement into the nearby Chinle Valley must have produced some interaction among Kayenta and Mesa Verde peoples. Research in this important region is imperative to a better understanding of the relations between Mesa Verde and Kayenta peoples. An intriguing problem of external Kayenta relationships is the possible contact with the White Mountains area of central Arizona. The Tsegi Phase practice of adding a white outline to designs on polychrome pottery may have been borrowed from White Mountains area potters. Certainly the Kayenta migration to Point of Pines (Haury 1958) indicates that people of the two areas were aware of one another's existence and that they probably maintained some sort of contact (Reed 1958). The data reported here exclude Tsegi Canyon as the source area for the Kayenta immigrants at Point of Pines. Tree-ring dates show that both the Point of Pines immigration and the peak of Tsegi Phase population in the canyon occurred between 1280 and 1285. The contemporaneity of these events suggests that they both resulted from a common influence.

Perhaps the most important implication of the present study for Kayenta Branch archaeology is that our knowledge of the Tsegi Phase contrasts so sharply with our knowledge of earlier periods of

the Kayenta sequence. A basic need exists for the study of the pre-Tsegi periods within controlled geographic and chronological frames of reference. Studies of this type are available for the Navajo Mountain area as a result of the Glen Canyon Dam salvage work of the Museum of Northern Arizona. The Tsegi Canyon--Marsh Pass region has been covered in a general fashion, but knowledge of the period from 1100 to 1250 is woefully inadequate. The Hopi Mesas expression of the Kayenta development is almost completely unknown.

METHODOLOGICAL AND THEORETICAL IMPLICATIONS

The collection and analysis of the data presented in this report give rise to several thoughts concerning the methodology and theory of archaeological interpretation. For the sake of convenience, I have divided the discussion into three parts: the interpretation of tree-ring dates, the concept of the phase, and culture-historical interpretation.

The Interpretation of Archaeological Tree-Ring Dates

The analysis of the tree-ring data from Betatakin and Kiet Siel demonstrates the significance of tight provenience controls, comprehensive architectural data, and large samples. The importance of these factors is shown by Figure 62 in which the clustering of dates from Betatakin and Kiet Siel are graphed against their respective population curves. If there were no provenience controls on the individual tree-ring specimens, the inferred population curves would, of necessity, approximate the graphs of cutting dates per

Fig. 62. Comparison of the distributions of cutting dates per year with estimated population curves at Betatakin and Kiet Siel. Solid lines indicate the number of cutting dates per year; dashed lines represent inferred population trends.

year as indicative of major construction periods. This eventuality would lead to the inferences that Betatakin was founded before Kiet Siel and that there were two major increments of population---one each in 1269 and 1276. Kiet Siel, in turn, would seem to have been built largely in one operation between 1272 and 1276. Only the provenience controls on each date and the detailed architectural data available permitted the actual internal temporal relationships, as represented by the hypothetical population curves, to be perceived.

With regard to sampling, it is clear that random samples of the beams in each of the ruins would not have been adequate for the type of analyses to which the data were subjected. Only samples that include nearly 100% of the available beams permit refined analyses of the type undertaken in this study. The interpretive significance of a near 100% sample of tree-ring specimens from a single site was first demonstrated by Haury (1934) at the Canyon Creek Ruin. A striking indication of the value of a complete sample is given by a consideration of the site dating before and after the completion of the recent work. Prior to the 1962 project, 14 dates from Betatakin ranged from 1242 to 1277---an array that only approximates the true building dates of 1267 to 1286 as established by the larger sample of 159 dates. Kiet Siel was originally represented by 30 dates ranging from 1100 to 1284. Only the more adequate sample of 140 dates permitted the pre-1250 dates to be identified as reused beams or deadwood timbers and the construction period of the site to be limited to the period between 1250 and 1286. I doubt that a

statistically random sample would permit this refinement, although it might enable a closer approximation to be achieved.

Finally, I believe that the analyses of the Betatakin and Kiet Siel data support my contention that tree-ring dates from archaeological contexts are just as much a part of the archaeological data as are artifacts from the same contexts. The Betatakin and Kiet Siel dates provide strong contributory evidence for several inferences about aspects of the archaeology that are completely unrelated to chronology. As part of the total corpus of archaeological data, the tree-ring dates assume an important and useful role in nearly all facets of the interpretation of the archaeological manifestation involved, whether it be a structure, an inferred social unit, or a unique historical event.

The Phase Concept

The Tsegi Phase data provide some useful insights into the concept of the phase as a basic unit of archaeological analysis and synthesis (Olson 1962). The first such insight is that changes in material culture sufficient to permit the definition of a phase may take place within a time span as short as 50 years. While other phases have been assigned 50-year time spans, none but the Tsegi Phase is so conclusively limited to this short a period of time.

The basic contribution of the Tsegi data to the concept of phase is the conclusive demonstration that all sites assigned to a single phase, even a phase of short duration, are not necessarily contemporaneous. Kiet Siel was occupied for 17 years before Betatakin

was founded and for about 22 years before Twin Caves Pueblo and Scaffold House were begun. The tree-ring dates strongly suggest that there was a point in time, between 1275 and 1285, when all the Tsegi Phase sites were occupied simultaneously. In the absence of such evidence, however, contemporaneity would be assumed merely on the basis of the inclusion of all the sites in a single phase. There is no logical reason why this assumption should hold true in general; indeed, the evidence from the Tsegi Phase suggests that this assumption does not always apply. The problem becomes even more acute when longer phases are involved.

This consideration leads to the distinction between absolute and classificatory contemporaneity. The latter involves an assumption of time equivalence based on close similarity in archaeological content. Thus, sites assigned to the same phase are generally assumed to be contemporaneous. This assumption is most often involved in making estimates of population trends. The use of this assumption thus may lead to overestimates of aboriginal population, especially in phases of long duration. Absolute contemporaneity is generally recognized through the use of some independent dating technique such as dendrochronology. If absolute contemporaneity can be established, much more accurate population estimates may be made. The knowledge that for a period of 17 years Kiet Siel and Betatakin were only classificatorily contemporaneous enabled Anderson (1966a) to restrict his ceramic comparison of the two sites to samples that were actually coeval. Unfortunately, independent chronological controls as good as those for the Tsegi Phase are rarely available

to the archaeologist, even in the Southwest where dendrochronology has been most successful. Therefore, the archaeologist usually must operate under the assumption of classificatory contemporaneity; however, he should be aware that it is an assumption and that it may not reflect reality.

The Tsegi Phase data are relevant also to a consideration of intra-phase variability. There can be little doubt that the sites considered in this report belong to a single phase; nevertheless, they exhibit considerable variation. Constructional techniques, masonry styles, and domestic and ceremonial architectural forms vary greatly from site to site and even within single sites. The results of the present study provide a chronological framework for carefully controlled analyses of intra-phase variability. Examples of the possibilities of this type of analysis are Anderson's (1966a) detection of a significant difference in the plainware ceramic components of absolutely contemporaneous levels in the Kiet Siel and Betatakin trash deposits and my inferences as to the social differences between the two sites. These examples are mere beginnings to more refined analysis of intra-phase cultural variability and the archaeological study of minute cultural changes and the processes that produce them.

Culture-Historical Interpretation

Some aspects of the significance of the present study for the methodology of culture-historical interpretation have already been discussed and need only be briefly recalled here. The value of refined site chronologies and detailed dated histories of single sites for

culture-historical interpretation has been amply demonstrated. Data of this type led to inferences about the social organization of the inhabitants of the sites, the population dynamics of some of the villages, and even the nature of the unidentified village from which the founders of Betatakin came. The value of these hypotheses for structuring future research is obvious.

Perhaps the major theoretical contribution of this report is the indication of the magnitude of changes that can occur in a short span of time. Betatakin, a relatively large village, was founded, peopled, and abandoned within a period of only 33 years. The history of Kiet Siel, an even larger village, spanned only 50 years. Some sites, such as Scaffold House, appear to have been occupied for 25 years or less. Indeed, the entire Tsegi Phase occupation of the canyon, which involved the immigration and subsequent emigration of about 700 persons, took only 50 years. Significant changes that took even less time were noted. At Kiet Siel the household that occupied Room Cluster 9 converted a granary into a living room, began construction of a new dwelling, gave up, and left the village, all within a span of four years. Anderson (1966a) documents a significant change in the composition of the Tsegi Phase ceramic component at Kiet Siel that apparently took place within a period of less than five years.

The recognition of significant short-term changes as noted above has significance for two aspects of culture-historical interpretation. First, it shows that the Kayenta Anasazi were considerably more mobile than might be expected for a "sedentary" agricultural people. The latter half of the 13th century was characterized by the

rapid movement of large numbers of people. Despite the state of flux, there was no detectable breakdown in Kayenta culture. Ceramic artistry reached a peak and there is no evidence for a decline in nonceramic material culture. Community size reached a maximum as, without apparent difficulty, large numbers of relatively mobile independent households were successfully integrated into the social systems of the villages. Obviously, Tsegi Phase society was geared to a relatively mobile way of life. The people involved had few compunctions about abandoning one village or area for another. This situation contradicts the usual assumption that Anasazi populations were rigidly structured sedentary units rooted in one spot until forced by dire circumstances to move---an assumption based on the historic stability of the Pueblo populations. The present sedentism of the Pueblo people is an artificial situation; they have been fixed in the villages they now occupy by the encroachment of European civilization rather than by choice. Numerous population movements among Puebloan people are recorded for the early historic period. The unwarranted assumption of almost absolute sedentism underlies much of the controversy concerning prehistoric "migrations" in the Southwest.

The second important implication of the short-term changes recognized in the Tsegi Phase data concerns the often-made assumption that short-lived single-component sites are culturally homogeneous throughout the span of occupation. This assumption is related to the problems of classificatory contemporaneity and intra-phase variation, although it is usually concerned with a single site. Anderson's ceramic data from Kiet Siel clearly demonstrate that this assumption is not

universally valid. Therefore, the applicability of the assumption must be thoroughly tested before it is used as a basis for the inference that observed intra-site differences in the distribution of archaeological features are not due to change through time. Even small sites occupied for only a few years may exhibit considerable change from the beginning of occupation to the end.

To conclude, the primary goal of this paper has been to demonstrate the utility of detailed dendrochronological data for archaeological interpretation. A number of hypotheses relative to this goal were advanced in Chapter 2. The analysis of tree-ring dates and architectural data from 13 Tsegi Phase sites was designed to test a number of the hypotheses. The results permit the conclusion that in large measure the goal of this undertaking has been attained.

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NAKAI CREEK

OLJATO WASH

EL CAPITAN WASH

FIGURE 1

NORTHEASTERN ARIZONA
and
THE TSEGI CANYON REGION

GALLERY LEDGE

GALLERY

GALLERY

FIGURE 16

BETATAKIN

NA-2515; ARIZONA D:6:7

FLOOR PLAN AND SECTIONS

- = first story
- ▨ = second stor
- = first story
- ▤ = second stor
- ▥ = jacal wall
- ⬢ = loom anchor
-))) = steps pecke
- f = firepit
- d = deflector
- e = entrybox
- v = vent
- h = hole
- n = niche
- m = melate bins
- s = shelf
- b = bench
- p = entrance ple
- w = windows
- L = Living Room
- C = Courtyard
- G = Granary
- S = Storeroom
- M = Grinding Ro
- ? = Function Un
- K = Kiva

16
KIN
ONA D:6:7
D SECTIONS

- = first story sealed doorway
- = second story sealed doorway
- = first story doorway
- = second story doorway
- = jacal wall
- = loom anchor
- = steps pecked into bedrock
- f = firepit
- d = deflector
- e = entrybox
- v = vent
- h = hole
- n = niche
- m = matote bins
- s = shelf
- b = bench
- p = entrance platform
- w = windows

L = Living Room
C = Courtyard
G = Granary
S = Storeroom
M = Grinding Room
? = Function Unknown
K = Kiva

30 40 FEET
9 12 METERS

UPPER LEVEL

LOWER LEVEL

FIGURE 23

KIET SIEL

NA-2519; ARIZONA D:3:1

FLOOR PLAN AND SECTIONS

- = first stor
- ▨ = second s
- ▧ = first stor
- ▩ = second s
- = jacal wa
- = post
- ◐ = loom an
- f = firepit
- d = deflector
- e = entrybox
- v = vent
- h = hole
- n = niche
- m = metate
- s = shelf
- b = bench
- L = Living R
- C = Courtyar
- G = Granary
- S = Storeroo
- M = Grinding
- ? = Function
- K = Kiva

- = first story sealed doorway
- ▣ = second story sealed doorway
- = first story doorway
- ▢ = second story doorway
- = jacal wall
- = post
- ⊕ = loom anchor
- f = firepit
- d = deflector
- e = entrybox
- v = vent
- h = hole
- n = niche
- m = metate bin
- s = shelf
- b = bench

- L = Living Room
- C = Courtyard
- G = Granary
- S = Storeroom
- M = Grinding Room
- ? = Function Unknown
- K = Kiva

23

EL

DNA D:3:1

SECTIONS

24 36 FEET
METERS