

ARCHAEOLOGICAL STUDIES
IN THE
PETRIFIED FOREST
NATIONAL MONUMENT



By
FRED WENDORF

With Sections by
KATE PECK KENT
EARL. H. MORRIS
ANNA O. SHEPARD

MUSEUM OF NORTHERN ARIZONA

Bulletin 27



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DEDICATED
TO THE MEMORY
OF
KIRK BRYAN

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FOREWORD

For many years archaeological field work carried on by members of the staff and associates of the Museum of Northern Arizona has centered about Flagstaff. A couple of hundred miles away other institutions have worked, studying many areas. All of these projects have had points of contact with our own, the interpretation of which were not clear, so, with the opportunity to explore the earlier ceramic levels in an intermediate area, the Petrified Forest, the Museum staff felt it was important to sponsor the work.

The field work was made possible by grants from the Viking Fund, now the Wenner-Gren Foundation of Anthropological Research, the Colt Archaeological Institute and a modest donor who wished to have his name withheld. Acknowledgment must also be made to the Petrified Forest National Monument Association for generously subsidizing the publication of this work.

We were fortunate in having Dr. Fred Wendorf lead the expedition who was ably assisted by his wife Nancy. Camp in the Petrified Forest, a part of the Painted Desert, is not a summer resort that one would choose. The young people who made this work a success demand our thanks for their fortitude in withstanding the rigors of a summer desert climate.

HAROLD S. COLTON

September 23, 1953

ACKNOWLEDGMENTS

MY FIRST experience with archaeological materials from the Petrified Forest was in the summer of 1947 when I was a student classifying Southwestern ceramics at the Museum of Northern Arizona. Dr. H. S. Colton, director of the Museum, suggested that I might begin my studies by working with a survey collection which the Museum had recently acquired from the National Park Service. This survey collection had been made by the Park Service personnel from sites in the Petrified Forest National Monument. My subsequent analysis of a portion of this material indicated that this area offered interesting possibilities for the study of early Southwestern ceramics, a prediction which was later borne out by our excavations. It was not, however, until two years later, during the summer of 1949, that we were able to secure the necessary funds and begin what was to be the first of two seasons' research in this area.

The success of this venture was assured by the aid and cooperation which we received from many individuals and institutions. I wish, first of all, to express my gratitude to Dr. Colton for his guidance throughout the project. Katharine Bartlett, also of the Museum of Northern Arizona, assisted in the solution of many of the problems connected with the preparation of this report. I have also had the benefit of council from J. O. Brew, E. N. Ferdon, Erik Reed, Albert Schroeder, Anna O. Shepard, Watson Smith, Stanley Stubbs, and Gordon R. Willey. In addition to their advice, all of the above further assisted by reading and criticizing parts of the manuscript. Brew, Smith, and Willey were my thesis advisors at the Department of Anthropology, Harvard University, where this report was submitted in partial fulfillment for the degree of Doctor of Philosophy.

Emil W. Haury arranged for the soil samples collected at the Flattop Site to be analyzed by Dr. T. F. Buehrer, Head, Department of Agricultural Chemistry and Soils, University of Arizona.

Milton Wetherill, Research Assistant, Museum of Northern Arizona, identified the faunal remains recovered in our excavation.

I should also like to express our thanks to the National Park Service for granting us permission to conduct our excavations. The friendly helpfulness of Superintendent Whitcraft, Naturalist Broderick and the other Park Service personnel greatly facilitated our work.

Financial support for the first season's work was received from the Wenner-Gren Foundation for Anthropological Studies (then Viking Fund, Inc.) and the Colt Archaeological Institute. The second season was made possible by a grant from a private donor who wishes to remain anonymous.

The Laboratory of Anthropology, through Stanley Stubbs, lent us the field equipment used during the first season.

Students, recruited from several universities, provided the majority of the labor. I wish to gratefully acknowledge my debt to them for, despite the often disagreeable heat and winds in which they had to work, all performed their assigned tasks both cheerfully and well.

1949 Season

Alice Dewey
Ralph Emerson
Elizabeth Tooker
Clair M. Williams
Nina Williams

1950 Season

William A. Bullard	Connie Peck
Jane Goodale	Robert Tanner
Charles Kellogg	Patricia Wheat
Donald Maynard	Richard Harris (Cook)
Lynn Pease	

My wife, Nancy Wendorf, was a member of both expeditions, the first season as cook. During the preparation of this report she served as an artist, valuable critic, and typist. Figures 33-42, 66, 80-82, 85-89 are her drawings. With the exception of Figure 4, which was drawn by Norton Allen, the remainder of the text figures were drawn by myself.

FRED WENDORF

CHAPTER I

INTRODUCTORY SECTIONS

THE Petrified Forest National Monument, because of its extensive areas of fantastically eroded badlands and the absence of permanent water, would seem a most unlikely area in which to find large numbers of pre-historic ruins. Despite this seemingly uninviting environment, however, over three hundred ruins of all sizes have been located within the Monument boundaries. The importance of the Petrified Forest has long been recognized by those studying the archaeology of the Southwest. Fewkes (1904), Hough (1902, 1903), and Mera (1934) made surveys of the area and conducted excavations. For the most part these studies were concerned with the later ruins found within the Monument. They disclosed that the latest ruins were abandoned around 1500 A.D. and that the area was unoccupied by the time of the Spanish *Entrada* in 1540. The late pueblos were large, located near permanent water, and were usually defensively built around a plaza. Earlier pueblos were smaller and more likely to be located near less dependable water. It seems probable that the large, late pueblos represent concentrations of the people from several of the smaller ruins in that area. This concentration of population into larger communities was not an isolated development, since a similar sequence has been demonstrated for many other areas in the Southwest. Its cause, whether it be environmental, sociological, political, or a combination of these factors, remains undetermined.

Although there remains much to be learned about the archaeology of the later pueblos in the Petrified Forest, our interests were primarily with the earlier horizons, especially the period just after pottery was first introduced to this area. Preliminary surveys had indicated that here were to be found many very early ceramic sites, the archaeology and relative chronology of which were unknown. Furthermore, the Petrified Forest was situated near an area where two different groups shared a common "frontier." We had an opportunity to observe at close range the effects these two cultures had on each other.

For purposes of grouping and comparing this complex data with material from adjacent areas we have utilized several classificatory systems. A discussion of these classifications will aid the reader in fully understanding these terms and their meanings as used here.

In 1927 an informal gathering of archaeologists met at the camp of Dr. A. V. Kidder near Pecos, New Mexico to, among other purposes, "lay foundations for a unified system of nomenclature" (Kidder, 1927, p. 555). The result of this conference was the now-famous Pecos Classification. As finally agreed upon by the majority of the participants of this conference, the Pecos Classification was as follows (Kidder, 1927, pp. 557-558):

Basket Maker I, or Early Basket Maker—a postulated (and perhaps recently discovered) stage, pre-agricultural, yet adumbrating later developments.

Basket Maker II, or Basket Maker—the agricultural, atlatl-using, non-pottery-making stage, as described in many publications.

Late Basket Maker, Basket Maker III, or Post-Basket Maker—the pit or slab-house-building, pottery-making stage (the three Basket Maker stages were characterized by a long-headed population, which did not practice skull-deformation).

Pueblo I, or Proto-Pueblo—the first stage during which cranial deformation was practiced, vessel neck corrugation was introduced, and villages composed of rectangular living-rooms of true masonry were developed (it was generally agreed that the term pre-Pueblo, hitherto sometimes applied to this period, should be discontinued).

Pueblo II—the stage marked by widespread geographical extension of life in small villages; corrugation often of elaborate technique, extended over the whole surface of cooking vessels.

Pueblo III, or Great Period—the stage of large communities, great development of the arts, and growth of intensive local specialization.

Pueblo IV, or Proto-Historic—the stage characterized by contraction of area occupied; by the gradual disappearance of corrugated wares; and, in general, by decline from the preceding cultural peak.

Pueblo V or Historic—the period from 1600 A.D. to the present.

It was believed that while agriculture and ceramics were introduced into the Southwest from the south, the development of the culture was essentially autochthonous (Kidder, 1927, p. 555).

The conferees viewed the Southwest as a cultural unit and it was intended that the classification define overall "stages" in the developmental sequence for the whole area. While chronology is implicit these designations applied ". . . to the complex and not to a single element or series of years." (Roberts, 1935, p. 33.)

Not all of those then working in the area found the system entirely satisfactory. Roberts (1935, p. 21) noted the following criticisms as particularly outstanding:

. . . that the use of a numerical system has too definitely fixed a time element for the whole province; that it implies a cultural homogeneity in all districts; that too great reliance is placed upon pottery; that there is no need for Basket Maker I; that the various terms are not sufficiently defined; that the assumption that all elements in the complex, except agriculture and the idea of pottery making, were independent local developments is open to question.

Roberts, one of the firm supporters of the Pecos Classification, attempted to reconcile some of these criticisms of the system by offering more specific definition of the Periods and revising the terminology to avoid the numerical terms applied to these Periods (1935, p. 32).

<i>Pecos</i>	<i>Roberts</i>
Basket Maker I	Omitted
Basket Maker II	Basket Maker
Basket Maker III	Modified Basket Maker
Pueblo I	
Pueblo II	Developmental Pueblo
Pueblo III	Great Pueblo
Pueblo IV	Regressive Pueblo
Pueblo V	Historic Pueblo

As noted above, the Pecos Classification as originally established was intended to apply over the entire Southwest, but it soon became apparent that the Periods, *as defined at Pecos*, did not express the varying sequential developments in many local areas. In fact, the defined periods were applicable only to that group which are now generally termed the Anasazi (Reed, 1942). The explanation for this situation lies in the absence of chronological studies in other areas at the time of the conference. Soon afterwards, however, the Gladwins (1929) began their investigations in the Gila Basin of Southern Arizona where a strikingly different cultural pattern had developed.

Instead of attempting to redefine the Pecos Periods, a new classification was proposed which was applicable not only to the newly recognized Gila Basin materials but for the Southwest as a whole. This new classification, proposed by the Gladwins (1934), segregated cultural developments into restricted geographical areas and established time segments within these restricted areas through the selection of certain arbitrary ceramic (principally) features as diagnostics. These time-areal units were termed Phases. The Phases were combined into larger units: branches, stems and roots. These ascending groupings were intended to indicate the degree of cultural resemblances between the different components. In practice, however, the diagrammatic expression of these resemblances proved extremely difficult and many misconceptions resulted. Even more important, the "cultural tree" concept implied cultural connections and relationships that were doubtfully established. Brew (1946, pp. 44-66) has questioned the validity of these concepts and has suggested that they are not applicable to cultural studies since they fail to express the varied factors involved.

One of the more significant and at the same time controversial features of the Gladwins' system was the definition of four Roots ". . . from which the later peoples are believed to have sprung" (Gladwin, Winifred and Harold S., 1934, p. 9). These basic units or "Roots" were termed Basket Maker, Caddoan, Hohokam and Yuman. The Gladwins neglected, however, to define these units, and it remained for Colton (1939, pp. 16-22) to crystallize the concepts in terms of specific traits. Colton also suggested certain terminological changes in the Gladwin system. Primarily these were: 1) change the term "Phase" to "Focus" and 2) assign different names to the basic "Roots" as follows:

<i>Gladwin</i>	<i>Colton</i>
Basket Maker	Anasazi
Hohokam	Hohokam
Caddoan	Mogollon
Yuman	Patayan

Each of these "Roots" were considered to have a geographical center. Population shifts were considered from time to time to have modified the exact areal extent of the "Roots," but their general areas were usually thought of as is indicated in Figure 1.

The utilization of tribal and linguistic names for the "Roots" of the Gladwin system has many obvious disadvantages. The implied cultural relationships, while in some cases possible, were by no means proven and in one instance (Caddoan) were highly unlikely. For that reason Colton's terminology has been more generally accepted and will be followed here. Significantly, the earlier concept that pottery and agriculture were both introduced into the Southwest from a southern source was not challenged.

Although neither Gladwin nor Colton ever made explicit the implications of this four-fold cultural division of the Southwest, it led to radical changes in the concept of the development of Southwestern culture history. Four cultural sub-areas were now envisioned, each of which was believed to be a cohesive unit with its own separate sequence. Movements of people and the diffusion of ideas from one area to another were viewed in terms of these cultural units. It broke up the ". . . traditionalist thought, the conception of the single center with its peripheries being replaced by several cultural areas or lineages with their separate sequences and inter-related history . . ." (Reed, 1942, p. 31).

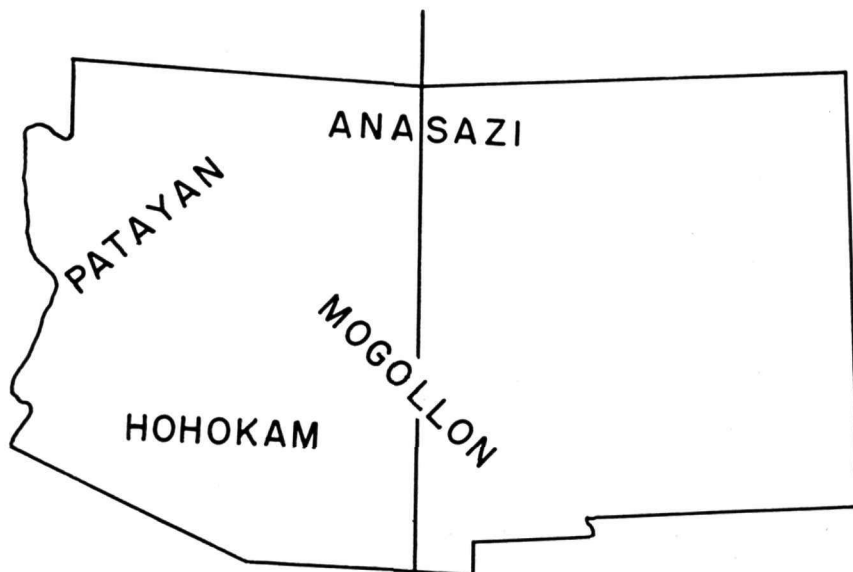


FIGURE 1.

Map showing the approximate areas occupied by the four "Roots" of the Gladwin-Colton system.

Unfortunately, theoretical concepts of how these cultural sub-areas came about—their cause in terms of cultural processes—never were seriously considered, or at least proposed in print. Instead all efforts by the proponents of the Gladwin-Colton system were directed toward the defense of the separateness of the various "Roots" in terms of specific traits (Rinaldo, 1941; Reed, 1946, 1948; Haury, 1932, 1936, 1940; Haury and Sayles, 1947; Martin, 1943).

Criticism of this concept was soon forthcoming. The Mogollon particularly has been the center of a protracted controversy. Some (Gladwin, until 1942; Haury, 1936; Colton, 1939; McGregor, 1941; Martin, 1943; Rinaldo, 1941; Lehmer, 1948) have contended that it was a "basic" culture from which the Anasazi and perhaps Hohokam received their stimulus for ceramics and other "higher" crafts. Others (Roberts, 1937; Brew, 1942; Nesbitt, 1938; Kidder, 1939; Daifuku, 1951; Smith, 1949) have contested the validity of the Mogollon concept and have seen the Mogollon and Anasazi as merely variants of the same general pattern.

One of the most critical differences of opinion between the pro- and anti-Mogollonists is the relative dating of sites in the Mogollon and Anasazi areas. Unfortunately, due either to scarcity of datable material or differences of opinion regarding correct dating procedures (Gladwin, 1940), dendrochronology has not solved this problem. The Mogollonists have long maintained that pottery was known in the Mogollon area considerably before it made its appearance among the Anasazi. Evidence supporting this position was accumulated in the form of tree ring dates for the Bluff Site (Haury and Sayles, 1947, pp. 80-82) in the early 300's A.D. (the earliest date for Anasazi ceramics is Obelisk Cave, at ca. 475 A.D.; Morris,

1936), radio-carbon dates for Pine Lawn Phase material in the Tularosa Cave (Johnson, 1951, p. 17) at 273 B.C. $\pm$ 200 and in negative evidence, that is, the absence of Anasazi intrusives in early brown ware sites adjacent to the Anasazi area (Hauray and Sayles, 1947, p. 62; Reed, 1948; Wendorf, 1950b). The "Pro-Mogollonists" contend that this validates the Mogollon as a separate group.

The "Anti-Mogollon" group has argued that the evidence for Mogollon ceramics earlier than Anasazi has not been conclusively demonstrated. They have further maintained that if ceramics were introduced from Mexico, as most Southwestern archaeologists believe, then it is to be expected that ceramic horizons would be found in the southern part of the area which are earlier than those farther north. In addition, they state, and logically, I believe, that merely having ceramics early does not make them a separate cultural entity (Smith, 1949, p. 68).

The supporters of the Mogollon concept were themselves divided into two "schools." One, representing the majority, contended that the Mogollon were a valid and separate cultural entity only before ca. 700 A.D. after which time the Mogollon were "submerged" by numerous Anasazi traits which obliterated cultural differences. The second school, propounded in print mainly by Reed (1942, 1946, 1948) considers the Mogollon a separate entity even until historic times.

Reed considers both Mogollon and Anasazi to be components of a "Puebloan" group and contrasts this "Puebloan" against the Hohokam-Patayan. He also suggested "Western Pueblo" or Southern Brownware complex, as a synonym for Mogollon and "Eastern Pueblo" or "Northern Pueblo" for Anasazi. Primarily and in contrast to the majority of pro-Mogollonists, Reed considers the differences between north and south in the archaeological material as continuing into the historic period and correlates roughly with the ethnographic western and eastern pueblos.

Although the controversy over the Mogollon remains even today a paramount issue among Southwestern archaeologists, the Hohokam have been generally recognized as something distinct and worthy of the separate classificatory placement given it by the Gladwin-Colton system (Roberts, 1935, pp. 16-20; Kidder and Shepard, 1936, p. 590). The paddle and anvil finished pottery, cremation burials, distinctive architectural sequence and numerous "Mexican" elements, such as ball courts, "mirrors" and canal irrigation set the Hohokam off from their taxonomic counterparts, the Mogollon and Anasazi.

The Patayan, in contrast to the Hohokam, have remained in a sort of taxonomic limbo. So little work has been done with the archaeological remains in western Arizona that distinctive traits, if they exist, are unknown. The method of pottery finishing (paddle and anvil) and disposal of the dead (cremation) are closely similar to the Hohokam. Many distinctive Hohokam traits, particularly those resembling the Mexican materials farther south are, however, apparently lacking. As a result some consider the Patayan as nothing more than a peripheral version of the Hohokam. Colton (1939, pp. 22-32), however, has defined three major groupings or "branches" within the Patayan: Cerbat, Cohonina and Prescott. The assignment of the last two branches was considered to be tentative and based primarily on pottery. Actually so little excavation had been attempted in Patayan sites that Colton used a listing (Forde, 1931) of ethnographic traits (presumably aboriginal) for the Yuma tribe as determinants for the "Root."

TREE RING DATING

Soon after the Pecos classification was first proposed, Dr. A. E. Douglass (1929) announced the development of a technique for dating prehistoric ruins. It had long been known that in ordinary years a living tree, as a process of its growth, adds one ring every year, but when that tree dies, or is cut down, then this addition of rings is immediately terminated. Dr. Douglass discovered that the varying widths of the annual rings of certain species of trees produced a unique pattern recognizable in trees growing over a wide area. When he compared the growth pattern on specimens which had died or been cut in the recent past with the patterns on living trees, he was able, by simply counting from the outermost ring on the living tree inward until he had reached the ring that matched the outermost ring on his earlier specimen, to determine the number of years that had elapsed since the earlier specimen had died. Then, by moving backwards in time with older and older materials, in each case correlating the earlier with the slightly later material, Dr. Douglass was able to construct a master chart depicting the growth patterns of trees that had died nearly 2,000 years ago. When wood samples from prehistoric ruins were compared with this chart they too could be dated, and if enough samples were available which still possessed the bark, a construction date, within a few years, could be determined for the structure.

It is not difficult to imagine the effect this development had on Southwestern archaeology. For the first time a means was available for determining, in terms of our own calendar, the rates of culture change and the years represented by the arbitrarily defined chronological segments. Understandably, a considerable effort has been expended in obtaining suitable material for tree ring dating and in evaluating the determined dates in terms of archaeology. These efforts have provided us with an overall chronological framework but they have not resulted in an abundance of conclusively dated sites. According to a recent summary (Smiley, 1951), all of the dated material from the entire Southwest, representing over twenty years of intensive effort, has resulted in only eighteen securely dated sites. One could hardly say this represents an adequate sample of the hundreds of sites excavated during this same period. The reasons for this situation are many. First, the techniques are not applicable over the entire Southwest since the datable species are limited in their distribution. Second, not all sites have produced a sufficient number of datable specimens and those specimens that were found often lacked their outermost growth rings. Despite these difficulties many archaeologists have placed great reliance on one or two dated specimens, and on occasion have drawn far-reaching conclusions therefrom. Often no allowance was made for the absence of bark, whether the specimen came from a tree which had been cut while green or if it came from a tree that had been dead for several years or any of the many other plagues of the dendrochronologist. In many cases tree ring dating seems to have been overemphasized, or at least incorrectly emphasized, to the detriment of the other chronological clues.

To further complicate the picture, two techniques for dating tree ring material, each on occasion obtaining significantly different dates for the same specimen, have been proposed (Gladwin, 1940). As yet, this controversy has not been conclusively settled.

The major contribution of dendrochronology to Southwestern archaeology is, and probably will remain, the establishment in general terms of

the years involved in the development of pre-Spanish Southwestern cultures. The following dates have been suggested for the Pecos Periods as applied to the Anasazi (McGregor, 1941) :

Pueblo V—1600 to Present
Pueblo IV—1300-1600 A.D.
Pueblo III—1100-1300 A.D.
Pueblo II—900-1100 A.D.
Pueblo I—700-900 A.D.
Basket Maker III—500-700 A.D.
Basket Maker II—Pre-500 A.D.

Our excavations in the Petrified Forest failed to obtain datable tree ring material, and therefore we are forced to depend on comparisons with other sites which have been dated in determining the age of both the Flat-top and Twin Butte Sites. When our work had been completed this was considered to be a major handicap. It is no longer so considered. Granted it would have been helpful to have had available sufficient dates to confirm our conclusions, nevertheless some of these deductions might never have been determined had we been so favored. It was necessary to develop other chronological guides which would place the sites in their correct chronological position relative to other excavated sites in the Southwest.

* * * *

Although the emphasis in this report will be historical rather than taxonomic, it is necessary to provide some sort of a systematic conceptual framework to handle the variety of data and assist in our interpretations and analysis of the prehistoric events in the area.

For purposes of chronological reference we shall make use of the Pecos Classification and the Gladwin-Colton system. We shall, as has become the general custom, restrict the usage of the Pecos Classification to the Anasazi. The defined phases (and aspects) of the Gladwin-Colton system, however, will be utilized not only for the Patayan and Mogollon but also for the Anasazi. This will enable us to quickly correlate the materials discussed with those already published.

An important modification of these existing systems will be utilized, however, to more accurately fix the chronological relationships of the various units to each other. Within each group a *single* criterion will be selected as diagnostic for each period considered in this report. Thus, an Anasazi site occupied for only a short period and containing neck-banded gray pottery (Kana-a Gray; Colton and Hargrave, 1937, pp. 195-196), but no types considered diagnostic of later periods, will be considered to be of Pueblo I date. In this context neck-banding serves as an "index fossil." This methodology reduces these classifications to chronological periods and, at the same time, deprives them of any implications that they are "overall stages in the development of the culture." They become analytical rather than descriptive classifications.

Changes in other manifestations of culture, such as architecture, physical type, and lithic materials, should be tied to this chronological framework and, where possible, they may be used as diagnostic features. It should be noted, however, that some of these features are less satisfactory than pottery as chronological indicators because of the comparatively slow rate at which these traits may ordinarily be diffused. Changes in house types and physical form, by their very nature, must be slower to change and therefore not as useful as sensitive chronological markers. More important, I can see

no reason to believe that modifications in the architectural pattern should simultaneously accompany changes in the ceramics, unless both the architectural and ceramic changes were parts of a linked complex which reached the area from an outside source. That in some instances this may have occurred is probable, but such connections must first be established before the synchronous nature of the changes can be recognized.

By selecting a single diagnostic criterion for the arbitrary units of time within each sub-group we avoid the confusion of "transition" sites where criteria of two or more periods are present at the same time in the same site. Kluckhohn (in Kluckhohn and Reiter, 1939, pp. 151-162), Martin (1938, pp. 458-463), Brew (1946, p. 153) and others have long recognized the difficulties involved in attempting to apply multiple diagnostics in defining small increments of time. Not only was it difficult to place sites chronologically but it prevented the determination of the direction that changes in other, slower diffusing, cultural manifestations have taken in moving from one area to another. Tree ring dates are of little value in such studies for, as we have seen, there are few sites conclusively dated. Further, the many problems of interpreting the significance of the dates available from most sites would cast considerable doubt on any attempt to prove that one site was fifty years older than another although such differences might be significant in tracing the diffusion of ideas. Variations in ceramic features, however, could and probably did spread within a few years over the area of an entire sub-group. When there is an adequate sample of the ceramic complex available, the presence and absence of ceramic features which are widespread throughout the sub-group provide us with very useful *relative chronological* indicators.

This method of chronologically orienting sites has been widely used outside of the Southwest (See Ford and Willey, 1949, pp. 38-43), but here, because of the widespread utilization of multiple period diagnostics and an over-dependence on tree ring dates, it has been neglected. A re-appraisal seems called for. Dendrochronology must be evaluated and assigned its rightful position, but results beyond its capabilities should not be expected.

In addition to the Pecos and Gladwin-Colton classifications, we shall propose a new scheme which, although basically similar to that proposed by Reed, differs from Reed's in certain important respects. Two *ceramic traditions* are defined: 1) Southwestern Scrape-Finished, and 2) Southwestern Paddle and Anvil Finished. As indicated by the names, differences in the methods of finishing pottery provides the basis for the distinction. The time-space distributions and the possible significance in cultural terms of these two traditions will be discussed in a later section.

Since at present over much of the area, little information is available on those manifestations of culture other than pottery, these traditions are necessarily limited to ceramics. Differences in other features undoubtedly accompany these ceramic distinctions, and if and when excavation discloses these consistent differences, then, the breadth of the tradition can easily be modified to include these newly defined features.

The term "Puebloan" has not been used here because: 1) as defined by Reed (1948) it would have included some of the groups, such as the Sinagua, which have paddle and anvil rather than scrape-finished ceramics and 2) these traditions are initially determined on the basis of ceramics, not architecture, as Puebloan suggests. Some will perhaps prefer that the term Hohokam might be used as a name for the second pattern. To be sure, Hohokam is a widely accepted term for at least a part of the Southwestern Paddle and Anvil Tradition. On the other hand, use of the term Hohokam generally

brings to mind the highly distinctive group with many obvious "Mexican" features, such as ball courts, canal irrigation, mosaics, spindle whorls, lip plugs, copper bells, etc. It is just such a connotation that I wish to avoid. As we shall discuss later, the basic foundation of the Paddle and Anvil Tradition may well lie outside of the "Mexican" area. Such a suggestion is not offered lightly for it is realized that the weight of traditionalist thought supports the generally accepted thesis that all Southwestern ceramics were derived from a southern source. As shall be pointed out, however, a consideration of the evidence indicates at least the possibility of other explanations.

THE MODERN ENVIRONMENT

The Petrified Forest National Monument is located twenty miles east of Holbrook in northeastern Arizona. The Monument is divided into two parts, a northern or Painted Desert Section and a southern or Petrified Forest Section. A narrow strip of land, one mile in width and five miles long, connects the two sections (Figure 2).

The northern section of the Monument is extensively eroded into colorful but barren badlands. There are no roads into most of this area and as a

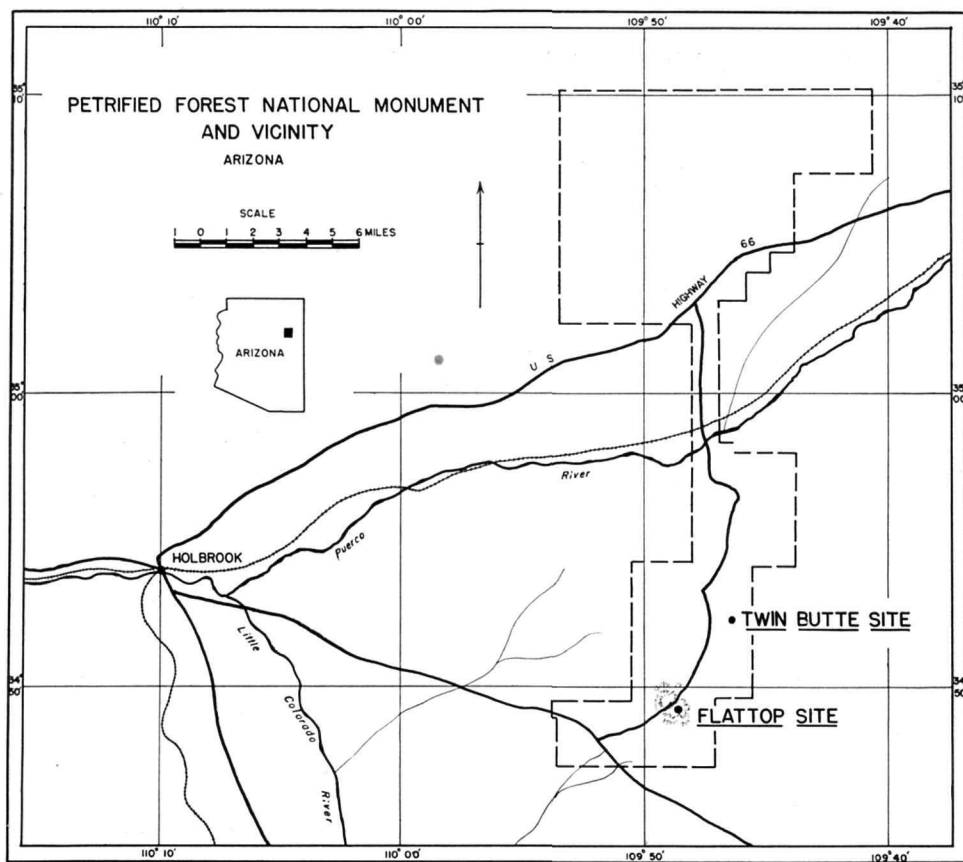


FIGURE 2.

Map of the Petrified Forest National Monument and vicinity.

consequence, except for a very sketchy survey, our investigations were largely limited to the southern or Petrified Forest Section.

Physiographically the region lies within the Navajo section of the Colorado Plateau (Fenneman, 1931, pp. 312-317). It is an area distinguished by nearly horizontal rocks, retreating escarpments and isolated mesas (see Figures 4 and 43). The major morphological features are determined primarily by the varying hardness of the caprock and the direction of the drainages. In the vicinity of the Petrified Forest the dominant structural feature is the Chinle Formation, a series of sandstones and variegated shales of Triassic age (Gregory, 1917, pp. 42-50). It is from this formation that the colorful petrified wood is eroded. Volcanics of a more recent age are also present but these are comparatively small and widely scattered. Inside the Monument igneous deposits were noted in only one small area located in the northern section. Outside the Monument, however, a prominent volcanic plug, known as Woodruff Butte, may be seen some ten miles to the southeast.

A thin canopy of wind-blown sand covers much of the area. In many places, however, this canopy has been removed by erosion leaving the soft Chinle shales exposed. These exposed areas, because of the sterility of the shales and consequent absence of vegetation, rapidly erode into fantastic badlands.

WATER SUPPLY. Most of this area is drained by the Puerco River which flows in a westward direction through the center of the Monument. The extreme southern portion of the Monument, however, is drained southward into the Little Colorado. The confluence of these two rivers is about twenty miles west of the Petrified Forest, near the town of Holbrook.

In the vicinity of the Petrified Forest the Puerco River has, since the late 1800's, cut a deep channel. However, the small tributaries of the river, such as Dry Creek which drains much of the Petrified Forest section, have not yet eroded their fill. Photographs (Wittick collection, Laboratory of Anthropology) taken around 1890 indicate that the area at that time appeared much as today. The scattered erosion of the sand canopy and the consequent development of the badland topography in these areas apparently predates the recent epicycle of erosion which has dissected most of the major drainages of the Southwest.

Away from the major streams, water can be obtained from small springs, several of which are located close to the Monument boundaries; however, only one spring, located at Agate Bridge near the center of the southern section, is actually within the Monument. It seems likely that when the Monument was designated an effort was made to exclude those areas adjacent to springs in order that the surrounding ranches could have the benefit of these water supplies. Many of these springs, however, were close enough to some of the prehistoric pueblos within the Monument that they could have been utilized as a source of water. Nevertheless, it seems probable that water was more readily available in the past. The archaeological survey demonstrated that the area had been occupied over a long span of time by a surprisingly dense population. As shall be discussed later, removal of the sand canopy in a few critical localities would have had significant results in terms of the available water supply.

CLIMATE. From published climatic records (Smith, 1945) maintained at the Monument headquarters since 1930 it is possible to obtain a fairly adequate picture of the present climate of the area. This data may be summarized as follows:

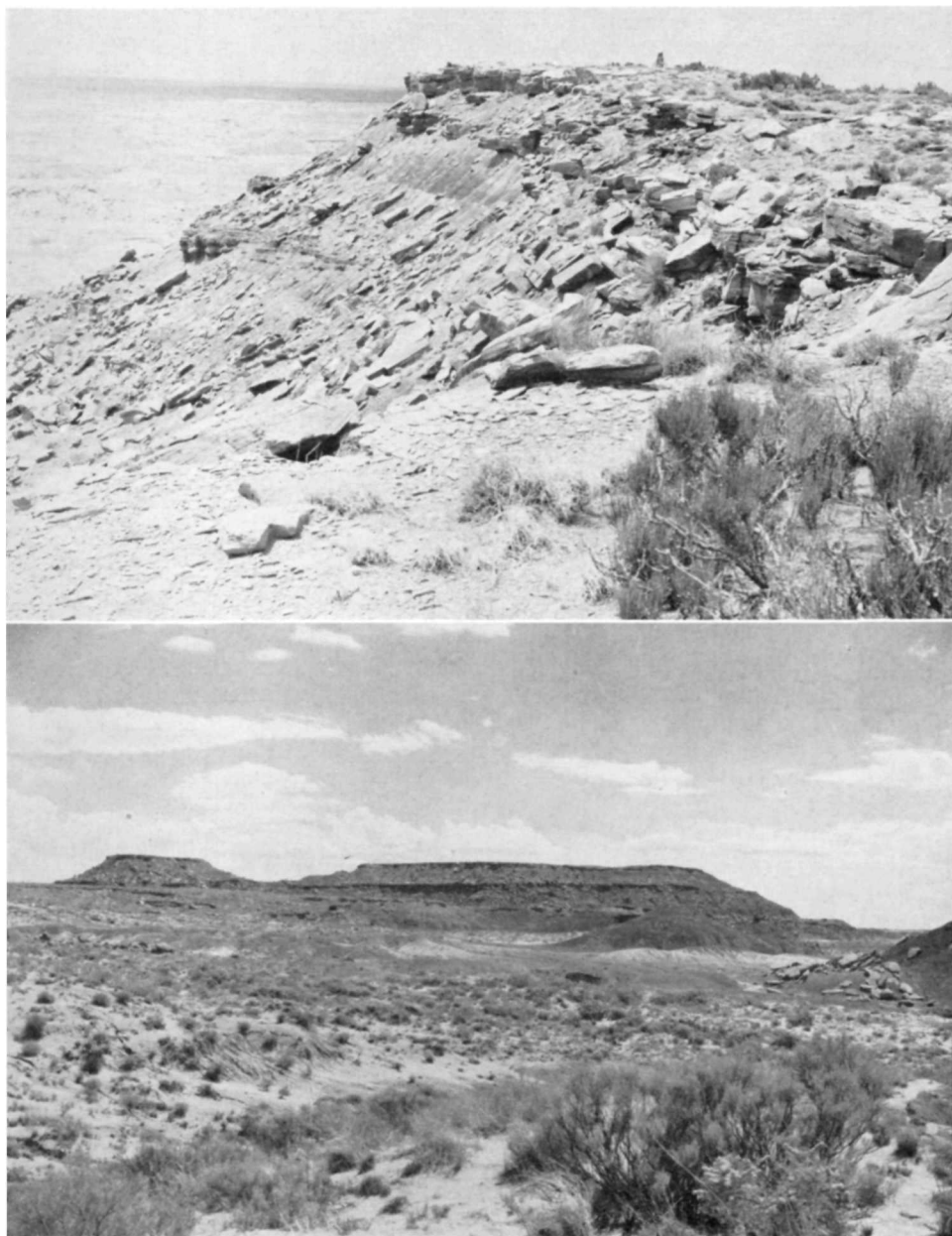


FIGURE 3.

Upper, View from Flattop Site, looking south. Lower, The Flattops, looking north.

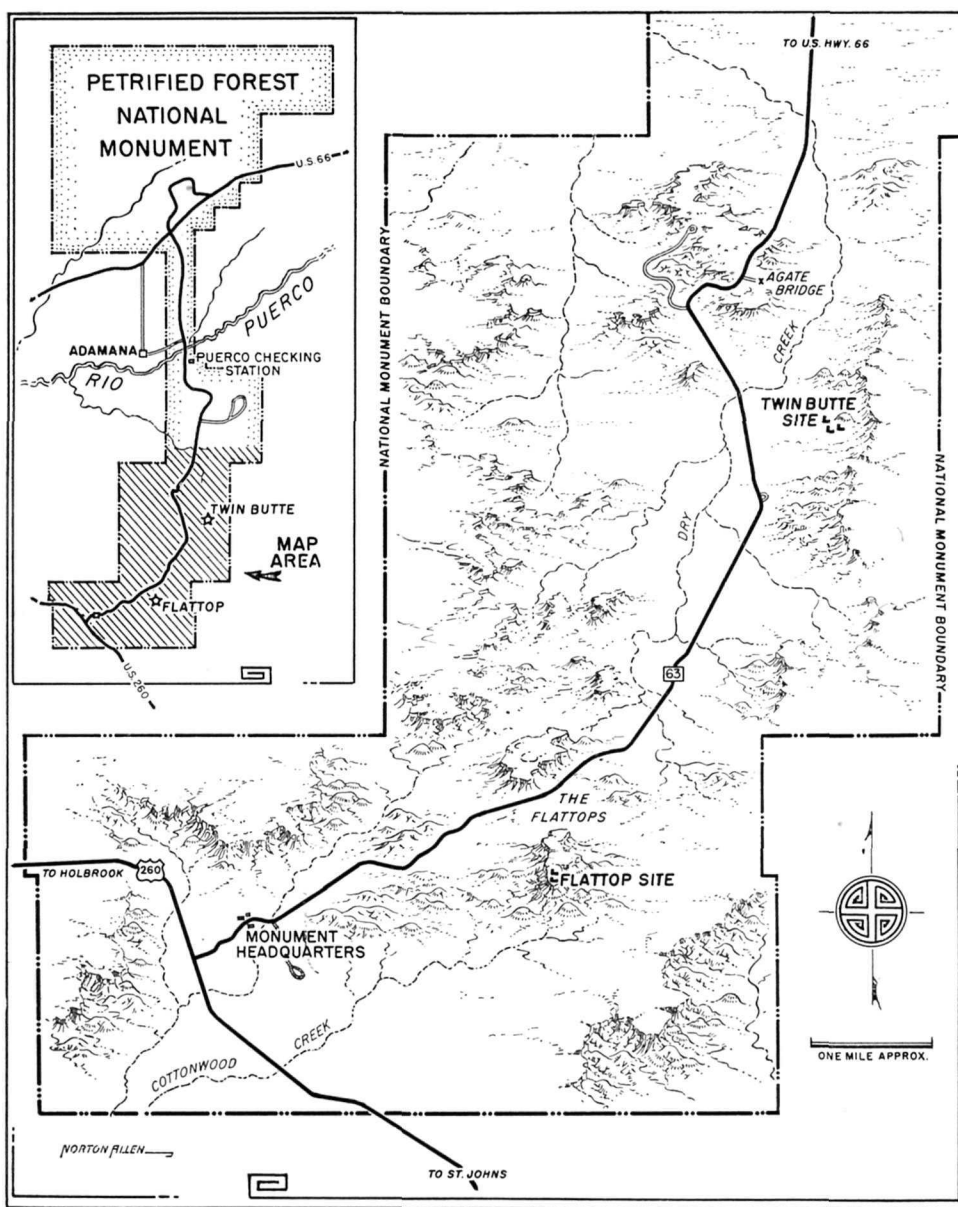


FIGURE 4.
*Physiographic diagram of the southern section of the
 Petrified Forest National Monument.*

Normal annual precipitation (Av. of 10 years)	9.58 inches
Highest mean maximum daily temperature (July)	91.8°F.
Lowest mean minimum daily temperature (January)	16.5°F.
Annual mean maximum temperature	69.8°F.
Annual mean minimum temperature	38.9°F.
Annual mean temperature	54.4°F.
Average date of last spring frost	April 24
Average date of first autumn frost	October 21
Average length of growing season	180 days
Prevailing wind direction	Southwest

Climatically the Petrified Forest is characterized by scant precipitation, wide temperature range and low humidity. Approximately half of the precipitation is during the months of July, August and September. The balance is fairly evenly distributed through the remainder of the year, with a minor peak in February. The summer precipitation is received through convectional showers and is often accompanied by electrical displays. The winter storms are usually frontal and precipitation may be either as rain or snow.

From the point of view of primitive agriculturalists the area is climatically suitable in so far as the length of the growing season is concerned, but lacks adequate precipitation.

SOILS. Within the Petrified Forest soils suitable for agriculture may be classified into two groups: 1) eolian (soils transported by wind), and 2) alluvial (soils transported by water). The major sources (Chinle formation) from which the alluvial soils are derived have resulted in heavily clay-charged silts and as a consequence these soils tend to be poorly drained and alkaline. The eolian soils are not only more extensive, but in many cases more suitable for agricultural purposes. Most of the mesa tops, as well as the valleys, are overlain by a sand canopy of varying thickness and degree of stabilization. As a general rule this sand mantle is thinly deposited; however, considerable thicknesses are to be found in favorable localities, especially near the bases of the escarpments where both climbing and falling dunes have accumulated.

The majority of these dunes are ancient and stabilized by vegetation. They probably date from the post-glacial optimum or altithermal period when the climate was considerably dryer than today (Hack, 1942, p. 50). The active dunes are usually restricted to exposed areas adjacent to alluvial flats or some other similar locality from which the wind could easily derive the sand. Such dunes may be either completely free and almost totally lacking in vegetation or else partially stabilized through a limited vegetation cover.

A very interesting illustration of the varying ages represented in the two types of dunes was noted at the Twin Butte Site (Figure 46 upper). There cultural debris of Basket Maker III age was found on top of an ancient climbing dune consisting of particles of sand cemented with calcium carbonate. Above the cultural layer was a partially stabilized active dune. All three of these layers, the fossil dune, the cultural layer and the active dune are today being removed by erosion.

In this, as in other areas in the Monument, once the sand canopy or the alluvial cover has been removed the underlying shales rapidly disintegrate.

Erosion of these shales continues until the area is recovered either by sand or alluvium deposit and vegetation can become established.

FLORA. Most of the Petrified Forest has a grass cover which is broken here and there by a few low shrubs. Trees are to be found only in the valley of the larger streams and in protected localities adjacent to the mesas. An occasional juniper also grows in the sand dunes on top of the mesas.

The Monument herbarium lists 153 species from the Petrified Forest. Below are recorded a few of the more common of these plants.

Rabbit brush (*Chrysothamnus*, spp.)
 Squawberry (*Rhus trilobata*)
 Greasewood (*Sarcobatus vermiculatus*)
 Saltbush (*Atriplex*, spp.)
 Galleta grass (*Hilaria jamesii*)
 Indian rice grass (*Oryzopsis hymenoides*)
 Muhly grass (*Muhlenbergia*, spp.)
 Sand drosied grass (*Sporobolus cryptandrus*)
 Grama grass (*Boutelous*, spp.)
 Salt grass (*Distichlis stricta*)
 Prickly pear (*Opuntia rhodantha*)
 Actina (*Actinea acaulis*)
 Yucca (*Yucca*, spp.)
 Sacred datura (*Datura meteloides*)
 Golden segalily (*Calochortus aureus*)
 Mormon tea (*Ephedra*, spp.)
 Loco weed (*Astragalus*, spp.)
 Oneseed juniper (*Juniperus monosperma*)
 Poplar (*Populus*, spp.)
 Coyote willow (*Salix exigua*)

FAUNA. The Petrified Forest is now a game preserve. It is probable, therefore, that the present wild life conditions closely approximate those of aboriginal times. An exception to this statement may be the antelope that range outside of the Monument and are therefore, probably reduced in numbers during the years that hunting is permitted in adjacent areas. The following is a listing obtained from the Monument "Wild Life Surveys." The numbers in the adjacent parentheses indicate their relative abundance with number 1 being most common:

Cottontail rabbit (1)	Bailey bobcat (2)
Jack rabbit (1)	Zuni prairie dog (3)
Wood rat (1)	Fox (3)
Antelope ground squirrel (1)	Skunk (3)
Hawks (1)	Badger (3)
Porcupine (1)	Golden eagle (3)
Pronghorn antelope (1)	Turkey vulture (3)
Great horned owl (1)	Weasel (3)
Coyote (2)	

USE OF THE AREA TODAY. Because of the concentrations of colorful petrified wood the area has been set aside as a National Monument. Cattle are permitted to graze on a small section of the Petrified Forest, but their numbers are closely restricted. Adjacent areas are utilized almost exclusively for cattle raising. The nearest agricultural attempts are at Woodruff, some ten miles to the southeast, where fields are irrigated with water from the Little Colorado.

SPECULATIONS ON THE AGRICULTURAL TECHNIQUES EMPLOYED BY THE PREHISTORIC INHABITANTS. The archaeological investigations demonstrated, through the finding of charred corn and other products (see pp. 72; 159), that the prehistoric inhabitants of the Petrified Forest derived their major subsistence from the practice of agriculture.

There seems little doubt but that these inhabitants were at least partially attracted to the area by the petrified wood. From this easily obtainable material they could fashion tools, ornaments and houses. There are some indications (see pp. 126-128) that neighboring groups traded with the local inhabitants, exchanging their products for petrified wood. A primitive agricultural society, however, would be forced to utilize the local environment if it were to establish permanent habitations in the area. It is highly improbable that such groups had developed commercial trade relations to such an extent that they could have subsisted from these sources alone.

In the absence of proof to the contrary we must assume that the environmental conditions of the area today are closely similar to those faced by these prehistoric inhabitants. It seems proper, therefore, that we should attempt to reconcile the apparent contradiction between the abundant proof of a dense agricultural population and the local environment, which in some respects seems unsuited for agriculture.

A solution to the problem lies in the study of modern agricultural practices of the Hopi. The Hopi country is located approximately one hundred miles north of the Petrified Forest and is closely similar in environment. The two areas differ in that the Hopi area has a greater altitude and consequent higher precipitation (average 13 inches), more numerous springs and shorter growing season. The Hopi area is also benefited by an adjacent high land mass (Black Mesa) which receives a greater precipitation and which provides additional moisture in the form of runoff. In both areas however, the rainfall is insufficient, except under certain conditions, to permit maturation of crops. In his study of the Hopi physical environment Hack (1942, p. 26), classified the Hopi agricultural fields into four main types, each with several sub-divisions.

- I. Fields watered by surface run-off (flood-water farming)
 1. Akchin fields (at arroyo mouth)
 2. On flood plains of large streams
 3. On flood terraces of large arroyos
 4. In bottoms of small arroyos
 5. Trincheras fields (on artificial terraces in drainage ways)
 6. Watered by hillside wash (probably not found in Hopi country)
- II. Fields watered by rainfall
 1. Sand dune agriculture—sandy soil
 2. In alluvial and other soils (in higher parts of Navaho country)
- III. Fields watered by underground seepage (seepage fields)
 1. In dune sand
 2. In colluvial soils
 3. In dune hollows
- IV. Irrigated fields (usually in colluvial and alluvial soils)
 1. Irrigated by diversion of permanent streams (not found in Hopi Reservation but common at Moenkopi)
 2. Irrigated from springs

An essential feature of all Hopi agriculture is the specialized plants which are particularly well adapted to the severity of the climate. This is especially true of corn. Hopi corn is

... planted about 10 to 15 inches in the ground to a depth at which moisture is held in the sandy soil. Ordinary corn cannot be planted deeper than 3 to 5 inches. When full grown, Hopi corn reaches a height of only 3 or 4 feet except in exceptional cases. This deep planting allows the plant to gain moisture during the dry spring and helps protect it from very late frosts. Some moisture is stored in the subsoil in the proper locations throughout the dry spring. (*Ibid.*, p. 20).

All of the Hopi agricultural methods would be possible today within the Petrified Forest although irrigation could only be practiced in the valley of

the Puerco and there only with considerable difficulty. Before the erosion of the present channel, however, irrigation in this valley would have been much simpler.

In the Hopi area flood-water farming is the most important single type. Hack describes the basic principles as follows:

On ordinary farms of the eastern United States, crops are watered by the rain that actually falls on the field and by the moisture that is stored in the ground between rains, but the rainfall in the Hopi country is inadequate for such farming. In flood-water farming the crops are watered by the run-off of an area much larger than the area actually cultivated. The moisture is stored in the soil between floods and provides a constant water supply for the plants except during long droughts. Flood-water fields are thus always located in a water course or adjacent to a water course, in such a position that during a flood large quantities of water will pass over the field, but not so rapidly as to wash out the crop. (*Ibid.*, p. 26).

In the vicinity of the Petrified Forest flood-water farming could be practiced adjacent to the Puerco and its tributaries, and in the bottoms or at the mouths of the small arroyos. Trinchera fields may also have been utilized, but, as in the Hopi country, fields watered by hillside wash are doubtful in as much as the topographic features, the flat mesas and abrupt escarpments, are unfavorable for this method. It should be noted, furthermore, that most of the alluvial soils in the Petrified Forest are unsuited for agriculture and that this area has an even smaller rainfall than that of the Hopi. Perhaps just as significant is the absence of an adjacent high land mass, such as is found in the Hopi area, which might receive a higher precipitation.

It is often difficult in the Hopi country to distinguish between sand dune fields watered only by rainfall and those which have an additional supply derived from underground seepage (*Ibid.*, p. 34). It is probably valid, therefore, to treat all fields in sand dunes as of one type. Hack (*Ibid.*, pp. 32-33) describes this method as follows:

There is no obvious source of moisture for these fields except that which falls as rain. On less porous soils, rainfall alone is inadequate as a source of moisture, but it is apparent that crops can be grown in dune sand, owing to its superiority as a storage reservoir for moisture. There are several sub-types of this sand dune agriculture all of which depend on the ability of the highly porous sand to store and conserve moisture. By far the most common situation of sand dune fields is where a more or less thin cover of dune sand (one-half to three feet thick) rests on a less pervious sub-soil, which being on a mesa top or mesa side is probably colluvial, derived by rainwash and slope wash. Many Hopi fields are known to be planted on a thin cover of sand. When abandoned the sand is blown away and reveals the thicker colluvial soil or bare rock below.

In Hopi sand dune agriculture, the loose surface of the sand acts as a dry mulch which invites the absorption of rain and which also prevents evaporation. So far as penetration of moisture is concerned the sand is more effective than the dust mulch of the 'dry farming' method as it is well known that there is no runoff from dune sand even in the heaviest rains. Furthermore only a thin layer of sand dries out and the sand below will remain saturated for a long time by the water held up by the less pervious soil below.

Many sand dune fields are planted on large climbing dunes or steep dune covered slopes of a mesa, where the sand must be thick. A common position for fields is near the base of these climbing dunes. Here water may be supplied by underground seepage from the upper dune slopes, so that some of the fields in these positions may come under the heading of seepage fields.

Many of the fields are located on a thin sand mantle resting on less pervious soil or bed rock, and the sand itself is in danger of being swept away, when cleared for planting. To hold it, lines of brush are placed in rows about 2 to 5 meters apart. The brush is held in place by heavy stones which become buried by the sand leaving only the brush projecting from 1 to 3 feet above the sand. When a field thus protected is abandoned, the brush gradually rots or is cut away by moving sand and eventually the whole area is blown clear of sand leaving only the lines of stones as evidence of the former existence of a field.

Sand dune fields are probably most common on the mesa walls where the cover of dune sand on colluvial soil is thin, or near the base of great climbing or falling dunes banked up against the mesa sides. Another common location is on ancient dunes on the mesa tops which have been cleared of vegetation and kept from becoming active either by the use of wind breaks, or by leaving large uncleared areas between. Sand dune agriculture is not practiced in areas of active dunes.

The pre-Spanish antiquity for these methods was also established. Hack (*Ibid.*, p. 71) noted that at one locality an old abandoned field, indicated by the stone alignments which had been placed as weights on the brush wind breaks around the field, had been covered by a Pueblo III ruin. It is assumed therefore, that sand dune agriculture is at least as old as Pueblo III (ca. 1100 A.D.), and is probably older.

Sand dune agriculture would, because of the comparative abundance and favorability of this type of soil, be particularly well suited for the Petrified Forest area. A thin sand canopy underlain by impervious shales provides the required soil conditions and it is probable that normal rainfall would be sufficient to allow for the maturation of the crops. The probability that this method was practiced by the prehistoric inhabitants is further indicated by the rock alignments which may be seen in many areas in the Petrified Forest. Generally these rock alignments are to be found in barren eroded areas, almost completely lacking in soil. It is believed that when the fields were abandoned the brush portion of the windbreaks soon disintegrated allowing the sand to blow away and leaving the rocks exposed on the shale sub-soil (Figure 43b). To judge from the evidence of such rock alignments, agricultural fields were usually situated either on mesa tops or near the bases of the mesa escarpments where climbing and falling dunes had accumulated and additional moisture was probably obtained as seepage from the mesa.

The removal of the vegetation cover in those areas where fields were cultivated was probably indirectly responsible, through the eventual wind removal of the underlying sand, for many of the eroded areas which may be seen in the southern section of the Monument. This statement is limited to the southern section only because the Painted Desert Section is almost completely badlands and other factors are probably responsible for this condition. It is probable that the essential morphology of the southern section, its broad flat alluvial valleys and abrupt escarpments, had been attained considerably prior to the period when the sand canopy was deposited over the area. It had, therefore, a relatively more mature profile than the northern section which had, and still has, a higher elevation than the Petrified Forest section. Since they both are a part of the same drainage system, the northern Painted Desert section consequently had a steeper gradient. Because of the exposed shale and this relatively steep gradient the northern section was more rapidly eroding. It is still in that process today. When the sand was deposited as dunes over this area, the erosion in the southern section, while probably active, was insufficient to remove the canopy before vegetation had become established. In the northern section, however, erosion seemingly removed this sand almost as soon as it was deposited, thereby preventing the stabilization of the surface through a vegetation and sand cover which would absorb the rainfall and minimize runoff.

The destruction of the vegetal cover through agricultural activity would free the sand and permit its rapid removal. As we have seen, the areas which were most suited for this type of agriculture were those which were underlain by the Chinle shales. These extremely solvent shales, however, do not support vegetation and once exposed are rapidly eroded. The degree of erosion would be largely determined by the amount and the gra-

dient of the area exposed but it would continue until the area is either 1) recovered by new sand dunes, 2) alluvial deposits capable of supporting vegetation have been deposited over it, or 3) reaches a stage of equilibrium. It seems likely, therefore, that many of the small barren flats, sometimes with rocks aligned over their surfaces, are the result of the practice of sand dune agriculture by the prehistoric inhabitants. It is believed that some of the eroded areas which lack rock alignments are localities where the erosion has proceeded so far that the alignments have been disturbed or the rocks removed.

A secondary effect of this removal of the sand cover may have been the destruction of springs. We have previously noted that the present water supply seems inadequate for a sizable population. Dune sand is a most important factor in the formation of springs for it provides an excellent intake and storage area for moisture. Removal of the sand allows the water to become lost either through rapid evaporation or surface runoff. It should be noted, however, that no conclusive proof of the destruction of former springs was noted in the area. Such evidence is extremely difficult to determine, but in the absence of conclusive proof of a moister climate in the past, this hypothesis warrants serious consideration.

ARCHAEOLOGICAL SURVEY

The Museum of Northern Arizona became actively interested in the Petrified Forest and adjacent areas when, through the excavation of the Ridge Ruin in 1939 (McGregor, 1941; Colton, 1941), it was realized that trade, particularly in pottery, was well developed in prehistoric times between the Flagstaff area and that portion of northeastern Arizona drained by the Little Colorado and Puerco Rivers. In an attempt to learn more about these pottery types and the other manifestations of culture associated with them, the Museum began a study of this area.

It is understandable, therefore, that when the National Park Service offered to loan a sherd collection gathered from over three hundred sites in the Petrified Forest, the offer was immediately accepted. The strategic location of the Monument near the confluence of the Little Colorado and Puerco Rivers made it an ideal location for continuing their work in the area. The survey was based on the earlier reconnaissance of Mera (1934) and was conducted by the staff naturalists at the Monument, Carl Jepson and L. F. Keller, neither of whom were trained archaeologists.

In 1947, as a student under Dr. Colton, I was assigned this survey collection as a research project (Wendorf, 1948). Because of limitations in time and my inexperience, the portion of the collection to be analyzed was reduced to one hundred sites. This was accomplished by briefly examining the total collection and selecting for further study all those sites which, on the basis of the evident decorated sherds, were occupied prior to Pueblo III. In order to round out the collection to an even one hundred, a few Pueblo III sites were also added. It was hoped at that time that the analysis of the entire collection would eventually be effected; however, this has not yet been accomplished. While it would be desirable to have a more complete picture of the prehistoric occupation of this area, the absence of such information is not critical for the present study which is limited to an examination of the earlier sites. The survey and subsequent analysis is reasonably complete, not only for the horizons in which excavations were conducted but also for the two to three hundred years following these investigated horizons.

THE ANALYSIS. As a result of previous work in the area, not only by the Museum of Northern Arizona but also by the Laboratory of Anthropology (Mera, 1934) and Gila Pueblo (Gladwin, 1945) a series of pottery types had already been defined. Following the method outlined by Colton (1946, pp. 248-250), and based upon these already established types, seven ceramic groups were defined.

<i>Group</i>	<i>Types</i>	<i>Number of Sites</i>
A	Adamana Brown (Mera, 1934, p. 5)	19
1	Lino Black-on-gray (Colton and Hargrave, 1937, pp. 194-195) La Plata Black-on-white (Hawley, 1934, p. 23) Lino Gray (Colton and Hargrave, 1937, pp. 191-192) Woodruff Brown (Mera, 1934, p. 6)	23
2	Whitemound Black-on-white (Gladwin, 1945, pp. 22-23) Lino Gray Woodruff Brown	21
3	Kana-a Black-on-white (Colton and Hargrave, 1937, pp. 205-206) Kiatuthlanna Black-on-white (Gladwin, 1945, p. 24) Lino Gray Woodruff Brown	4
4	Black Mesa Black-on-white (Gladwin, W. and H. S., 1934, Fig. 1) Holbrook Black-on-white (Colton and Hargrave, 1937, pp. 235-236)	12
5	Sosi Black-on-white (<i>Ibid.</i> , pp. 211-213) Walnut "A" Black-on-white (<i>Ibid.</i> , pp. 237-240) Snowflake Black-on-white (Colton, 1941, pp. 62-63) Puerco Black-on-white (<i>Ibid.</i> , pp. 58-59)	44+
6	Chaco Black-on-white (Hawley, 1936, pp. 43-44) Whipple Black-on-white (Colton, 1941, pp. 60-62) Tularosa Black-on-white (Colton and Hargrave, 1937, pp. 240-241) Cheta Black-on-white (Colton, 1941, pp. 63-64) Pinedale Black-on-white (Colton and Hargrave, 1937, pp. 241-242) Walnut "B" Black-on-white (<i>Ibid.</i> , pp. 237-240)	46+

Several months after this analysis was completed, I had an opportunity to re-examine a sizable proportion of the analyzed sites and it soon became apparent that groups 1 and 2 could probably be combined. Although not all of the sites in this category were investigated, those sites that were visited which had been assigned to group 1 also contained White Mound Black-on-white and these sites should therefore, have been assigned to group 2. On this evidence it seems likely that more critical collecting from all group 1 sites would have produced decorated types indicating placement in group 2. Further, it seems doubtful if the data warrants my previous distinction between the two groups. This re-interpretation does not necessarily mean that the Petrified Forest was unoccupied during group 1 times, but rather that the chronological span of group 2, in this area, should be extended backward to include the time range of group 1 in adjacent areas (particularly around Flagstaff).

Several sites, as was to be expected, were occupied during more than one ceramic period. The validity of the ceramic groups is confirmed, however, by the presence of several sites containing only those types assigned to that group. For the groups primarily concerned in this report (group A, 1 and 2) ten of the nineteen sites ascribed to group A contained only sherds of this group, while of the forty-four sites assigned to groups 1 and 2, twenty-seven were uncontaminated by later material.

It is apparent from the right hand column in the table above that there were notable fluctuations in the prehistoric population in this area. The nineteen sites of group A indicate that during the time interval represented by this group the area contained a significant, although scattered, population. In the next interval, represented by groups 1 and 2, the number of sites more than doubled. One can only guess whether this represents a longer time interval, an increase in population, different settlement patterns, or a combination of several of these factors. We may note, however, that a large proportion of the sites assigned to groups 1 and 2 are very small clusters of storage units (probably accompanied by a pit house) located in the general vicinity of the larger Twin Butte Site. This distribution suggests that these small units may represent outlying segments of an extensive community. The group A sites, on the other hand, are usually scattered villages consisting of several individual pit houses situated in a defendable locality.

Significantly, the major break in the occupation occurs with group 3 (Pueblo I). Only four sites were found in the entire area which contained group 3 ceramics and none of these contained these types to the exclusion of all others. These four sites, in contrast to those of the preceding periods, are all small and it seems likely that the considerable population indicated by the previous groups had, to a large extent, abandoned the area. The apparent increase in the number of sites in mountainous area to the east, from Lupton on the Puerco River (Roberts, 1939 and 1940) to Kiatuthlanna (Roberts, 1931) near the Little Colorado, at the beginning and during ceramic group 3 times (Pueblo I) may indicate a movement in this direction. Notably, the population of the Petrified Forest in the following periods, after an interval of perhaps a hundred or more years, gradually increased during Pueblo II, III and, possibly, Pueblo IV (Wendorf, 1948, p. 32).

The excavations described in the following pages are concerned with those periods prior to group 3: The Flattop Site represents group A; the Twin Butte Site group 1, 2 and the very beginning of group 3.

The absence of indicators from other ceramic groups in such a large proportion of group A sites forces the chronological seriation of group A sites as either prior to group 1-2 sites or else later than all of the other ceramic groups.

The early chronological position of group A sites was at least partially confirmed by the finding of Adamana Brown (Group A indicator) in adjacent areas to the south in early sites dated by dendrochronology (Haury and Sayles, 1947, pp. 55-56). It is not suggested, however, that all group A sites were abandoned prior to group 1-2 times, for the presence of an occasional site containing both group A and 1-2 ceramics may indicate either a reoccupied village or a later site chronologically overlapping both groups. Only further excavation can settle this problem.

EXCAVATIONS

BACKGROUND. Following the analysis of the National Park Service survey a series of problems were formulated which centered around the determination of the correct relative chronological position for Adamana Brown and the earliest Anasazi ceramics in the area. The so-called "historical approach," that is, working from the known latest horizons ever backward in time, was not contemplated. Funds were not available for such an ambitious program and it was decided to concentrate on what was

believed to be the two earliest horizons and through stratigraphic or other data relate these periods to chronologies of adjacent areas.

With this planned program in mind, a brief visit was made to the Petrified Forest where the type site for Adamana Brown (Mera, 1934, p. 5) was examined. This examination confirmed the previous survey reports on the condition of the site and arrangements for its excavation were made. Several promising sites which the survey indicated were occupied during the following period (Basket Maker III) were also checked but none were suitable for our purposes. Most had been extensively damaged by erosion while others were so small that it was feared an adequate sample could not be obtained. Meanwhile, in the summer of 1949 funds were raised, a small student crew assembled, and excavation was begun on the Adamana Brown village which we had named the Flattop Site from its location on the top of one of a group of small mesas known as "The Flattops." As this work progressed, in off hours we continued the search for a suitable Basket Maker III site. Such a site was finally located. It was undoubtedly the largest village of its period in the Monument, but, surprisingly, it had been missed by the Park Service survey. This village was named the Twin Butte Site because of the two cone-shaped bentonite remnants which stood in the midst of the site. Test excavations, conducted in the last two weeks of the 1949 season, confirmed our belief that the site warranted our intensive study.

METHODS. The excavation methods employed at both the Flattop and Twin Butte Sites were essentially the same. A contour map on which was located all of the visible structures was first prepared. At the Flattop Site these structures were assigned letter identifications in the order that they were found. At the Twin Butte Site the letter designations were applied to architectural groups (with the exceptions of B and C which are part of the same group) and numerals were assigned to each unit excavated within that group. Thus, the fourth structure excavated in group F was known as F4.

We knew at the beginning of our excavations that our available funds would not permit complete excavation of either of the sites. Therefore, in order to obtain as complete a sample as possible, houses in all sections of the sites were selected for examination. This was a relatively simple matter at the Flattop Site for there the houses were shallow and clearly outlined by vertical slabs visible on the surface of the ground. Before each house was excavated it was photographed and all surface sherds and debris were removed from the area of intended excavation. A small pit was then begun on the inside of the house against one wall and continued downward until the floor was reached. The pit was then expanded into a trench which followed along the walls until the entire house had been outlined. The undisturbed core in the center of the house was then removed. After the fill had been removed an area fifty centimeters wide surrounding the house was stripped to determine if there were other features not evident from the surface. When this was complete the house was photographed and carefully mapped. Testing outside the houses was very limited, in retrospect it seems too limited, but the trash was shallow wherever we tested.

The Twin Butte Site was slightly more complex. There we could see the outlines of numerous small slab-lined cists usually clustered into several crescentic groups. We knew from the excavations of others (Brew, 1946; Martin, 1939; Morris, 1939; Roberts, 1939) in similar sites in adjacent areas that these crescentic groups usually accompanied a pit

house or "proto-kiva." The problem was to locate the associated pit house. This was accomplished by a series of trenches excavated to sterile soil. By following the contours of the sterile rust-colored clay it was possible to detect features, such as, storage pits and houses. The depth of each feature was first explored and then a narrow trench was excavated around its periphery. As in the Flattop houses, the remaining core was then removed, the surrounding area stripped, and the structure was photographed and mapped.

The standard procedure in handling artifacts was the same from both sites. Sherds from the fill of each structure were saved and sacked together while those sherds found in contact with the floor were sacked separately. All sacks were labelled with the date, site and house number, location in the house, type of contents and the initials of the recorder. Artifacts were left *in situ* until the house had been cleaned, photographed and mapped at which time they were carried to our field camp for cleaning and cataloging.

The excavations were conducted as an informal field school with students providing most of the labor. In return for their assistance they received training in field techniques and in some cases received credit from their university for this training. Each member of the field party did his own digging, recording, photographing and mapping. Mimeographed outline forms were provided for each structure and these forms insured a certain minimum standard for the data. Attached to these data sheets were individual detached maps and profiles showing the locations of all features and artifacts found in each structure.

CHAPTER II

THE FLATTOP SITE

INTRODUCTION

THE FIRST and also the earliest site which we excavated was a pit house village located on the top of one of a group of small mesas known as the Flattops. These mesas (Figure 3), conspicuous landmarks standing well above the surrounding terrain to a maximum elevation of 5700 feet, are remnants of a once larger plateau which has been extensively desiccated by erosion. The Flattops are capped with a sandstone layer varying from ten to fifteen feet in thickness and are underlain by thick beds of soft bentonite clays separated from each other by layers of sandstone similar to that forming the caprock. The softer members of this formation erode much more rapidly than do the sandstones, resulting in continuous undermining of the more resistant deposits. Vegetation, because of the bentonite, has not succeeded in establishing itself on the slopes of the mesas, but an occasional juniper and other low brush, together with a few clumps of grass, are to be found where soil has accumulated in cracks in the sandstone or on small benches.

The site is located on the largest, and southernmost, of the Flattops in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 32, Township 17N., Range 24E. From here one has a commanding view of the surrounding area and can see the Hopi Buttes and beyond in the north, the Zuni Mountains in the east and the White Mountains in the south. To the west, the tremendous expanse of the Mogollon Platform and the valley of the Little Colorado River extend in a seemingly unending plane toward the San Francisco Peaks, over a hundred airline miles distant.

A climb to the summit of the Flattop is a somewhat arduous but not difficult task despite the abruptly sheered edge which completely encircles the mesa. Fortunately, the bentonite clay base was of the proper consistency to provide footholds and its sandstone cap was sufficiently cracked to afford easy access to the top.

Once on top, the Flattop appears as an almost featureless mesa. Its flat, gently tilted summit is lightly covered with a loose sandy soil, although in places the wind has removed even this canopy leaving the bare rock exposed (Figure 6). Occasional clumps of bunch grass and low shrubs grow wherever soil conditions were satisfactory.

Evidence of occupation at the site was plainly evident to even the most casual observer. Numerous vertical sandstone slabs, the tops of which were visible on the surface, marked the locations of houses. We were able to identify twenty-five such structures from surface indications alone; doubtless, many more are also present but unrecognized. As shown in Figure 5, the houses were independent structures casually placed around the eastern edge of the escarpment. Around this area of occupation trash had accumulated in places to depths of fifty centimeters with significant

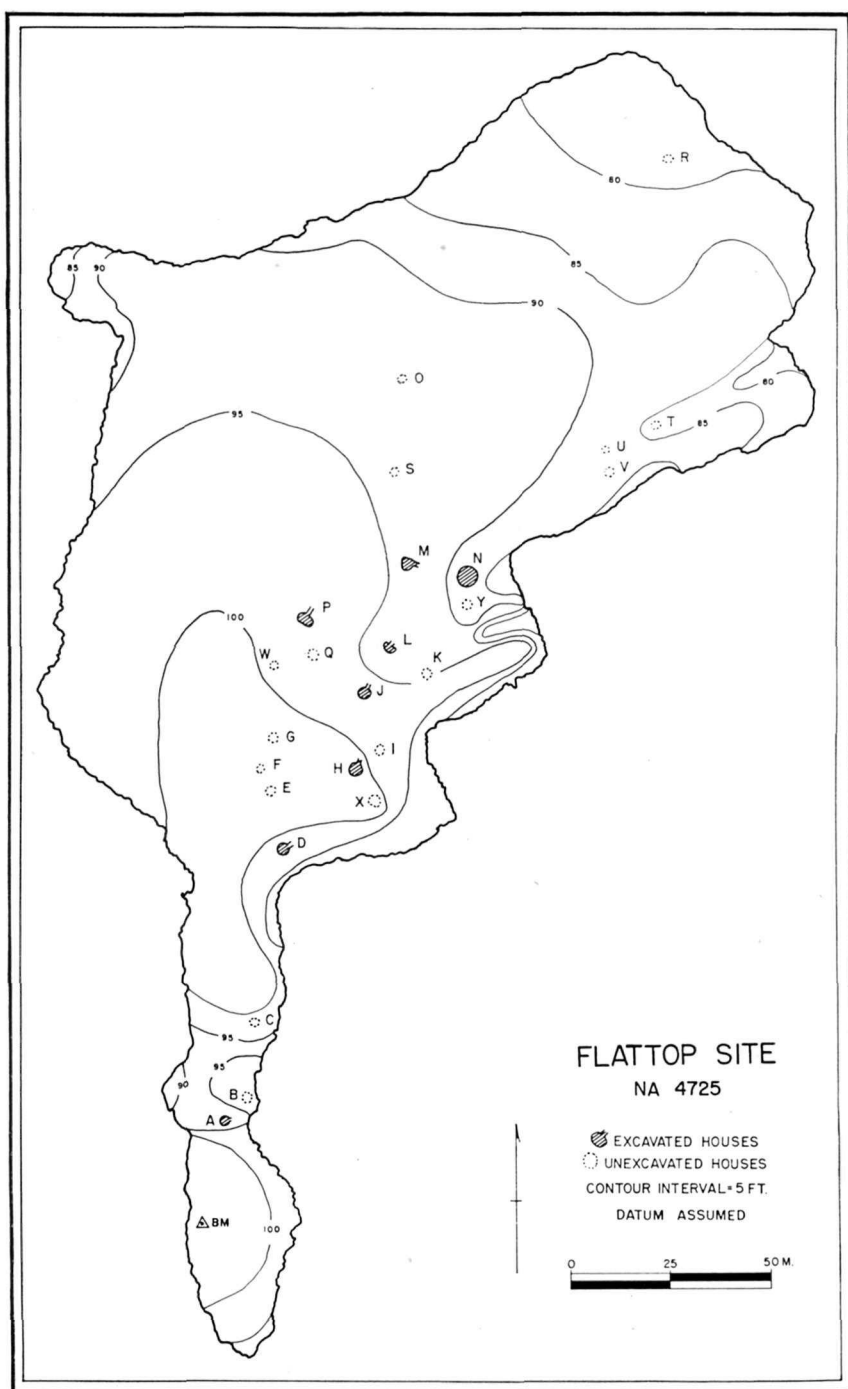


FIGURE 5.
Topographic Map of the Flattop Site.



FIGURE 6.

Top of Flattop, looking northeast.

depths occurring wherever the underlying bedrock had been deeply eroded. Broken pottery, to one accustomed to seeing later sites, was not common, but together with the numerous broken implements and flakes, was sufficiently plentiful to indicate an extensive occupation.

FLATTOP SITE ARCHITECTURE

The following houses, but eight of the known twenty-five structures located by visual inspection of the surface of the ground, represent what is believed to be an adequate sample of the architectural efforts by the inhabitants of the Flattop Site. However, it is believed, due to the presence of trash which partly or completely supports the vertical wall slabs on all of the houses, that none of these structures were among the first to be built at this site. Furthermore, the absence of any evidence of superposition; that is, the placement of a later house on top of an earlier one, prevents us from offering suggestions regarding the sequence of house styles through the time the site was occupied. It should be pointed out, though, that a good idea of the shape of all of the seventeen visible but unexcavated houses was obtained by observing the tops of the wall slabs. In so far as could be thus determined none of these houses varied either in size or shape, from the excavated houses.

Figure 7—House A

Walls: Of vertical slabs reinforced at ground level with horizontal blocks.

Entrance: Possibly on east side. Short, slightly inclined.

Wing Wall: None.

Floor: Thin layer of clean, packed sand on sandstone bedrock.

Hearth: None. Indistinct ash layer noted in center of floor.

Associated Floor Artifacts: Stone—mano (1); hammerstone (1). Sherds—Adamana Brown (176).

Fill: Principally wind-blown sand with a few scattered adobe lumps and several large, thin, roughly shaped slabs.

Photograph: Figure 8.

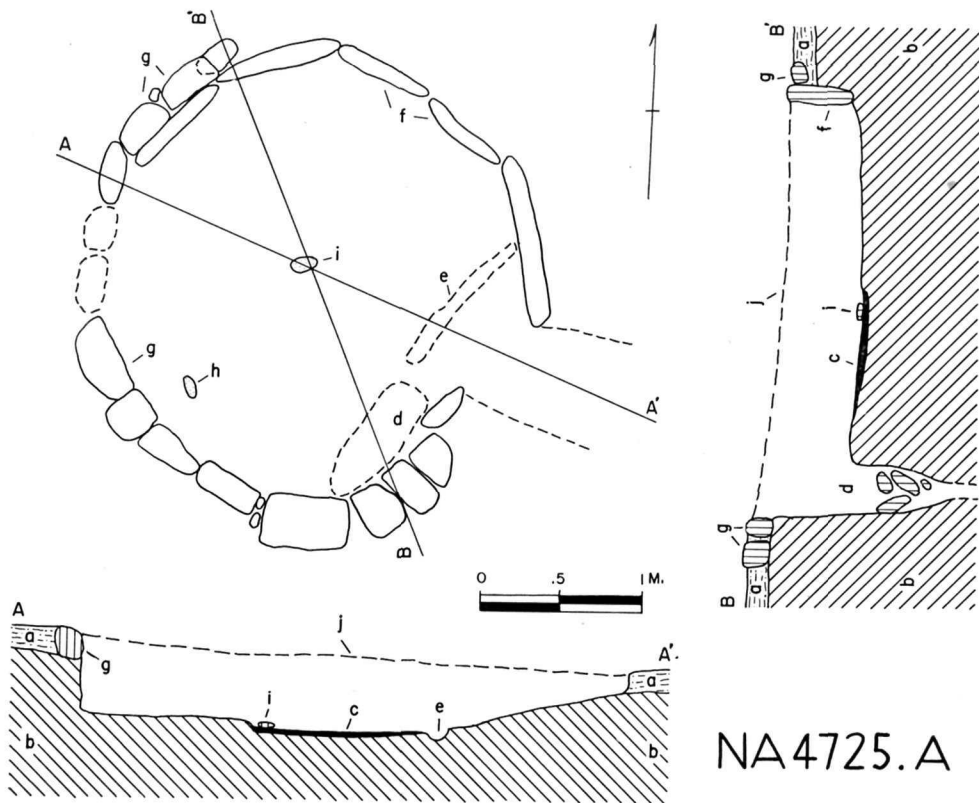


FIGURE 7. Plan and sections of House A.

- a, Trash.
- b, Sandstone bedrock.
- c, Sand floor.
- d, Crack in bedrock, filled with debris to level of floor.
- e, Groove in floor, probably continuation of crack above.
- f, Vertical sandstone slabs.
- g, Horizontal blocks.
- h, Hammerstone.
- i, Mano.
- j, Surface prior to excavation.

FIGURE 8. *House A.*Figure 9—*House D*

Walls: Vertical sandstone slabs. No plaster.

Entrance: Long, slightly inclined. Lined with vertical slabs. Burned debris in fill suggests once covered.

Wing Wall: Two vertical slabs reinforced at base with smaller slabs. Held in position with plaster.

Floor: Thin layer of packed sand.

Hearth: Not defined.

Storage Features: Inside house in southwest corner. Slab-lined. Held in position with plaster.

Associated Floor Artifacts: Stone—manos (6); trough metates (3); basin metate (1); notched stone (1); chipped knife (1). Pottery—neckless jars (2); tall neck jars (2); ladle (1). Sherds—Adamana Brown (387).

Fill: Consists mainly of wind-blown sand, burned clay, charred juniper (*Juniperus monosperma*) branches and several large sandstone slabs.

Photograph: Figure 10.

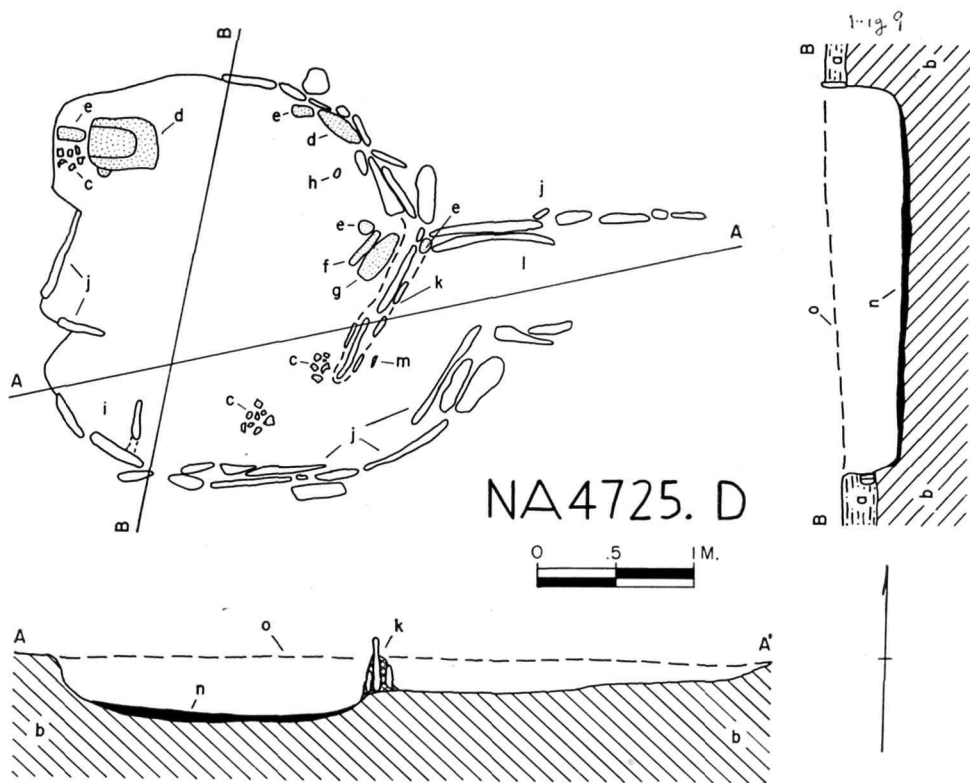


FIGURE 9. Plan and section of House D.

- a, Trash.
- b, Sandstone bedrock.
- c, Broken pottery vessel.
- d, Trough metate.
- e, Mano.
- f, Notched stone.
- g, Basin metate.
- h, Ladle.
- i, Slab lined bin.
- j, Vertical sandstone slabs.
- k, Wing wall, limits of plaster indicated by dotted line.
- l, Entrance.
- m, Chipped knife blade.
- n, Sand floor.
- o, Surface prior to excavation.

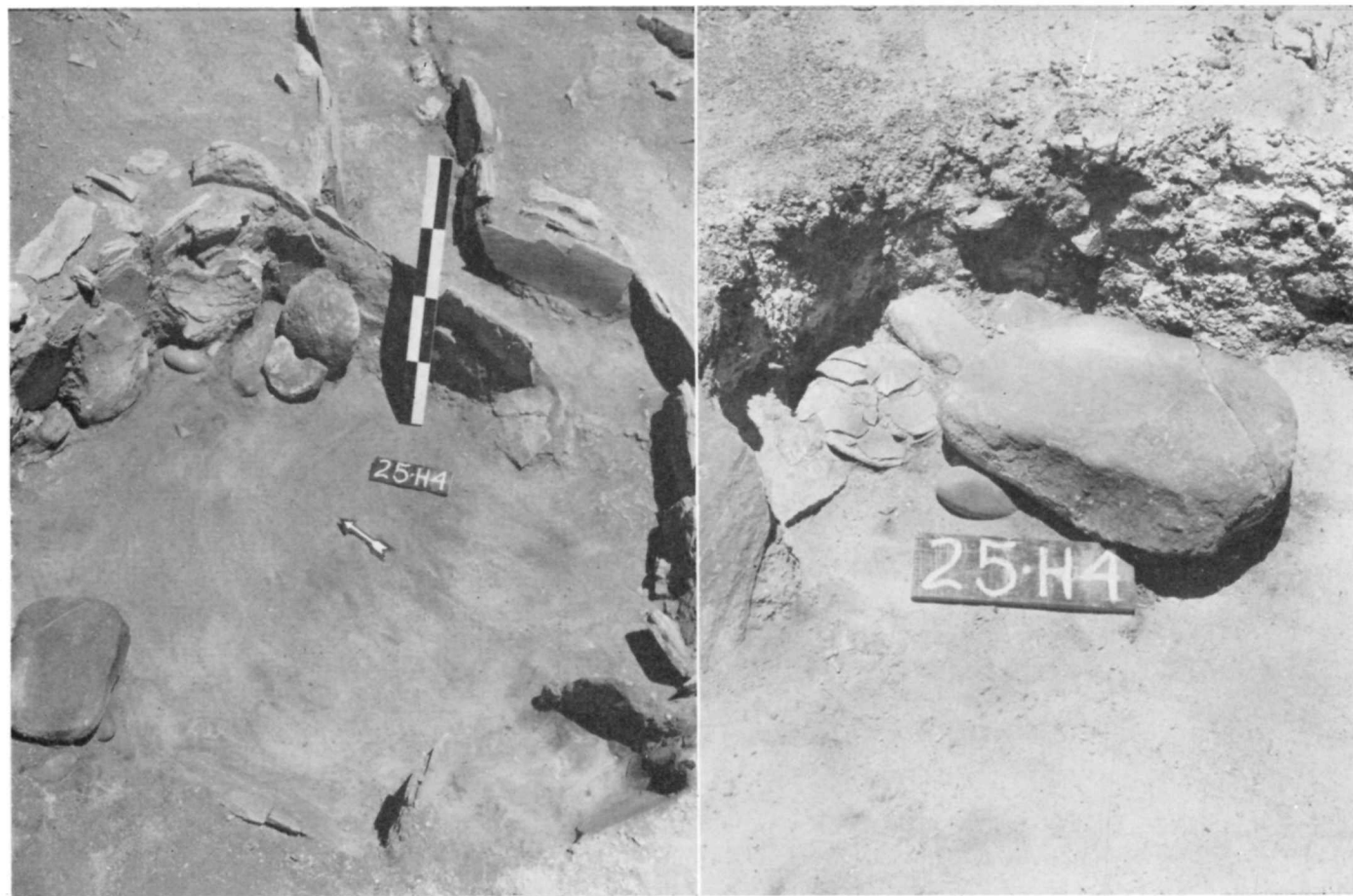


FIGURE 10. *Left, House D. Right, Detail of metate facing wall of house; note manos nearby and bowl in front of metate.*

Figure 11—House H

Walls: Vertical sandstone slabs. No plaster.

Entrance: Northeast side. Lined with vertical slabs. Charred branches and brush in fill, possibly remnants of roof.

Wing Wall: Single slab. Held in position with plaster.

Floor: Bedrock. Irregular areas leveled over with packed sand.

Hearth: None defined. Several burned areas on floor.

Storage Feature: Slab-sided bin outside house along south side of entrance. Contents of bin: 6 sherds of Adamana Brown.

Associated Floor Artifacts: Stone—manos (7); metate (1); sandstone discs (2); hammerstones (2); eccentric points (1). Pottery—bowls (2); neckless jar (1); tall neck jar (1); ladle (1); jar with undetermined neck (1). Sherds—Adamana Brown (75).

Fill: Wind-blown sand, numerous large sandstone slabs, charred material including juniper branches and foliage, and a few chunks of fire hardened clay.

Photograph: Figure 12.

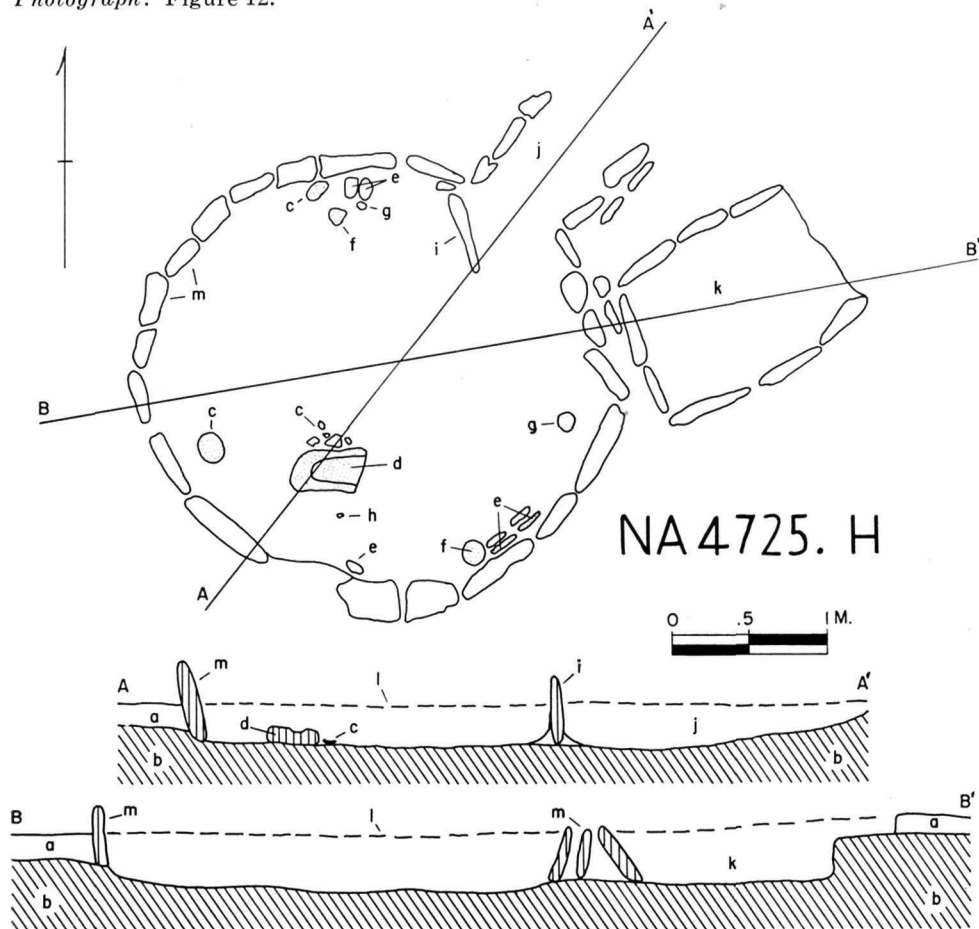


FIGURE 11. Plan and section of House H.

- a, Trash.
- b, Sandstone bedrock.
- c, Pottery vessel.
- d, Metate.
- e, Manos.
- f, Sandstone disc.
- g, Hammerstone.

- h, Eccentric point.
- i, Wing wall.
- j, Entrance.
- k, Storage bin.
- l, Surface prior to excavation.
- m, Vertical sandstone slabs.

FIGURE 12. *House H.*Figure 13—*House J*

Walls: In part vertical slabs. Elsewhere bedrock.

Entrance: Northeast corner. Slab-lined.

Floor: Sandstone bedrock.

Hearth: None.

Associated Floor Artifacts: Stone—manos (3); metate (1); core (1); sandstone disc (1); projectile point (1); stone ball (1). Sherds—none from floor.

Fill: Almost completely filled with large sandstone slabs.

Remarks: Note position of metate.

Photograph: Figure 14.

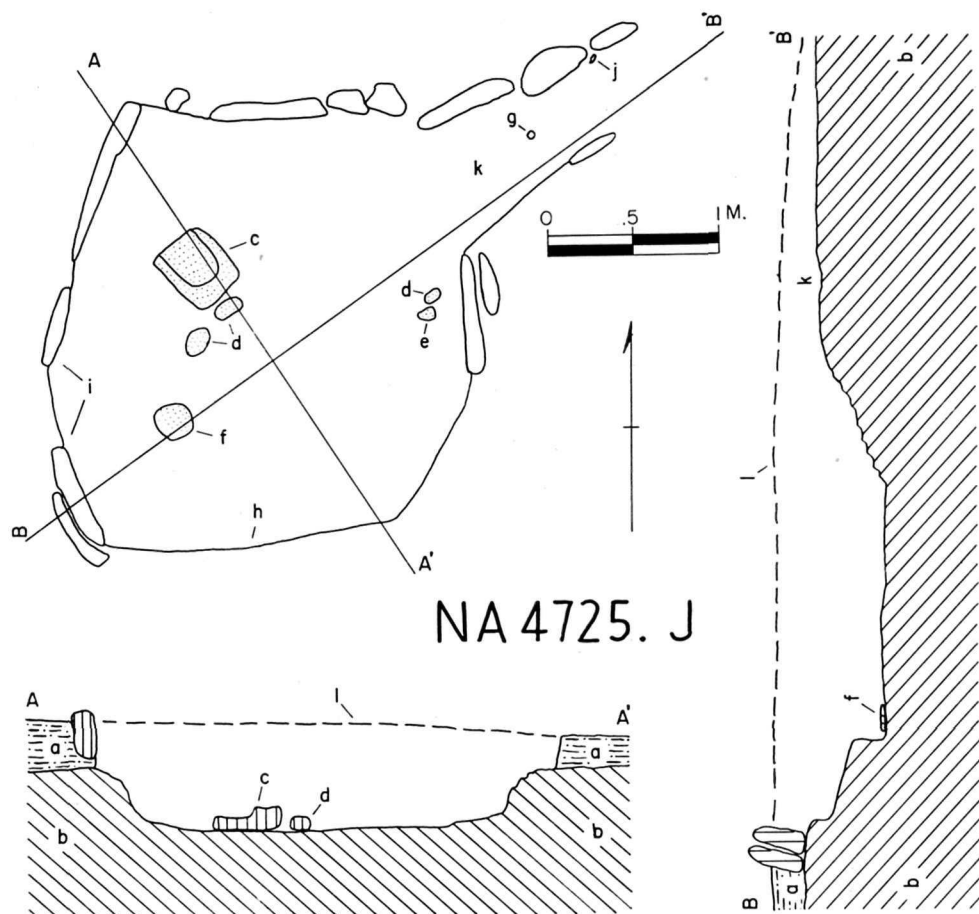


FIGURE 13. Plan and section of House J.

- a, Trash.
- b, Sandstone bedrock.
- c, Metate.
- d, Mano.
- e, Petrified wood core.
- f, Sandstone disc.
- g, Stone ball.
- h, Edge of house.
- i, Vertical sandstone slabs.
- j, Projectile point.
- k, Entrance.
- l, Surface of ground prior to excavation.



FIGURE 14. *House J.*

Figure 15—House L

Walls: Vertical slabs.

Entrance: Northeast side. Slab-lined.

Floor: Sandstone bedrock.

Hearth: None. Burned area against south wall opposite entrance.

Associated Floor Artifacts: Stone—manos (3); metates (2); hammerstones (4); sandstone disc (1); chipped blade (1). Sherds—Adamana Brown (38); sand tempered brown (8).

Fill: Wind-blown sand, few chunks of adobe and several large sandstone slabs.

Photograph: Figure 16.

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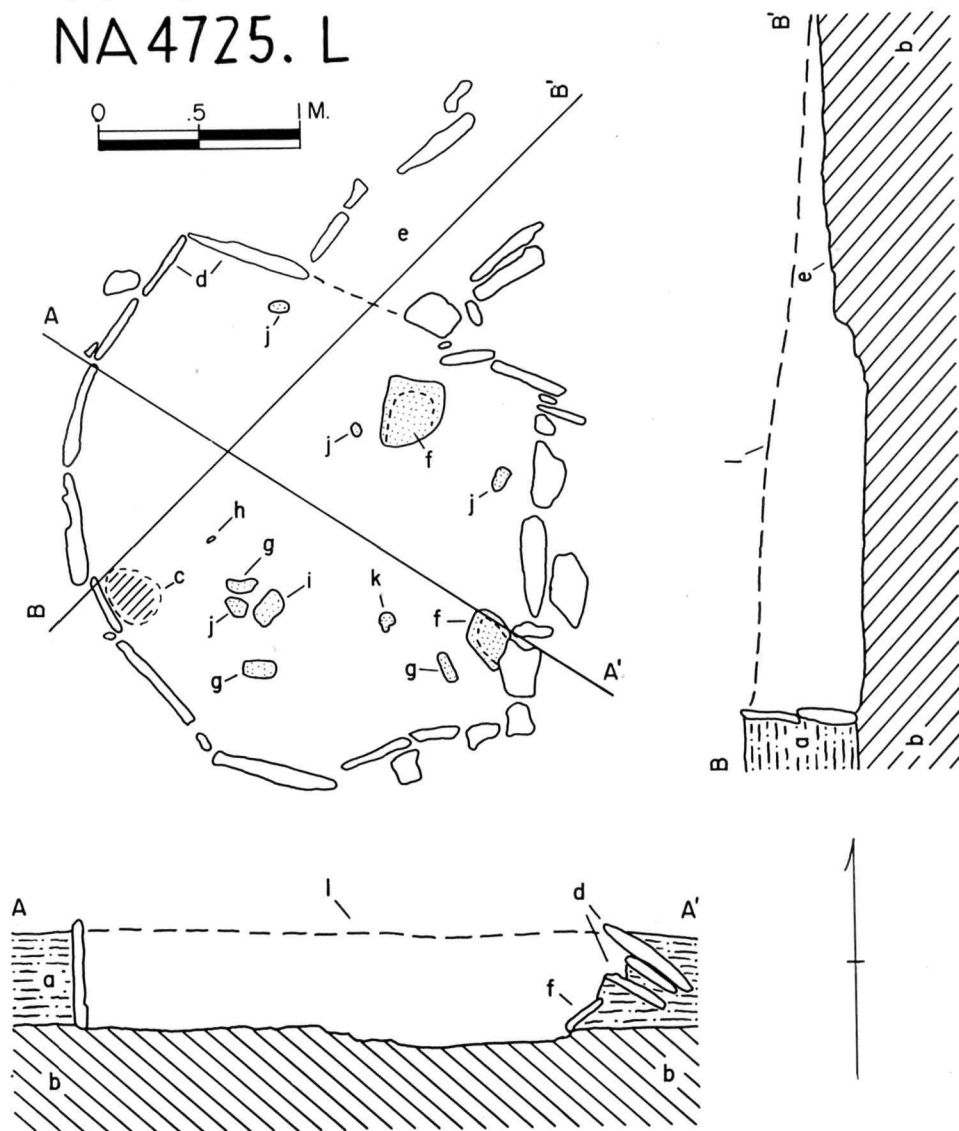


FIGURE 15. Plan and section of House L.

- | | |
|--------------------------|---|
| a, Trash. | g, Mano. |
| b, Sandstone bedrock. | h, Chipped blade. |
| c, Burned area on floor. | i, Sandstone disc. |
| d, Vertical slabs. | j, Hammerstone. |
| e, Entrance. | k, Human right ilium and head of femur. |
| f, Metate. | l, Surface of ground prior to excavation. |



FIGURE 16. *House L.*

Figure 17—House M

Walls: Slab-lined.

Entrance: East side.

Floor: Sandstone bedrock. Levelled off in some areas with sand.

Hearth: None inside house.

Associated Floor Artifacts: Stone—hammerstone (1); sandstone disc (1); chopper (1).
 Sherds—none from floor.

Fill: Wind-blown sand and several large sandstone slabs.

Remarks: Note the slab-lined hearth located outside house.

Photograph: Figure 18.

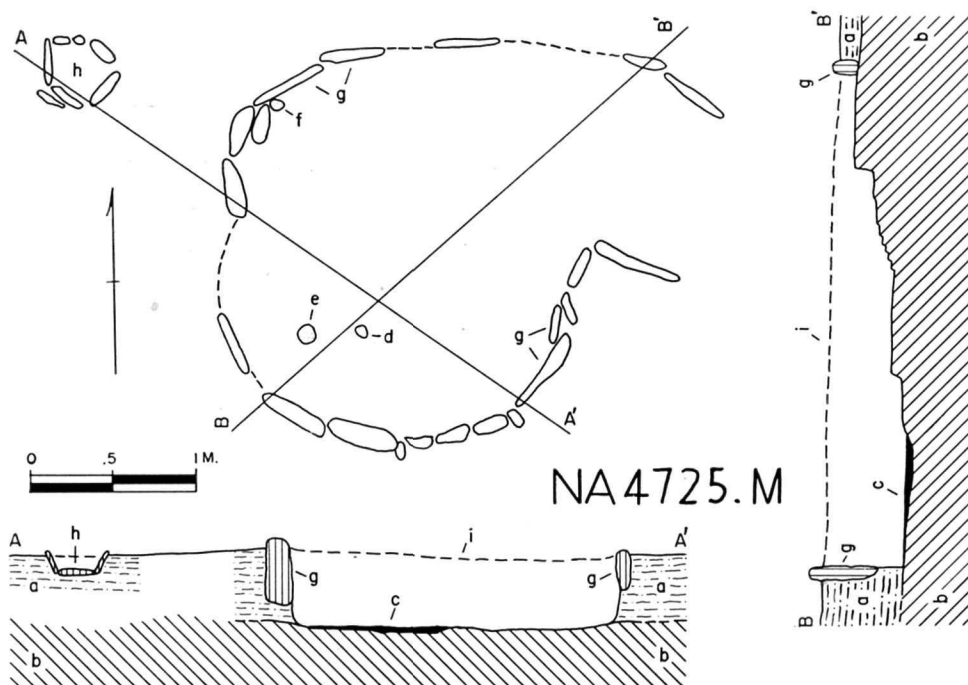


FIGURE 17. Plan and section of House M.

- a, Trash.
- b, Sandstone bedrock.
- c, Packed sand floor.
- d, Hammerstone.
- e, Sandstone disc.
- f, Chopper.
- g, Vertical slabs.
- h, Slab lined hearth.
- i, Ground surface prior to excavation.



FIGURE 18. *House M.*

Figure 19—House N

Walls: Vertical sandstone slabs, crude attempts at coursed masonry. West side not clearly defined.

Entrance: None located.

Floor: Packed sand.

Hearth: Shallow basin filled with reddish sand. Four cobbles rest on top of sand framing ash area in center. Slight extension of pit on north side covered with flat slab and incomplete stone bowl.

Associated Floor Artifacts: Stone—flake knife (1); projectile point (1); stone bowl (1). Sherds—Adamana Brown (17); Alma Plain (5); sand tempered brown (1).

Fill: Trash, wind-blown sand. No slabs except one isolated example near surface and in vertical position located in the approximate center of room. (Exact location not recorded.)

Remarks: House may have served specialized purpose, i.e., community house. Not in use when village abandoned, note vertical slabs above wall in Figure 20. (Just north of A in Figure 19.)

Photograph: Figures 20 and 21.

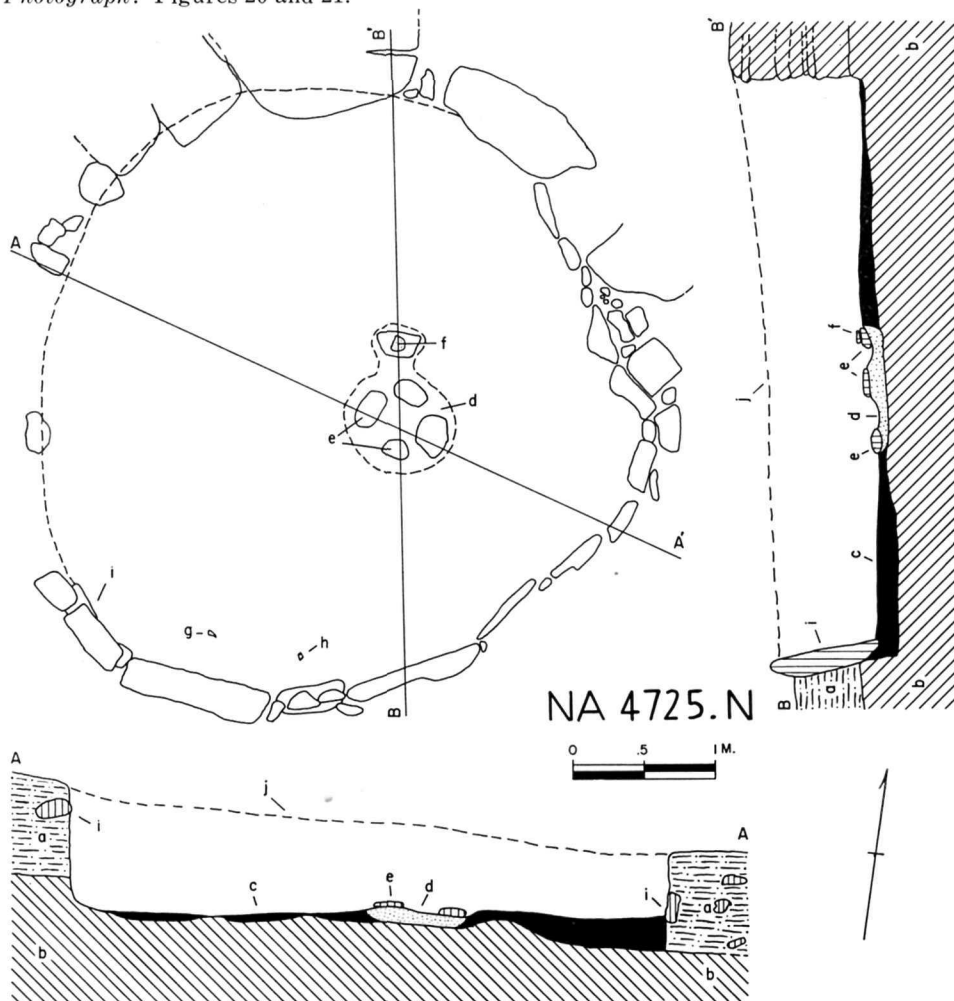


FIGURE 19. Plan and section of House N.

- | | |
|--|---|
| a, Trash. | f, Incomplete stone bowl. |
| b, Sandstone bedrock. | g, Flake knife. |
| c, Packed sand floor. | h, Stone projectile point. |
| d, Hearth, dotted line indicates edge. | i, Vertical and horizontal wall slabs. |
| e, Hearthstones. | j, Surface of ground prior to excavation. |



FIGURE 20. *House N.*



FIGURE 21. *Detail of hearth in House N.*

Figure 22—House P

Walls: Bedrock, sides of excavation. Partially slab lined.

Entrance: Northeast side. Slab-lined, probably covered. Charred brush and branches found in fill.

Floor: Irregular sandstone bedrock. Sharp edges removed by pecking. Leveled off with sand.

Hearth: None. Several burned areas apparent on floor, possibly resulting from burning of house.

Storage Bin: Outside of house along east side of entryway.

Associated Floor Artifacts: Stone—manos (16); metates (2); hammerstones (4); sandstone disc (1); notched stone (1); stone bowl (1); core (1); projectile point (1); chopper (1). Pottery—bowls (4); ladle (1); neck ring (1); pitcher (1); neckless jars (5); short neck jars (2); effigy (1); tall neck jar (1); indeterminate jars (5). Sherds—Adamana Brown (981); fiber tempered vessel (1).

Fill: Wind-blown material, burned clay, juniper brush and branches, an occasional large slab.

Remarks: House burned.

Photograph: Figure 23.

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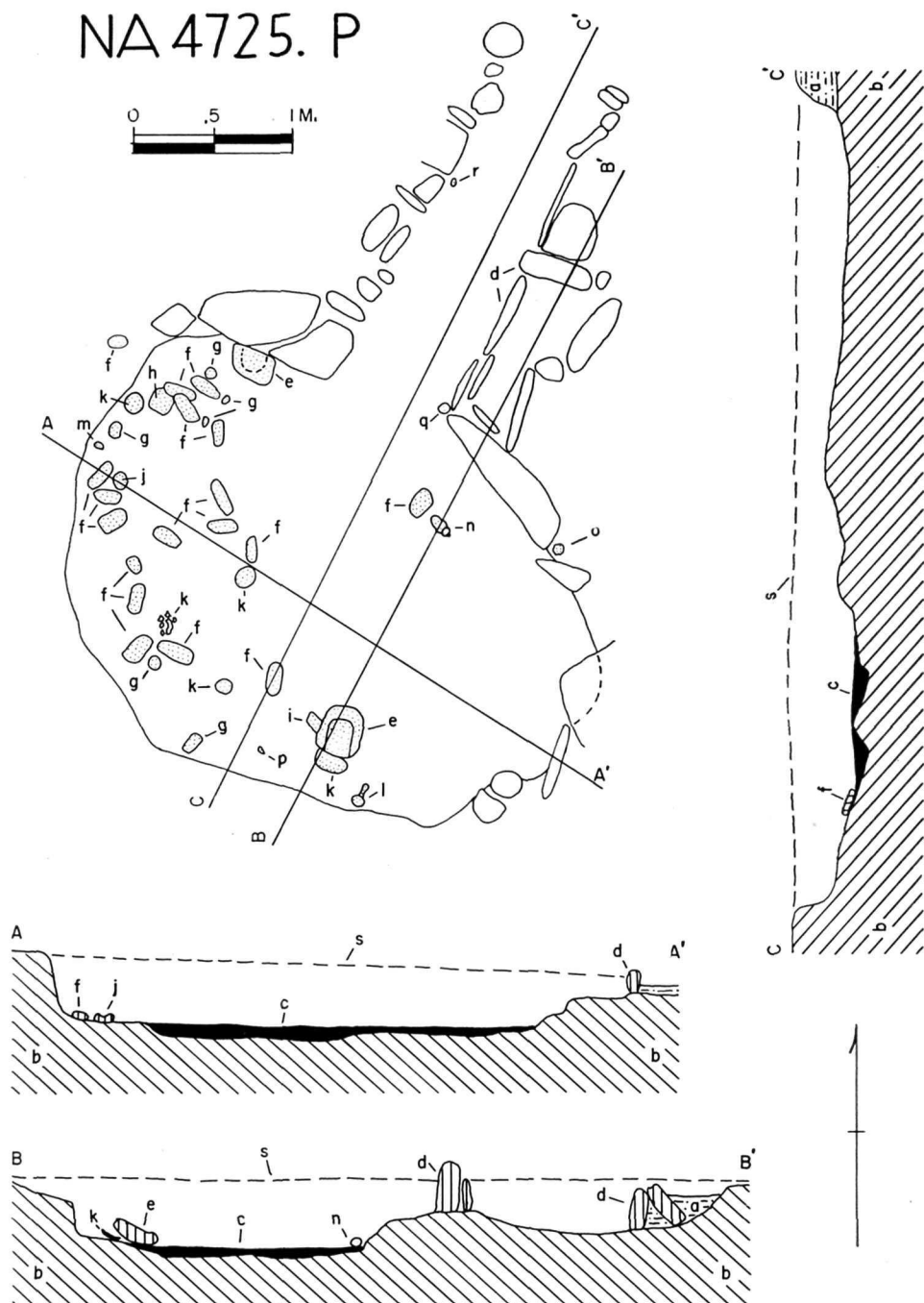


FIGURE 22. Plan and section of House P.

- | | | |
|-----------------------|-------------------------|---------------------------------|
| a, Trash. | i, Notched stone. | p, Incomplete projectile point. |
| b, Sandstone bedrock. | j, Stone bowl. | q, Chopper. |
| c, Packed sand floor. | k, Pottery vessel. | r, Quartzite pebble. |
| d, Vertical slabs. | l, Ladle. | s, Surface prior to excavation. |
| e, Metate. | m, Fiber tempered bowl. | t, Cist. |
| f, Mano. | n, Duck effigy. | |
| g, Hammerstone. | o, Petrified wood core. | |
| h, Sandstone disc. | | |

FIGURE 23. *House P.*

COMMENTS

While the small size of the foregoing houses is somewhat surprising, that they served a domiciliary purpose seems amply demonstrated by the amount of cultural material found on their floors.

Each house, while shallow, averaging fifty centimeters in depth, was partially excavated into the underlying bedrock. Such quarrying, though requiring considerable effort, was facilitated by the tendency of the rock to scale off in sheets an inch or more in thickness and time-cost factors were presumably of little importance to the builders. It is to be noted, however, that on occasion the more consolidated sections of the bedrock were left in position. In such cases the face of the rock was dressed by pecking until a smooth, rounded surface was obtained. Then fine, clean sand was spread over the floor to even off the remaining irregularities. It seems undeniable, in view of the difficulties which they were forced to overcome, that the pit house was a well-established trait in the culture of the Flatop people.

Unfortunately, details of superstructure associated with these basal outlines could not be accurately determined from our excavations. It is possible that the vertical roof supports were simply rested on the bedrock floors without any attempt being made to carve special receiving holes for them. Some data on the general nature of the side-walls and roofs were obtained, however, from those houses that had burned. In them we found the remains of numerous small branches overlain by smaller twigs and brush. A few chunks of burned clay were also noted which suggested that

at least a portion of the superstructure was of brush and mud construction. In addition, numerous large, thin sandstone slabs were found in the fill of the houses resting on top of the roof debris. It is possible that these slabs served as weights on the walls and roofs holding the lighter brush in position. Such an arrangement would be beneficial during most of the year, as high winds often whip across the mesa. To my knowledge, however, use of the slabs for this purpose has not been noted elsewhere in the Southwest, cautioning us to remain alert for other explanations.

Other inferences regarding the general character of the superstructures may be drawn from the arrangement of the artifacts, particularly metates, on the house floors. Ordinarily in both modern and prehistoric (See, for instance, Mindeleff, 1891, Plate LXXXVI) pueblos metates were placed so that the person using them would face into the room. From this position the millers received the maximum amount of light and could also observe the goings-on in the room and interact normally with the other occupants. In contrast, in the Flattop houses those metates found in an upright position and with manos conveniently nearby were located so that the person using them faced into a corner or wall and away from whatever light was available inside the house. The positions of these metates suggest that better light was available near the walls than elsewhere in the house. Windows or other formalized wall openings may be indicated. As is intimated by the physical remains discussed above, however, the superstructures of these houses may not have been of too substantial nature. Should this supposition be correct, then it is probable that light coming in from outside through the more or less open superstructure accounts for the peculiar placement of the metates in the Flattop houses. Under such conditions these locations would not only give the person using the metate full advantage of the light, but at the same time allow observation of the other activities in the village.

Of perhaps more far-reaching significance is the possibility of only seasonal occupation of the village. When it is considered that with the exception of House N, there were no fire hearths inside the houses, the possibility arises that the houses were not occupied during the disagreeably cold winters of the area. Perhaps they were comparable structures to the temporary houses erected by the Hopi and Zuni near their fields during the summer months (See Mindeleff, 1891, pp. 217-219). If this be so, then we have no data at present either on the location or nature of the winter homes of the Flattop people. But, it should be remembered that standards of comfort among primitive groups differ markedly from those in our own culture and our judgments on matters such as these are necessarily biased.

It is possible that heating and perhaps minor cooking were done at the numerous but ill-defined ash areas noted on the floors of many of the houses. None of these, however, gave any indication of prolonged use, suggesting that most of the cooking was done outside of the houses at small fire pits and hearths similar to that excavated alongside House M. Several other apparently similar fire pits were noted around the village area, but they were not sufficiently numerous to warrant a suggestion that each house was equipped with an exterior fireplace.

The curious wing walls noted in two of the houses (See Figures 9 and 11) suggest further comment. In House H the wing wall consisted of a single vertical slab resting on top of the rock floor and plastered into place. The arrangement in House D was more complex because the major slab was reinforced at its base by a series of smaller slabs set on each

side of and parallel to the wing slab. Plaster was then applied to hold the wing wall in position. In both cases the wing walls jutted out into the room from the northernmost junction of the entrance and the house proper and were too high to be conveniently stepped over, thus forcing those entering the house to maneuver around them. The probable function of these wing walls remains in doubt. They may have served as deflectors protecting the interiors of the houses from direct draft, but regardless of their function, they appear to be unique, perhaps a local innovation which for some reason was not generally adopted elsewhere.

The partition walls often found in early Anasazi pit houses (Brew, 1946, Figure 27) are perhaps the closest parallel. These Anasazi partition walls were constructed of either vertical slabs or clay and divided the house into two unequal parts; the smaller part including that portion where the lateral entrance or ventilator entered the room. The function of these walls has never been conclusively determined, but it has been suggested (Morris, 1939, p. 25) that they initially may have served to mark off that portion of the house where ceremonies were performed from the area where the secular activities were conducted. It is apparent that these partition walls are significantly different from the wing walls on the Flattop houses inasmuch as the wing walls do not divide the house.

From a comparative point of view these houses have few parallels with known house types elsewhere in the southwest. In part, this may be attributed to the temporary nature of the structures and perhaps to the shallow depth at which the underlying bedrock lay beneath the surface. Pit houses excavated into bedrock which in many respects parallel these from the Flattop Site are, however, also reported by Haury and Sayles (1947) from the Bluff Site. At this site two Phases were defined, the earliest or Hilltop and a later or Cottonwood Phase. Minor architectural differences were noted between the two Phases: principally, that the later houses were framed by vertical slabs while those of the earliest Hilltop Phase had bedrock walls. Haury and Sayles in evaluating this situation ascribed the use of vertical slabs in the Cottonwood Phase pit houses to Anasazi influence. It might be questioned, however, whether or not the use of these slabs in both the Flattop houses and those from the Bluff Site, might more reasonably be attributed to a local functional rather than a wider cultural inspiration. In so far as the Flattop Site is concerned, sandstone slabs were the most conveniently available means of retaining the loose sandy soil surrounding the house pits. It is interesting to note that slab walls were used at the Bluff Site in those admittedly later houses constructed after a loose, sandy, trash impregnated soil had accumulated.

Although little work has been done in Anasazi house sites contemporary with these from the Flattop and Bluff Sites, one site, excavated by Morris near Durango, Colorado, had several Basket Maker II houses which are probably coeval or slightly earlier than these from the Flattop Site. Here, instead of being of slab construction, Morris found the walls to be of logs laid horizontally in crib fashion (Morris, letter dated 15 February 1951). Indeed, one can hardly even call them pit houses, although, in order to obtain a level floor, one end of the house had been dug into the hillside. The true pit house appears in that same general area, on the Mesa Verde, at a slightly later date, during Basket Maker III, when both slab-sided and simple earth-walled shallow pit houses are found (O'Bryan, 1950, pp. 55-61). At Shabik'eschee, in Chaco Canyon, Roberts (1929) found most of the houses were slab-lined, but again of Basket Maker III date. Elsewhere in the Anasazi area, moreover, slab-sided houses are rare

(See, for instance, Colton, 1946, pp. 101-102) although slab-sided storage rooms and cists are common.

According to Morris (letter dated 15 February 1951) there are but few parallels between the Basket Maker II houses he excavated near Durango and those found in slightly later Basket Maker III sites in the same area. While it must be realized that considerably further work must be done in Basket Maker II house sites before adequate comparative data will be available, Morris' work does suggest that radical architectural change marks the beginning of Basket Maker III. Whether this modification can be attributed to the same source or sources that stimulated the development of ceramics among the Anasazi is not clear from present evidence.

The use of slabs in framing Anasazi houses has not been demonstrated to have an antiquity prior to the introduction of pottery in that group although it was a common architectural device employed on Basket Maker II storage cists. Since there is good evidence (see following section) to postulate a date for the Flattop Site as approximately contemporary with Basket Maker II, it consequently seems probable that the use of slabs in the Flattop houses cannot, from present known data, be attributed to Anasazi influence unless the slab-sided cist played a major role in formulating pit house architecture. This possibility cannot be completely eliminated, but the effect of the surrounding soils, the depth of the structure, and perhaps other factors should receive ample consideration before the responsibility for the use of slab frames be attributed to outside cultural inspiration.

Instead of excavating sub-floor pits into the bedrock, as is common in Mogollon houses, storage at the Flattop Site was provided by erecting slab-sided bins or cists, similar to those employed by contemporary Basket Maker II groups living farther north. While originally it was felt that these people merely found it more convenient to erect bins rather than excavate pits in the bedrock, this explanation now seems doubtful. Examination of other Flattop Phase sites in this area disclosed that the slab-sided bin was not confined to those localities where bedrock immediately underlay the surface. Therefore, it seems reasonable to suggest that the slab-sided cist was a consistent architectural feature of this group and, further, that it may have been borrowed by the Flattop people from the Anasazi. Although conceivably, the Anasazi might have received the idea for the slab cist from the Flattop group, the widespread occurrence of this feature among the Anasazi argues against such a possibility. In this connection we should note that beyond the common use of slabs in some early Basket Maker III houses and the Flattop houses there are few resemblances between the two groups. On a general level they are comparable in that both are shallow pit houses but specific parallels are absent. For instance, the Flattop houses lack antechambers, deflectors, specialized fire pits, *sipapus* and partition walls, all of which are found repeatedly in Anasazi Basket Maker III pit houses. It remains to be determined if these Basket Maker III features are also present in earlier Anasazi houses. We cannot, however, attribute many specific features of the Anasazi pit house to influence from the Flattop people.

Similarly, although both the Bluff and Flattop Sites have many basic architectural resemblances, such as use of lateral entrances and general shape and size, there are significant differences between the architecture of the two sites. The houses at the Bluff Site were in general more complex, with fire hearths, clay-lined storage bins, post holes, sub-floor pits

and floor grooves, all of which were again lacking in Flattop houses. Whether these differences are symptomatic of the possible seasonal nature of the Flattop houses or can be attributed to cultural factors must await excavation in other Adamana sites. It should be noted, however, that farther south in the Mogollon area, houses at the SU (Martin, 1943), and Cave Creek (Sayles, 1945) sites have even fewer resemblances to these houses at Flattop Site. They are larger, possess numerous sub-floor storage pits and lack slab sides. Specialized fire pits, however, apparently were not a consistent feature in the houses at the SU Site (Martin, 1943, p. 115).

West of the Petrified Forest in the area around Flagstaff, Arizona, an early ceramic group has been identified and termed Sinagua. Sites ascribed to this group contain plain brown pottery made by the paddle and anvil technique, as was the Adamana pottery at the Flattop Site. In the earliest site of this group thus far excavated, located near Cinder Park north of Flagstaff, three shallow pit houses were uncovered which in general outline are reminiscent of the Flattop houses. They were roughly oval to circular in outline and were entered through a long, slightly inclined entryway. Beyond this, however, again there are few parallels. For instance, the Cinder Park houses lack the slab framing of the Flattop houses, and have fire pits, deflectors, and, occasionally, sub-floor pits (Colton, 1946, pp. 243-247). Houses contemporary with these from the Flattop Site have not yet been excavated, however, in the Flagstaff area. We may expect that earlier Sinagua houses might differ significantly from those excavated at Cinder Park.

Houses among the early Hohokam, particularly the earlier phases in the Pioneer Period, show few parallels to these from the Flattop Site. Although shallow and entered through a long, slightly inclined entryway, they were rectangular rather than circular in outline and possessed fire pits and multiple roof supports.

House N, because of its somewhat larger size, greater depth, specialized hearth, and the apparent absence of a lateral entrance requires special comment. In many of the early Mogollon and Hohokam sites¹ excavated farther south it was found that one structure because of its size and other features stood apart from the other houses in the village. Generally, these distinctive houses were very large, so large that the term "Great House" (Gladwin, 1950, p. 123) has been applied to them. Haury (1950b) has recently suggested that the idea of the Great Kiva of the White Mountain area of east central Arizona could be traced to these "Great Houses." However, House N, although larger than the other houses in the village, either excavated or visible on the surface, is considerably smaller than these Mogollon "Great Houses." On the other hand the distinctive features of the house do set it off from its neighbors and suggest the possibility that it had a special function, perhaps communal, and thus was a counterpart of the Hohokam and Mogollon "Great House."

POTTERY

METHODS OF CLASSIFICATION

In Figure 24 is depicted in chart form the provenience of all of the pottery from the Flattop Site except that found on the surface. With the exception of eighty-three sherds all pottery recovered from excavations at the Flattop Site was classified as one type: Adamana Brown (Mera, 1934, p. 4).

¹ Haury, 1936, pp. 8-21; 52-63; 1940, pp. 43-47; Haury and Sayles, 1947, pp. 21-24; Gladwin, 1948, pp. 112-123.

As a routine procedure in the laboratory all sherds were washed, numbered as to location found and megascopically segregated by type. In order to determine vessel shapes all broken vessels were repaired and the remaining sherds were re-examined to determine if other vessel shapes were indicated which were not represented in the repaired vessels. With the aid of a binocular microscope the collection was again examined for peculiarities of paste and temper. In the final counts all sherds were tabulated including those which were utilized in repairing vessels. Those sherds found within fifteen centimeters of the floor were classified as floor sherds, the remainder, as fill. Not included in these totals are some twelve hundred sherds found on the surface of the site. Although considerable effort was made to collect all such sherds, a re-examination of the site following the close of excavations disclosed an undetermined number of sherds on the surface, evidently exposed by subsequent erosion. Included in the original surface collection were fifteen black-on-white and corrugated sherds of early Pueblo III types. Most of these sherds were found in a restricted area away from the main concentration of the village. It is believed they were brought to the Flattop from an adjacent mesa where an early Pueblo III ruin is located.

TECHNOLOGY

Mera (*Ibid.*) in naming Adamana Brown, also described it in detail. For the benefit of those who are unable to consult Mera's work, his description is repeated below:

The pottery is a mediumly coarse-textured ware ranging in color, with considerable variability from a light warm gray, through a tan to, when highly fired, a light red. A more exact definition of color may be obtained from consulting the Dictionary of Color (Maerz and Paul, 1930), where color blocks (pl. 13, 1-A; pl. 14, 7-E; pl. 4, 10-B) will give some idea of the range.

HOUSE	SHERDS						RESTORABLE VESSELS										
	ADAMANA BROWN		SAND TEMPERED		ROCK TEMPERED		DEEP BOWLS	FLARE RIM BOWLS	SHALLOW BOWLS	NECKLESS JARS	TALL NECK JARS	SHORT NECK JARS	LADLES, FORM "A"	LADLES, FORM "B"	PITCHERS	EFFIGIES	JARS, NECK UNKN.
	FLOOR	FILL	FLOOR	FILL	FLOOR	FILL											
A	176	22															
D	387	28		4						2	2			1			
H	75	207					1		1	1	1		1				
J		136		49		13											
L	38	78	8	6													
M		68		2													
N	17	108		4	6	3											
P	981	106					3	1		5	1	2	1		1	1	5

FIGURE 24. Chart showing location of sherds and restorable vessels from the Flattop Site.

PASTE: Microscopically, the paste has a dense and homogeneous appearance but has little tensile strength, being easily fractured and somewhat friable. In color it conforms to the surface to which it is contiguous. The temper used is a fairly coarse water-worn sand containing numerous flecks of mica, the occurrence of which on all surfaces is a distinguishing feature of the type. As the mica has a decidedly nacreous cast, it strikingly resembles fragmentary mussel shell. (See comment in Appendix I, pp. 190-191.)

FINISH: Exterior surfaces of jars and both surfaces of bowls are usually well smoothed but show little attempt to produce a polish. The interiors of jars especially, present an uneven appearance like that produced by the paddle and anvil process of shaping, so, at the moment, it is presumed that this method was employed.

DECORATION: Only two sherds out of the entire amount collected at all sites indicated an attempt at decoration. These had remains of a fugitive red wash still adhering to their surfaces. If this was a common practice, weathering has destroyed all traces in the bulk of surface material.

FORMS: Fragments of both jars and bowls were collected, a number of which demonstrated the forms of rims used. These were, for both classes, of the direct kind with no flaring but in a majority of cases noted there was a tendency to taper abruptly at the edge. The sides of bowls are judged to have had only a limited degree of flare and the vessels a considerable depth in proportion to the diameter. Wall thicknesses lies on an average between $\frac{3}{16}$ and $\frac{3}{8}$ of an inch.

Although Mera's work is based entirely on surface material, our excavations, except in the range of vessel forms and technique of manufacture add but little to his descriptions.

VESSEL SHAPES: Deep hemispherical bowls (Fig. 25e); globular jars with restricted orifices, no necks (Fig. 25j); large, slightly elongated, globular jars with tall vertical or slightly tapering restricted necks (Fig. 25h); ladles with attached cylindrical handles (two present) (Fig. 25b); small globular jar with short restricted neck (one represented) (Fig. 25j); small jar with elongated bodies and tall slightly flaring, restricted neck (one represented) (Fig. 25c); ladles with tapering handles (one represented) (Fig. 25a); shallow bowl (one represented) (Fig. 25d); deep bowl with flared rim (one represented) (sherds only); duck effigy (one represented) (Fig. 25i).

RIM FORMS: Simple, direct.

MANUFACTURING TECHNIQUE: Examination of the restored vessels disclosed that the vessel walls on most were marked by a slight swelling completely encircling the vessel a short distance above the base. Apparently the base was directly shaped by hand while the sidewalls above the base were constructed by coiling. The base of at least one vessel had been molded in a basket. Note basket impression beneath scalloped exterior surface of sherd in Figure 26. The slightly irregular interior surface continues above the molded portion. The general appearance is highly suggestive of paddle and anvil manufactured pottery. A few sherds, however, show smearing on their interiors. Apparently on those vessels the potter had wiped the vessel interior with her hands before it had dried.

A sub-type, Adamana Grooved (Figure 27b, c and e), represented by three sherds, also was found at the site. Similar to Adamana Brown in all respects but exterior finish, this sub-type has on the exterior broad deep grooves emphasizing the coils from which the pottery was made. This seems to have been achieved through the aid of a blunt tool and may be considered a variety of incising. Striking parallels between Adamana Grooved and some early Hohokam pottery are evident (Compare with Gladwin, et al., 1937, Plate XLXXXVII).

A second sub-type, Adamana Incised, was represented by only one sherd (Figure 27f). On this example the simple and geometric design was cut into the smoothed exterior surface before the clay had completely dried.

NON-ADAMANA POTTERY. Scattered in the fill and on the floors of six houses were ninety-five plain brown potsherds which in general appearance and character of paste could not be classified as Adamana Brown. No restorable vessels of Non-Adamana pottery were found. The distinctiveness of these sherds was not recognized until detailed laboratory studies had been conducted and consequently in the preliminary report on this site (Wendorf, 1950b, p. 49) no mention was made of the Non-Adamana sherds.

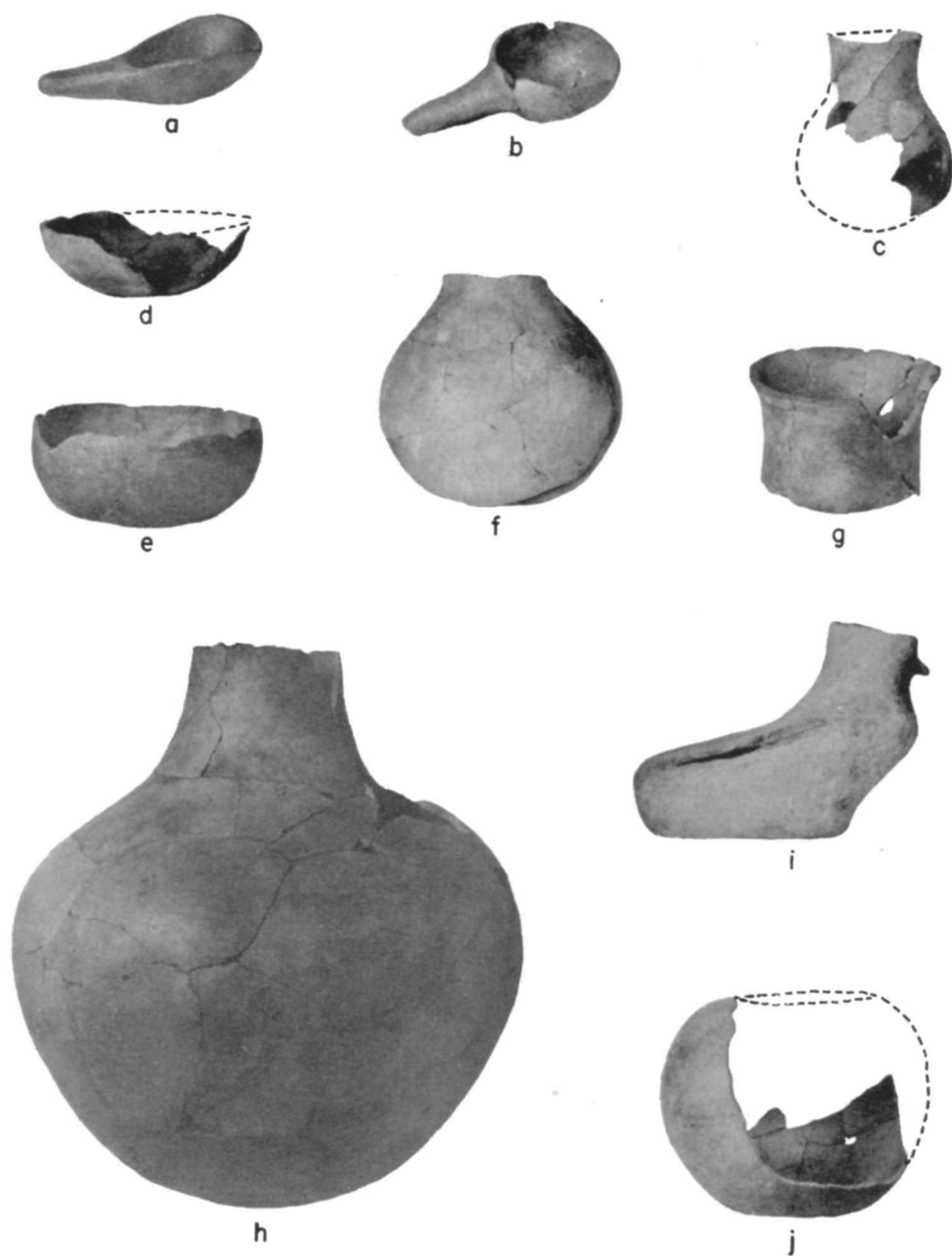
FIGURE 25. *Adamana Brown Vessels.*



FIGURE 26.

Sherd of Adamana Brown showing traces of basket impression beneath smoothed surface.

Miss Anna O. Shepard kindly consented to examine these sherds as well as a sample of the type Adamana Brown. Her preliminary findings are recorded in Appendix I (pp. 190-191).

NON-ADAMANA POTTERY—COMMENTS. Although there are important paste differences between Adamana Brown and the Non-Adamana sherds, perhaps more significant was the method of manufacture. The Non-Adamana sherds were finished by scraping and thus differ from the paddle and anvil finished Adamana Brown.

As we have indicated in the introductory section, all pottery which had been finished with the paddle and anvil has been grouped together to form a single ceramic tradition. Similarly, that pottery finished by scraping has been typologically grouped into a separate ceramic tradition. The important technological differences separating these two traditions survived into historic times with the paddle and anvil used by the so-called "Desert tribes"—Pima, Papago and Yuman groups—and scrape-finished pottery among the Pueblos—Hopi, Zuni, Acoma and Rio Grande.

The distinctiveness of the two methods are apparent from the following description of modern pottery making:

1) San Ildefonso (Rio Grande) scrape-finished (Guthe, 1925, pp. 13-14)

The potter first forms a pancake-shaped pat of paste from six to eight inches in diameter; this she presses into the mould, or puki, to form a base. Then the walls of the vessel are built up by the addition of successive ropes, or rolls, of paste laid one upon another. The small bowls are the only exception, for they are formed in the hands of the potter from a single lump. In some cases the building is done all at one time; in others, and always with the larger vessels, a few rolls are added, then the piece is set aside to dry a little before the addition of a few more rolls. The potter usually builds two or more vessels at once in order to permit work upon one while the other is undergoing a brief period of drying. The preliminary shaping of the vessel is done either in the course of the building or after the building has been completed. The obliteration of the junctions between the rolls and of finger-marks is accomplished with the kajepe, or gourd-spoon, and further use of this implement aids in giving the vessel its shape. The final step, the finishing, consists of going over the entire vessel carefully, first with the kajepe, then with the fingers, to remove slight irregularities and to even the lip and rim.

2) Cocopa (Colorado River) Paddle and Anvil finishing (Gifford, 1928, pp. 354-355)

The paste (clay and powdered sherds, as temper) was kneaded into a biscuit and worked and patted between the hands into a slightly concave-convex disk, four

inches in diameter and three-quarters inch thick. The disk was placed on the mushroom-form anvil, which had been dipped in the temper to prevent the paste sticking to it, held in the left hand, and patted with a wooden paddle, with a blade four by four inches in size. The result of this manipulation was a shallow saucer, five inches in diameter and about one-quarter inch thick, at least near the periphery. The saucer was then placed on the potter's left knee, she sitting cross-legged.

The potter then prepared a foot-length cylinder of clay by rolling it out between her hands as she held it suspended vertically. This was of three-quarters inch diameter and proved to be of just the right length for one circuit of the edge of the growing vessel. It was pinched on to the edge with the fingers. The new edge was rubbed with the fingers moistened with water. The anvil was now held vertically within, the vessel's side wall resting on it, to resist the blows of the paddle in the thinning process. The vessel was held on its side on the right knee and revolved to bring each part over the anvil. A bit of the edge which proved too high after the patting process was pinched off with the fingers.

The process of adding concentric coils was continued until the vessel was complete.

The pre-Spanish distribution in the Southwest of paddle and anvil finished pottery includes the Colorado River area and Baja California (Yuman), the lower Gila-Salt drainages (Hohokam), the Verde Valley and northward to the San Francisco Peaks (Sinagua and Cohonina), and eastward from there to the Petrified Forest. Throughout this entire region our present evidence indicates that the earliest, and in some cases the only, pottery made was finished with the paddle and anvil. Outside of the Southwest paddle and anvil pottery is known only to the north and east in sites that have been classified as "Woodland." This technique evidently never spread southward any great distance into Mexico for only scrape-finished pottery has been reported from that area.²

East of the area characterized by paddle and anvil finished pottery, particularly in the mountainous region of what is now eastern Arizona and western New Mexico, the earliest pottery was finished by scraping. The resemblance in manufacturing technique employed in this portion of the Southwest to that farther south in Mexico may indicate a historical relationship between these two areas characterized by scrape-finished pottery. The southwestern scrape-finished pottery may be a northern extension of the more highly developed and probably earlier centers farther south.

Most significantly, it would seem from this distribution that the early ceramic history of the Southwest cannot be a case of simple diffusion from a single source, but rather that two traditions were actively participating in this development. As we shall discuss later, our present evidence indicates that these two traditions appeared in the area at approximately the same time, but with the paddle and anvil pottery being confined to the western half of the area while the scraping technique spread into the mountainous central zone.

DATING THE FLATTOP SITE

The general character of the archaeological remains recovered from the Flattop Site, the simple, primitive pit houses, and the unpainted, unslipped, unsmudged and rarely decorated pottery, both suggest a simple and perhaps, though not necessarily, early archaeological complex. The major problem to be considered here lies not in determining the exact or approximate year or years represented by the occupation, for this is a

2. Woodland-like pottery also apparently reached the Southwest but at a later date (ca. 1100 A.D.), distinguished by paddle and anvil manufacturing technique(?), vessel forms and design (Hibben, 1949).

question involving dendrochronological techniques. In view of the current disagreement concerning the correct methodology to be followed in the tree ring dating it is doubtful if agreement could be reached. We are concerned, rather, in ascertaining the correct *relative* date of the site to others in the Southwest and in tracing the course, if not the time involved, in the development of Southwestern prehistory.

In the absence of tree ring dates the determination of the correct relative chronological position rests primarily upon ceramics. This is accomplished through the utilization of several lines of evidence: 1) chronological seriation of types; 2) cross dating through intrusive pottery; 3) negative evidence, i.e., the absence of particular pottery types; 4) stratigraphic evidence.

One of the most difficult and at the same time one of the most important problems is in connection with Anasazi pottery. At least by 600 A.D., and probably earlier, gray pottery, one of the diagnostic criteria of the Anasazi, was being manufactured in the northern part of the Southwest in what is now known as the Four Corners District. For many years much discussion and speculation has been concerned with the origin of this pottery. Some (Morris, 1927) have contended that it was an independent invention developed locally by the Anasazi, while others have argued that the Anasazi borrowed the trait from the already pottery-using peoples farther south (Haury and Sayles, 1947, pp. 61-62). A satisfactory resolution of the differences between these two contending groups has been hindered by the few tree ring dates available for the early southern pottery sites which could support the postulated early dates for that group prior to the appearance of gray ware pottery.

A solution to this problem was believed by many to have been found when Haury and Sayles excavated an early Mogollon village called the Bluff Site, located some fifty miles south of the Petrified Forest, and discovered brown pottery associated with tree ring material dated by the Douglass method in the early 300's of our era. Recently, however, Gladwin (1948, pp. 154-157) questioned this early date and suggested that it might more reasonably date in the 600's. Although the theoretical background which led to these differing dates from the same tree ring material need not concern us here, it is an important example of the possibilities for varied results with this technique. Fortunately, however, the Flattop Site can throw some light on this problem.

Adamana Brown, the principal component of the Flattop Site, has been reported from two relatively early Mogollon sites located south of the Petrified Forest: The Bluff Site (Haury and Sayles, 1947, pp. 55-56) and the Bear Ruin (Haury, 1940, p. 80). The first of these contained as intrusive pottery, in addition to the thirty-four sherds of Adamana Brown, seven sherds of Gila Plain of Hohokam origin and, in two late houses, three sherds of Lino Gray from the Anasazi. Haury and Sayles (*Ibid.*, p. 56) attached considerable significance to the absence of Anasazi intrusives in the early houses in the site. They suggested

... that although the early residents of the Bluff Site were making pottery, their northern neighbors were not.

In this instance "their northern neighbors" probably refers to the Anasazi, not to the makers of Adamana Brown since Adamana Brown was recorded from the earliest houses.

The possibility of contemporaneity of the Bluff and Flattop Sites seems evident: both lack Anasazi intrusives (the Bluff only in earliest levels)

and the Bluff Site contained as intrusive (trade) pottery small amounts of Adamana Brown.

As we have seen previously, however, there is considerable disagreement over the correct chronological position of the Bluff Site. It seems likely, in view of their possible contemporaneity, that arriving at a relative date for the Flattop Site will shed light on this controversy.

The Bear Ruin, the other site from which Adamana Brown has been reported, is probably contemporary with Anasazi Basket Maker III and perhaps early Pueblo I. It contained nine sherds of Adamana Brown, two hundred and five sherds and two restorable vessels of Lino Gray, four sherds of Lino Black-on-gray, sixty-seven sherds of White Mound Black-on-white, thirty-six sherds of Gila Plain and six sherds of Gila Butte Red-on-buff. There were also a large number of other brown and smudged types considered by Haury to be intrusive. The indigenous pottery was closely similar to the brown colored, scrape-finished ceramics found in the Twin Butte Site (See pp. 115-116). This association of Adamana Brown and typical Anasazi Basket Maker III and Colonial Hohokam ceramics strongly suggests that Adamana Brown lasted well into Basket Maker III times. A further confirmation of this terminal Basket Maker III chronological position was obtained in the stratigraphic tests at the Twin Butte Site where Adamana Brown was confined to the *lower* levels of the tests but in association with typical Basket Maker III ceramics (See p. 127).

Elsewhere in the Petrified Forest, the National Park Service survey recorded ten sites which have produced Adamana Brown but lack Basket Maker III or later ceramics (Anasazi). The survey also located nine other "Adamana" sites which have a complex ceramic history, that is, in addition to Adamana Brown there are various other types of pottery representing a variety of chronological periods. These latter sites are believed, for the most part, to be Adamana sites reoccupied at a later date. The other sites, those which lack Anasazi Basket Maker III or later ceramics, and including the Flattop Site, probably antedate Basket Maker III in this area. It is possible, I would add probable, that they antedate the appearance of pottery among the Anasazi, but this is by no means certain since Anasazi pottery making may well have received its initial stimulus in areas too far distant from the Petrified Forest to permit substantial trade in these products.

At the same time an early chronological position for the Flattop Site, and in turn the Bluff Site, seems undeniable. The presence in this immediate area of numerous Anasazi Basket Maker III sites, together with the absence of Anasazi ceramics in several Adamana sites, both combine to support a pre-Basket Maker III date for these two sites.

Adamana Brown, like many other pottery types, lasted for a considerable length of time. Whether the manufacturing centers for this type remained (if they were ever there) in the Petrified Forest or whether the area was abandoned and reoccupied by the Anasazi, cannot be determined at this time. Data obtained from both the Bear Ruin and Twin Butte Site, however, conclusively demonstrate the survival of Adamana Brown into Basket Maker III times.

For the purpose of comparisons the Flattop Site will be considered to be roughly contemporary with not only the Bluff Site (Hilltop Phase) but also with the SU (Pinelawn Phase; Martin, 1943), Cave Creek (Peñasco Phase; Sayles, 1945), San Simon (Peñasco Phase, *Ibid.*), Harris (Georgetown Phase; Haury, 1936b), Mogollon (Georgetown Phase; *Ibid.*), Starkweather (Georgetown Phase; Nesbitt, 1938) and Snaketown (Pioneer

Period, especially Vahki, Estrella and Sweetwater Phases; Gladwin et al., 1937) sites. This rough chronological equivalence is based upon the following evidence: 1) Absence from all of the sites of intrusive Anasazi pottery suggesting (on the basis of negative evidence) that they date prior to Basket Maker III; 2) presence of Anasazi Basket Maker III pottery as intrusive into Phases conclusively later through stratigraphic superposition (San Francisco Phase, Mogollon Village, Haury, 1936b, p. 26; Cottonwood Phase, Bluff Site, Haury and Sayles, 1947, p. 56); 3) common possession of similar pottery types as intrusives and the absence of other local pottery types which are later in age.

By this seriation I do not mean to imply that all of these sites were occupied at the same time for there is some evidence (chiefly radiocarbon dates for Pinelawn Phase at 273 B.C. $\pm$ 200, Johnson, 1951, p. 17, and tree ring dates near the 300 A.D. for the Bluff Site) which suggests that several hundreds of years may be represented. At the present time, however, it is doubtful if sufficient evidence is available to permit closer seriation beyond the attempts in this direction already made by Martin, Rinaldo and Antevs (1949, pp. 192-193).

COMPARISONS: VESSEL SHAPES. Listed in order of their numerical representation the vessel shapes employed by the Flattop potters were as follows:

1. Deep hemispherical bowls.
2. Globular jars with restricted orifices, no necks.
3. Large, slightly elongated, globular jars with tall vertical or slightly tapering restricted necks.
4. Ladles with attached cylindrical handles (two present).
5. Small globular jar with short restricted neck (one represented).
6. Small jar with elongated body and tall slightly flaring, restricted neck (one represented).
7. Ladle with tapering handle (one represented).
8. Shallow bowl (one represented).
9. Deep bowl with flared rim (one represented).
10. Duck effigy (one represented).

This evaluation is based on restored vessels; however, examination of the sherd collection failed to disclose other forms not represented in the above list.

Comparisons with the forms reported from other sites considered to be approximately contemporary suggest several important differences as well as similarities. Those ceramic sites often considered to date prior to the appearance of pottery among the Anasazi—the earliest levels at Snaketown (Gladwin, et al., 1951) and the San Simon Village (Sayles, 1945), the Cave Creek Site (*Ibid.*), the SU Site (Martin and Rinaldo, 1946) and the Bluff Site—all shared as a group two vessel forms: deep hemispherical bowls and globular jars without necks. With the exception of the SU Site, they also all contained jars with everted rims and shallow bowls. Of this list only the jars with everted rims were not noted at the Flattop Site. The large globular jars with tall necks and small elongated jars with tall, restricted necks were reported from only the SU Site (Martin and Rinaldo, 1947, pp. 366-367). In the Bluff Site (Haury and Sayles, 1947, p. 51) tall neck globular jars were noted but all were small in size. Ladles with cylindrical handles and deep bowls with flare rims were, except for miniature ladles which were found at SU (Martin, 1943, p. 233) and San Simon (Sayles, 1945, Plate XVII) Sites, noted only from the Sweetwater Phase at Snaketown (Gladwin, et al., 1937, p. 193).

The Flattop Site also produced several vessel shapes which, at this time level, are unique. These include the small globular jars with short vertical necks, the ladle with tapering handle and the duck effigy. At a slightly later time horizon, during Basket Maker III, these distinctive shapes made their initial appearance in other areas and in other types of pottery, particularly among the Anasazi where both duck effigies (Morris, 1939, Plate 191) and globular jars with short vertical necks (Roberts, 1929, p. 111) were reported. Ladles with tapering handles, however, are so far known only from Pueblo I or later sites (Morris, 1939, Plate 239). At a similar time level (Basket Maker III-Pueblo I) among the Mogollon, the globular jars with short vertical necks and duck effigies were found at the Bear Ruin (Haury, 1940, p. 71 and 76). Neither of these forms, however, ever became a very common Mogollon vessel form although the Anasazi made considerable use of them throughout later developments.

In many other respects, particularly in the numbers of large jars with tall restricted necks and the abundance of ladles of various types, the vessel forms of the Flattop Site are similar to and possibly foreshadow many of the Basket Maker III forms of the Anasazi. None of these forms could be considered foreign to the Anasazi although, as indicated above, there are important differences from both the Mogollon and Pioneer Hohokam. One of the most notable of these differences is the large, tall necked jar which is a common Anasazi form (See Roberts, 1929, p. 114) but is not usually reported from early Mogollon sites (only SU) and, thus far, never from Pioneer Hohokam. This apparent close relationship to the Anasazi and the dissimilarities to the Pioneer Hohokam is somewhat surprising for, as shall be later discussed, there are important technological affinities between the pottery of the Hohokam and that from the Flattop Site. If our previous conclusions regarding the relative date of the Flattop Site are correct, then it seems probable that the forms employed in Adamana Brown heavily influenced Anasazi potters. It is perhaps significant that these forms were absent in Anasazi basketry prior to the appearance of pottery (Morris and Burgh, 1941, Figure 11).

THE ABSENCE OF SLIPPED RED AND SMUDGED POTTERY. Red ware, such as that commonly found in such early Mogollon sites as SU (Martin, 1943, p. 240), Cave Creek (Sayles, 1945, p. 15), San Simon (*Ibid.*, p. 39) and Bluff (Haury and Sayles, 1947, pp. 54-55), was not present at the Flattop Site. A few of the Flattop Site vessels, however, were treated with a fugitive red pigment added after the vessel was fired. This fugitive red cannot be considered as a slip although it may have been an attempt to duplicate, without the correct technological knowledge, the red slipped pottery perhaps seen among other groups. This interpretation overlooks, however, the widespread distribution in North America of smearing a red pigment on pottery and other possessions (See Brew, 1946, p. 294).

Red slipped pottery, during the approximate time interval represented by the Flattop Site, had its center of greatest concentration south and east of the Petrified Forest in the vicinity of the SU and Cave Creek Sites and westward from there to the Gila River in the vicinity of Snaketown. The Fluff Site was apparently near the northern limit of slipped red pottery during this time for only a few sherds of this type were noted. With the exception of Snaketown, which has many other features suggesting strong Mogollon influence, red slipped pottery is absent, or appears only at a very late date, in Papagueria, the Lower Colorado River area and

the region between these areas and north central Arizona. Significantly, all of these areas were also characterized by paddle and anvil finished pottery.

At a slightly later date, during the period contemporary with Anasazi Basket Maker III, red ware diffused northward from the earlier Mogollon center to the Anasazi (See p. 114 and Daifuku, 1950). It was not until considerably later (in the 1000's) that red slips became common in Papagueria and the other areas including the Gila valley which were characterized by paddle and anvil finished pottery.

A similar distribution is indicated for smudged ware, that is, "pottery with polished and blackened interiors, the latter achieved in the firing process by causing a deposit of carbon to be put on the vessel wall . . ." (Haury and Sayles, 1947, p. 53). The geographical center for smudging may, however, be considerably farther north than red ware, perhaps in the area around the White Mountains of east central Arizona. Smudged pottery has been reported from the Bluff Site (*Ibid.*, pp. 53-54) and Arizona W:10:15 at Point of Pines (Wheat, 1951, p. 19). Smudged pottery was absent at the SU (Martin, 1943, pp. 236-240), Cave Creek and San Simon Sites (except as intrusives in the late horizons) (Sayles, 1945, p. 47). In view of this more northern distribution of early smudged ware it is even more surprising that the Flattop Site completely lacked smudged pottery. Chronology may be a factor in this problem for it is possible that the Flattop Site could date just prior to the development of smudging in the area immediately to the south, but the later slow diffusion of smudging to areas where paddle and anvil finished pottery was made suggests that factors other than simple diffusion may be responsible. Although before the end of Basket Maker III neighboring groups such as the Anasazi (See p. 114) and most of the Mogollon (Haury, 1940, p. 90), had begun to smudge the interiors of some of their vessels, the Sinagua (Colton, 1946, p. 26), Hohokam (Haury, 1940, p. 90) and other groups who finished their pottery with the paddle and anvil did not begin smudging vessel interiors until nearly 1100 A.D. or later when, as noted above, red slipped pottery also began among these groups.

It would be of considerable significance if we could determine whether the apparent reluctance to slip or smudge vessels among nearly all of the groups who finished their pottery with the paddle and anvil was due to geographical factors, i.e., distance from the centers of development, or to cultural selection. Heretofore only the first possibility has received any appreciable attention. Both of these, however, should be considered, especially in view of the apparent relationship of these several features over a wide geographical area.

SURFACE TEXTURING. The three sherds of Adamana Grooved and the single example of Adamana Incised represent the only decorated pieces found at the Flattop Site. Painting of vessels, except the occasional smearing of fugitive red pigment over the vessel exteriors, was not practiced by the Flattop potters.

The incising of simple geometric designs such as that seen in Figure 27f appeared among the Mogollon in the Georgetown Phase (Haury, 1936a, p. 40; Nesbitt, 1938, p. 138). According to the seriation by Martin, Rinaldo and Antevs (1949, pp. 192-193), the SU Site (Pinelawn Phase) was earlier than the Georgetown Phase. If this seriation is correct, then the earliest Mogollon apparently lacked any form of surface texturing. We may note, however, that the rarity of Adamana Incised (only one sherd recorded) would strongly indicate that texturing did not reach the Mogo-

llon from this source. Quite the contrary, it seems likely that the Adamana potters may have borrowed this feature from either the Mogollon (and thereby indicating that the site is later than the Pinelawn Phase) or from some other group who possibly also stimulated the Mogollon. Interestingly, pottery decorated with simple geometric incised lines was common in early "Woodland" sites located in the upper Mississippi Valley and on the High Plains (Hill and Kivett, 1940, p. 188). Recent radiocarbon dates indicate that "Woodland" may have been sufficiently early to have influenced Southwestern ceramic groups although the geographic distances separating the known early "Woodland" sites from the Southwest is a definite handicap to suggestions of contact.

Adamana Grooved (Figure 27b, c and e) has a remarkable resemblance to the earliest grooved types found at Snaketown (compare with Gladwin, et al., 1937, Plate CLXXXVII). As a further check, the three sherds from the Flattop Site were sent to Haury for examination. In a letter (dated April 16, 1951) Haury expressed the following opinion:

Superficially these have all the earmarks of our oldest Pioneer Period group material. The laying up of the coils themselves, the grooving subsequently and the light polish are all indicative. . . . Technologically it would certainly appear there is a connection between your material and Hohokam.

Vessels with exterior grooves have not, to my knowledge, been reported from any of the Mogollon sites here considered to be contemporary with the Flattop Site. During later periods similar grooving was occasionally used by both the Mogollon and Anasazi but was not identical in that the grooving was generally confined to the necks of jars, and thus a form of neck-banding. The Snaketown examples, however, and presumably the Flattop pieces, were grooved over most of the exterior.

MISCELLANEOUS OBJECTS OF CLAY

FIBER TEMPERED POTTERY. On the floor of House P (See Figure 22m) was discovered a badly crushed, unfired, fiber tempered vessel. No evidence of rim remained. We were not able to determine the maximum dimensions of the original vessel or if it had been a bowl or jar. The remaining portion averaged 1.2 cm. in thickness and both the exterior and interior surfaces were smoothed but unpolished. Collections from the surface of the site also produced several similar fiber tempered sherds. These had been fired, either by accident or design, and had, therefore, survived.

COMMENTS. Unfired, fiber tempered pottery is reported from several Basket Maker II sites (Morris, 1939, pp. 20-21). Indeed, the presence of this crude pottery in these sites was one of the strongest arguments for independent development of pottery by the Anasazi. It cannot be demonstrated at present whether this pottery can be attributed to the Basket Maker II peoples living north of the Petrified Forest or is a local product by the Flattop people. However, it seems incongruous that a group such as the Flattop people who presumably could manufacture such excellent pottery would be interested in acquiring the obviously inferior products of their neighbors. At the same time, one might wonder why excellent potters would, on occasion, manufacture such crude vessels.

WORKED SHERDS (3) (Figure 27a, d and g). All made from Adamana Brown. Two (a, d) are simple, unperforated discs ground smooth on the edges. The third (g) is roughly rectangular in outline with a slight pro-

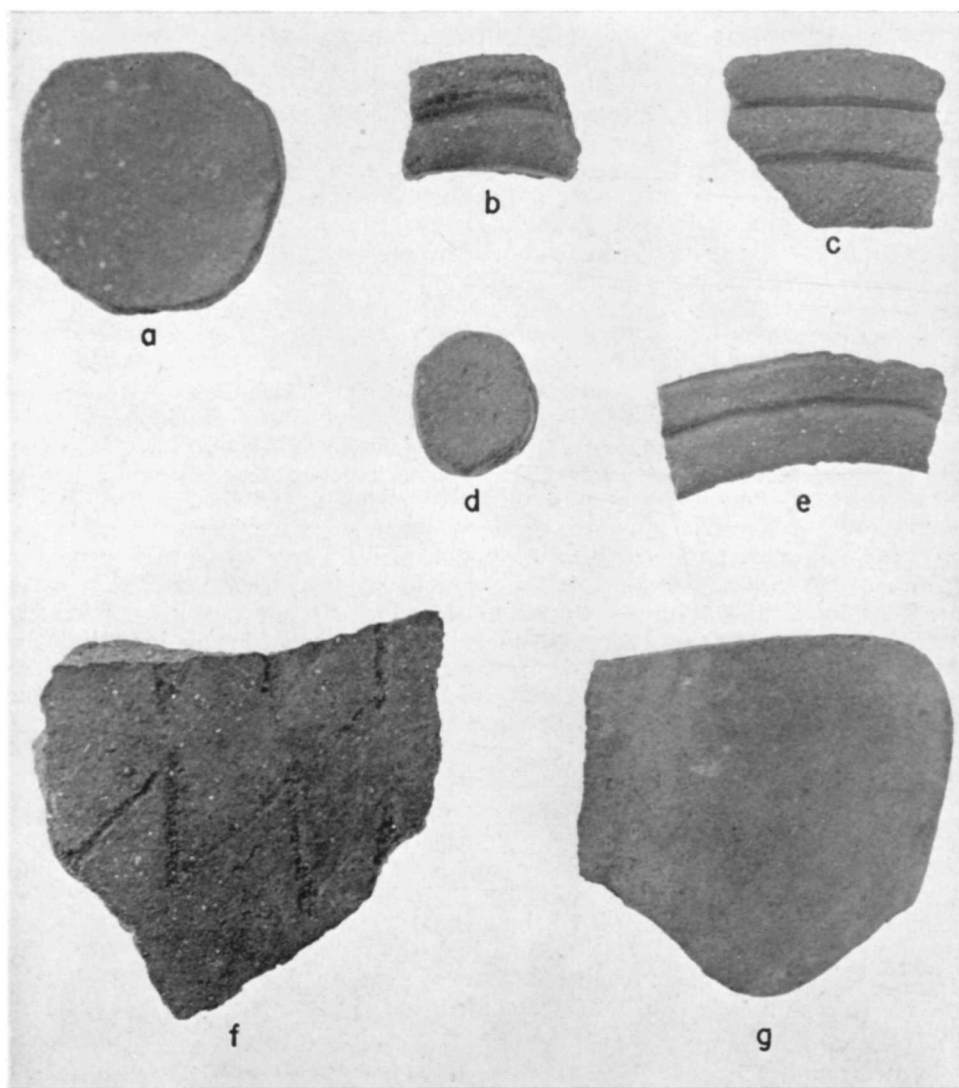


FIGURE 27. *a, d, and g, Worked sherds. b, c, and e, Sherds of Adamana Grooved. f, Adamana Incised.*

jection along one side. This latter sherd may have been used as a spoon or scoop. Diameters, from 2.0 to 6.2 cm. Thicknesses, from 0.4 to 0.6 cm. All from surface.

COMMENTS. Worked sherds similar to these are reported from the Bluff (Haury and Sayles, 1947, p. 63), Cave Creek (Sayles, 1945, p. 15) and SU (Martin, 1943, p. 230) sites. None, however, were found at Snaketown earlier than the Colonial Period. With this exception, which may be attributable to inadequate data, worked sherds are apparently as old in the Southwest as pottery.

ARTIFACTS OF STONE

MATERIALS. Below are listed the materials utilized in the manufacture of stone tools. Numbers in parentheses indicate actual count while those in the right hand column are the percentage calculations for the total collection.

Petrified wood (162)	60%
Sandstone (60)	22
Chert (27)	10
Basalt (2)	T
Quartzite (11)	4
Obsidian (1)	T
Fossilized bone (3)	1
Calcite (1)	T
Shale (2)	T
Olivine (1)	T

Considerable difficulty was encountered in distinguishing chert from petrified wood and some errors may be expected therefrom. Observation of the local concentrations of petrified wood, the probable source for many of the tools described below, suggested that not all of it was translucent and therefore "chalcedony." In the main, structure, color and general appearance, based on a familiarity with these local materials, became the established criterion of distinction.

All of the above materials, with the possible exception of olivine, calcite and obsidian, are available within a few miles of the Flattops. Petrified wood, sandstone and fossilized bone all occur in the local Chinle formation. Chert and quartzite occur as nodules in many of the adjacent stream beds, while basalt can be obtained from one of the volcanic outcrops, such as Woodruff Butte, a few miles to the south.

MANUFACTURED BY GRINDING OR PECKING

METATES (9).

a. (Figure 28a) 8

Troughed, open at far end. Some shaping around sides and ends to remove projections. Grinding trough parallel sided, and in worn examples strongly convex both transversely and longitudinally. Grinding motion confined to one axis. Near end shelf-like, in two examples shelf lightly roughened possibly to receive mano when not in use.

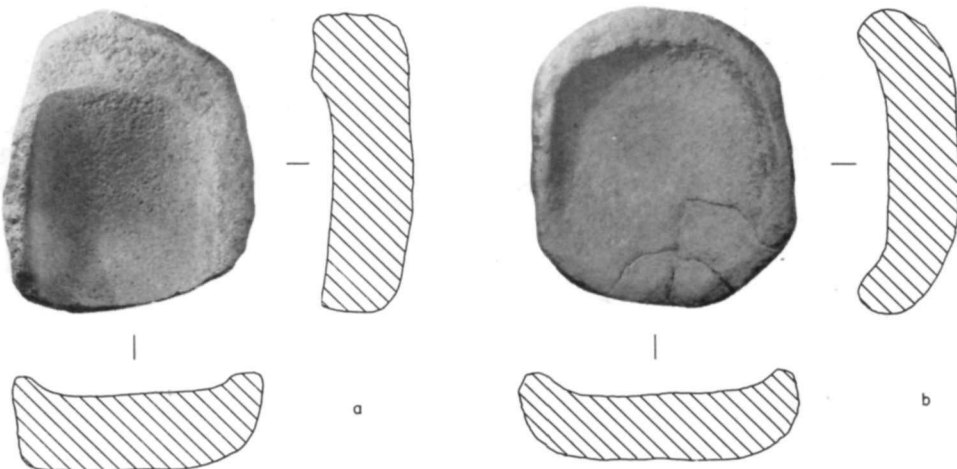


FIGURE 28. Metates. a, Trough. b, Basin.

Lengths, from 36 to 47 cm. Widths, from 29 to 37 cm. Thicknesses, from 5 to 16 cm. Widths of grinding surfaces range from 21 to 26 cm.; lengths from 28.5 to 34 cm., depth from trace to 7.0 cm. All indurated sandstone. One each from floors of Houses H and J, two each from floors Houses D, L and P.

b. (Figure 28b) 1

Basin. Shaped around sides and bottom. Oval in outline, grinding surface occupies most of upper surface. Grinding motion free but probably not rotary. Length, 38 cm. Width, 32 cm. Thickness, 10.5 cm. Depth of grinding surface, 7.5 cm. Soft, decomposing sandstone. Found on floor House D.

MANOS (38).

a. Figure 39b, c and d) 33

Sub-rectangular in outline, slightly convex sides, rounded ends. Shaped by pecking. Some examples utilized with minimum of trimming. Cross section ranges from rectangular to triangular, apparently depending on amount of use. Grinding surface confined chiefly to one face, but occasionally upper surface slightly worn from use. Ends on all examples are abraded from contact with sides of metate. Grinding surfaces moderately to strongly convex in both axes. Finger grips pecked into sides of four specimens. Lengths, from 15.8 to 23.6 cm. Widths, from 8.5 to 10.5 cm. Thicknesses, from 4.2 to 7.9 cm. All indurated sandstone. One only from floor House A, two from floor House J, three from floor House L, four from floor House D, seven from floor House H, sixteen from floor House P.

b. (Figure 29a) 5

Oval in outline, designed for use in one hand. Shaped by pecking. All but one have two opposed grinding surfaces placed at angles to the long axis. Grinding motion free but not rotary. Probably used in basin variety metates. Lengths, from 8.7 to 14.4 cm. Width, from 7.6 to 10.5 cm. Thickness, from 3.4 to 5.5 cm. Three quartzite, two sandstone. One each from floor Houses D, J, and P; two from floor House H.

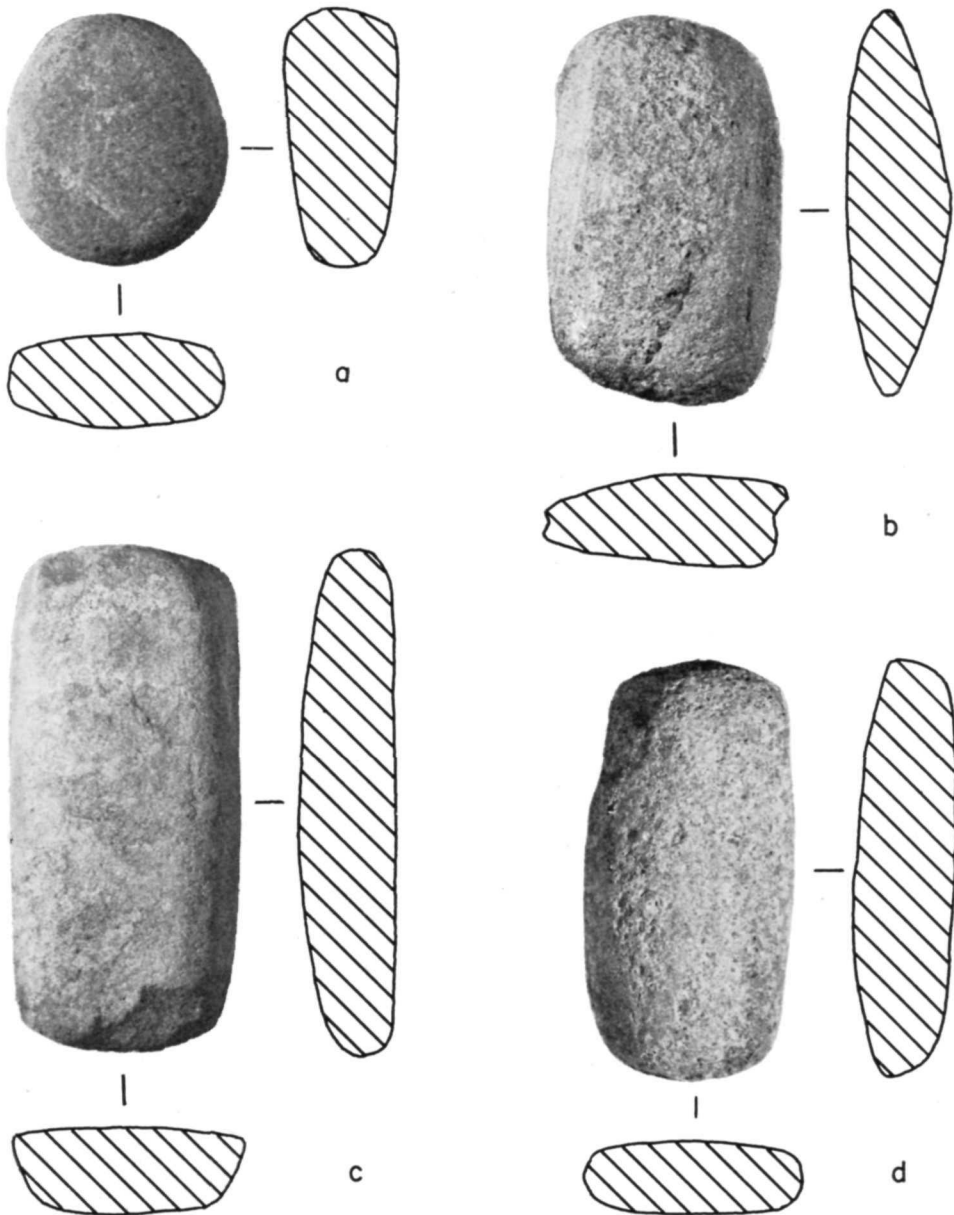
COMMENT. Although Mera (1934, p. 3) from his survey reported that the basin metate was the predominant style associated with sites producing Adamana Brown, our excavations did not confirm his impression. Except for one example, all of the metates from the Flattop Site were troughed and used with a back and forth or reciprocal grinding motion. The two-handed manos, in addition to the usual wear on the grinding face, in almost every instance displayed evidence of wear along the ends. Presumably this abrasion resulted from contact with the walls of the metate troughs. Basin metates, and small one-handed manos designed for use with this variety of metate, were not common. They seem to be, as Haury and Sayles (1947, p. 77) suggest, survivals of an earlier horizon.

Trough metates similar to these from the Flattop Site are also reported from the Bluff Site (Haury and Sayles, 1947, pp. 64-66) in the Forestdale Valley. Like the metates from the Flattop Site, those from the Bluff Site also occasionally have a shallow depression in the platform which closes one end of the grinding surface. Metates with this secondary depression are sometimes referred to as the "Utah type" (Steward, 1933, p. 9). The distribution for these somewhat specialized "Utah" metates has long been assumed to center in the northern periphery of the Southwestern area (*Ibid.*). South of the Petrified Forest and Forestdale Valley areas trough metates, similar to the "Utah" type but lacking the distinctive secondary depression, were found in the SU Site (Martin, 1943). Only the basin metate is reported, however, from the Cave Creek Site (Sayles, 1945). Apparently the "Utah" type metate was never adopted by these southern groups.

HAMMERSTONES (23).

a. (Not illustrated) 12

Chunks of petrified wood of varying size and shape. Battering evident around edges and ends. Diameter, from 6.9 to 9.0 cm. One each from floor Houses A, H, and M; four from floor House P; remainder from surface.

FIGURE 29. *Manos*.

b. (Not illustrated) 8

Water worn stream cobbles showing limited use of ends and sides for pounding. Original crust still present over most of surface. Two examples have traces of red ochre adhering to one or more surfaces. Lengths, from 6.5 to 16.0 cm. Thicknesses, from 3.7 to 7.2 cm. One each from floor Houses A, D and H; two from floor Houses L and P.

SANDSTONE DISCS (7).

- a.* (Not illustrated) 5

Thin sandstone slabs roughly broken to shape. Circular to oval in outline. Smoke blackened on one or both sides. Possibly used as cooking slabs. Largest example also has traces of red ocher on one side. Diameters, from 14.2 to 21.8 cm. Thicknesses, from 0.8 to 2.5 cm. One each from floor Houses H, J, L, M and P.

- b.* (Not illustrated) 1

Similar to above but carefully pecked into shape. Circular in outline. Diameter, 13.8 cm. Thickness, 1.9 cm. Found on floor House H.

- c.* (Not illustrated) 1

Small, circular sandstone disc; roughly broken to shape. Similar to *a.* above, much smaller and lacks characteristic smoke blackening. Possibly used as jar cover. Diameter, 6.7 cm. Thickness, 1.1 cm. Found in fill House P.

BALLS (3). (Figure 30).

Carefully pecked. Two examples have flattened ends while the third is approximately symmetrical. Possibly gaming pieces. No evidence of battering. Diameters, from 5.5 to 6.2 cm. One from floor House J, one from fill House M, the other from surface. Sandstone.

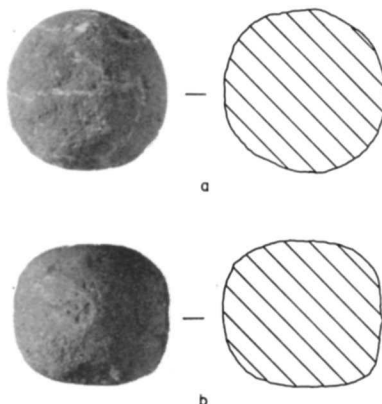


FIGURE 30. Stone balls.

BOWLS (3).

- a.* (Figure 31) 2

Small, possibly naturally formed sandstone hemispheres 11.5 and 13.4 cm. in diameter with shallow depressions pecked into one face. Cavities measure 7.5 and 8.8 cm. in maximum diameter and 1.4 and 1.7 cm. in depth. One example (incomplete) has a smooth, almost flat base, while the other is rounded but unsmoothed. Found on floor Houses N and P.

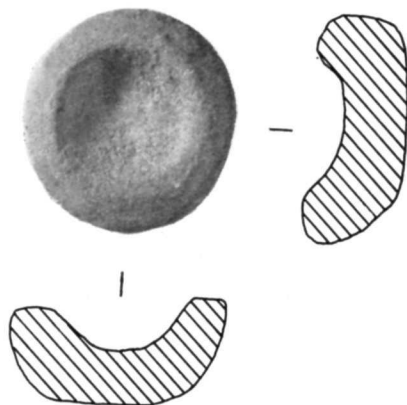
- b.* (Figure 32a) 1

Rim fragment. Maximum diameter undeterminable. Light scoring, possibly resulting from manufacture, visible on both surfaces. Maximum thickness (at rim) 0.9 cm. Calcite. Found in fill House P.

COMMENT. Stone vessels are a common feature in the Pioneer levels at Snaketown (Gladwin, et al., 1937, p. 111). Indeed, the Hohokam apparently utilized stone vessels far more frequently than other contemporary groups.

PIPES (2). (Figure 32d)

Short, tubular. Careful workmanship. Slight taper from bowl to mouthpiece end. Bore drilled from both ends. Interior of one bowl blackened, other incomplete. Length, 5.0 cm. Diameter, 3.1 cm. Vesicular basalt. Both from surface.

FIGURE 31. *Stone bowl.*

COMMENT. The use of vesicular basalt in manufacturing these pipes is suggestive of a foreign origin. Although basalt may be found within ten miles of the Flattops, it is not a common material in this area. Those pipes found in the Twin Butte Site discussed later which were incomplete and therefore presumably locally made, were all made from the more readily available sandstone.

The tubular stone pipe is apparently a common feature in early Mogollon sites. From both the SU (Martin, 1943, p. 204) and Bluff (Haury and Sayles, 1947, p. 70) sites pipes similar to these from the Flattop Site are reported. It should be noted, however, that they are by no means an exclusive Mogollon trait inasmuch as they are also reported from contemporary Anasazi Basket Maker II sites. None have been found at Snake-town or in early Hohokam levels at other sites.

LAPSTONE (1). (Figure 32b)

One face and edge lightly scored with short, irregularly placed incised lines. Opposing edge rounded and worn smooth from repeated rubbing over abrasive surface. Length, 6.7 cm. Width, 3.8 cm. Thickness, 0.4 cm. Found on surface. Limey shale.

PENDANT (1). (Figure 32c)

Incomplete. Carefully worked, polished. Hole for suspension drilled from both sides. Fossil bone. Surface.

EFFIGY(?) (1). (Figure 32f)

Possibly quadruped with large bushy tail. Features indicated by grooves of varying width and depth. No details such as eyes or mouth. Carefully smoothed. Incomplete. Length, 1.9 cm. Height, 0.7 cm. Thickness, 0.4 cm. Limey shale. Found on floor House M.

COMMENT. The paucity of ornaments and non-utilitarian artifacts in this collection is pointed up by the fragmentary pendant and possible effigy described above. Particularly noteworthy is the absence of shell beads, bracelets and pendants. Analysis of soil samples taken from this site suggests that soil acidity cannot account for the absence of these materials (See p. 74). Significantly, the Bluff Site (Haury and Sayles, 1947, pp. 79-80) also lacks shell artifacts. On the other hand these items were available in quantity to their northern neighbors, as is indicated by numerous finds in Basket Maker II Sites. This distribution indicates that the trade

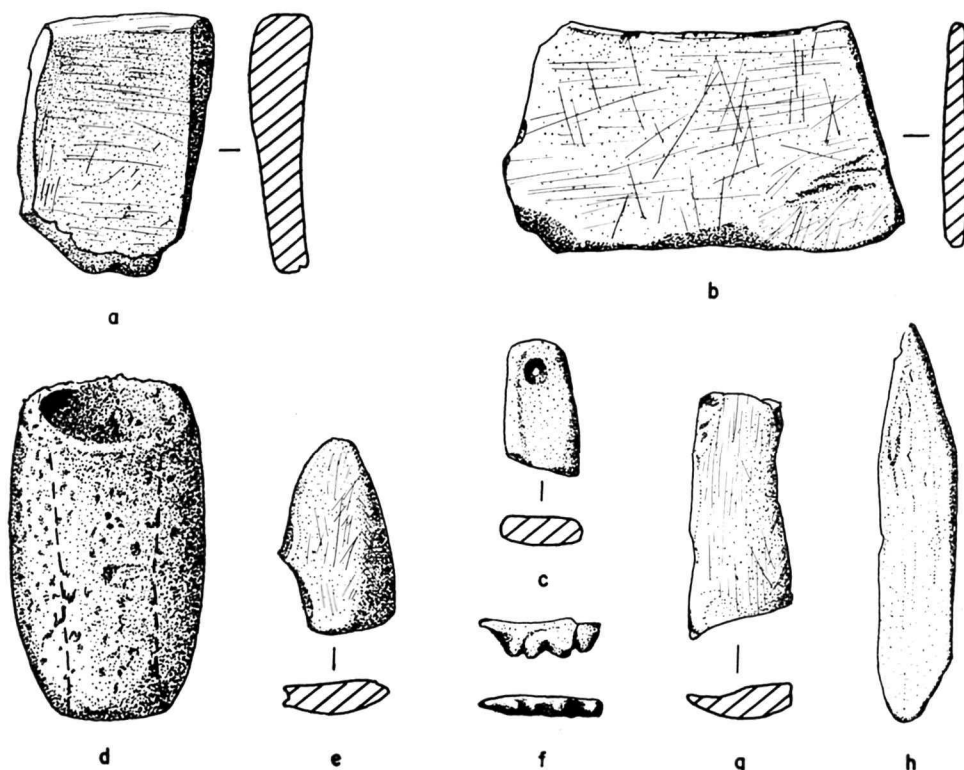


FIGURE 32. *Miscellaneous pieces from Flattop Site. Length of d, 5.0 cm.*

routes linking the sources of these marine products with the Basket Maker II peoples probably by-passed this intervening mountainous and plateau area.

NOTCHED STONES (2).

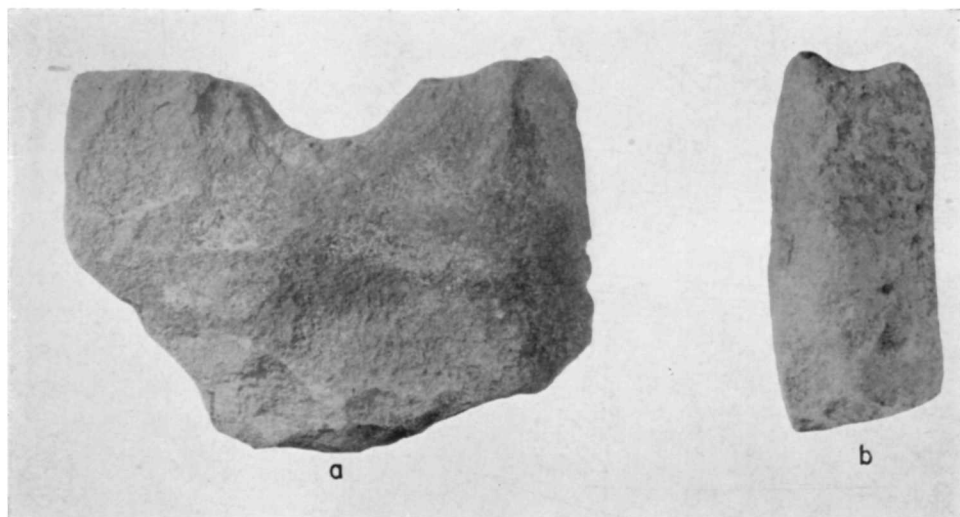
a. (Figure 33b) 1

Irregular unshaped block with shallow notch in one end. Length, 20.8 cm. Width, 8.2 cm. Thickness, 8.3 cm. Width of notch, 4.0 cm. Depth, 0.7 cm. Sandstone. Found on the floor of House P.

b. (Figure 33a) 1

Sandstone slab roughly broken to shape. Possibly used in conjunction with hearth with base imbedded in sand to give it stability. Notch possibly served to hold spit or brace supporting vessel being used over fire. Height, 19.2 cm. Width, 26.5 cm. Thickness, 5.2 cm. Width of notch, 8.5 cm. Depth, 3.0 cm. Found on floor House D.

COMMENT. Similar notched stones have been reported from Roosevelt: 9:6, a Colonial Hohokam site (Haury, 1932, pp. 38-40), the Swarts Ruin (Cosgrove, 1932, pp. 49-50) and from Fitzmaurice Ruin (Spicer and Caywood, 1936, pp. 100-101). At both Fitzmaurice and Roosevelt: 9:6 the slabs were found imbedded in the floors of rooms. In these instances it seems probable that the notched stones supported low platforms. A similar function for the Flattop examples cannot be demonstrated since neither was found imbedded in the floor.

FIGURE 33. *Notched Stones.*

AWL (1). (Figure 32h)

Splinter, abruptly tapering point, partially rounded base. Point tip incomplete. Length (estimated), 6.8 cm. Width, 1.2 cm. Thickness, 0.3 cm. Fossilized bone. Found on surface.

MISCELLANEOUS PIECES (2). (Figure 32e and i)

Small pieces of worked stone, functions unknown. Both examples have numerous irregularly placed incised lines over one or more faces. Edges of one (e) ground to point. Both incomplete. Fossil bone and olivine. One found in fill House M, other found on surface.

MANUFACTURED BY PRESSURE

RANDOM FLAKES UNMODIFIED EXCEPT BY USE (82)

Large to small percussion flakes utilized without further modification. Nature of wear determines classification below.

a. SCRAPERS (52). (Figure 34a-e)

Random fortuitous flakes utilized as scrapers. Minute flakes removed from one or more edges as a result of use but confined to one side of that edge. Lengths, from 2.4 to 7.8 cm. Widths, from 1.9 to 5.5 cm. Thicknesses from 0.4 to 1.7 cm. Five chert, one obsidian, remainder petrified wood. One from fill House H; remainder from surface.

b. KNIVES (28). (Figure 35a, b and d)

Similar to above but with minute utilization flakes removed from both sides of working edge. Lengths, from 2.5 to 10.0 cm. Widths, from 1.4 to 4.9 cm. Thicknesses, from 0.2 to 2.5 cm. Four chert, remainder petrified wood. One each from floor Houses D and N and two from Houses A (Fill) and J (Floor); remainder from surface.

c. GRAVERS (2). (Figure 35c)

Accidentally pointed random flakes used without further modification. Points show small flake scars resulting from use. Lengths, 2.4 and 3.3 cm. Widths, 1.1 and 2.0 cm. Thicknesses, 0.6 and 0.5 cm. One chert, other petrified wood. Both from surface.

BIFACIALLY WORKED BLADES AND POINTS.

a. BLADES (34).

Heavy cutting tools. All specimens incomplete.

1. (Figure 36m, p) 23
Straight to slightly convex base, parallel sides. Lengths (estimated), from 1.8 cm. to 5.0 cm. All petrified wood. All from surface.

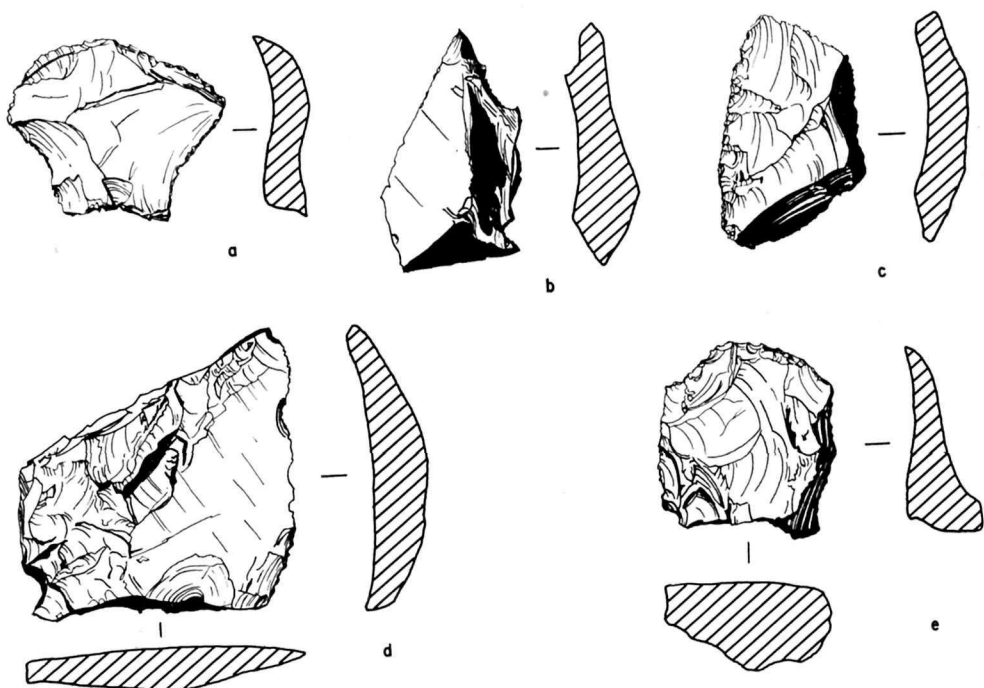


FIGURE 34. *Random flakes utilized as scrapers. Length of b, 4.8 cm.*

2. (Figure 36h) 7
Similar to above but with rounded base and tapering sides. Lengths (estimated), from 5.0 to 8.0 cm. Widths, from 2.3 to 4.0 cm. Thicknesses, from 0.5 to 1.1 cm. All petrified wood. All from surface.
3. Too incomplete to classify 4
- b. POINTS (32).
Long, thin, carefully worked.
1. (Figure 36a-c) 10
Diagonal corner or lateral notched. Bases vary from slightly concave to convex. Lengths, from 3.7 to 7.4 cm. Widths, from 1.8 to 2.4 cm. Thicknesses, from 0.2 to 0.7 cm. One chert, remainder petrified wood. One each from floor Houses J and P, remainder from surface.
2. (Figure 36d-e) 7
Unnotched, tapering sides, slightly concave or straight bases. Estimated dimensions: Lengths, from 5.3 to 6.5 cm. Widths, from 2.1 to 2.5 cm. Thicknesses, from 0.4 to 0.6 cm. Two chert, rest petrified wood. One from floor House N, one from fill House J, remainder from surface.
3. (Figure 36g) 2
Parallel sided, notched concave bases. Both incomplete. Chert. Surface.
4. (Figure 36j) 1
Contacting stem, pronounced shoulders. Made from basal portion of incomplete stemmed blade. Sides of tang on original blade were ground smooth. Present length, 4.5 cm. Width, 3.0 cm. Thickness, 0.4 cm. Chert. Surface.
5. (Figure 36k) 1
Contracting stem, weak shoulders. Serrated edges. Length, 4.7 cm. Width, 1.6 cm. Thickness, 0.4 cm. Petrified wood. Fill, House D.

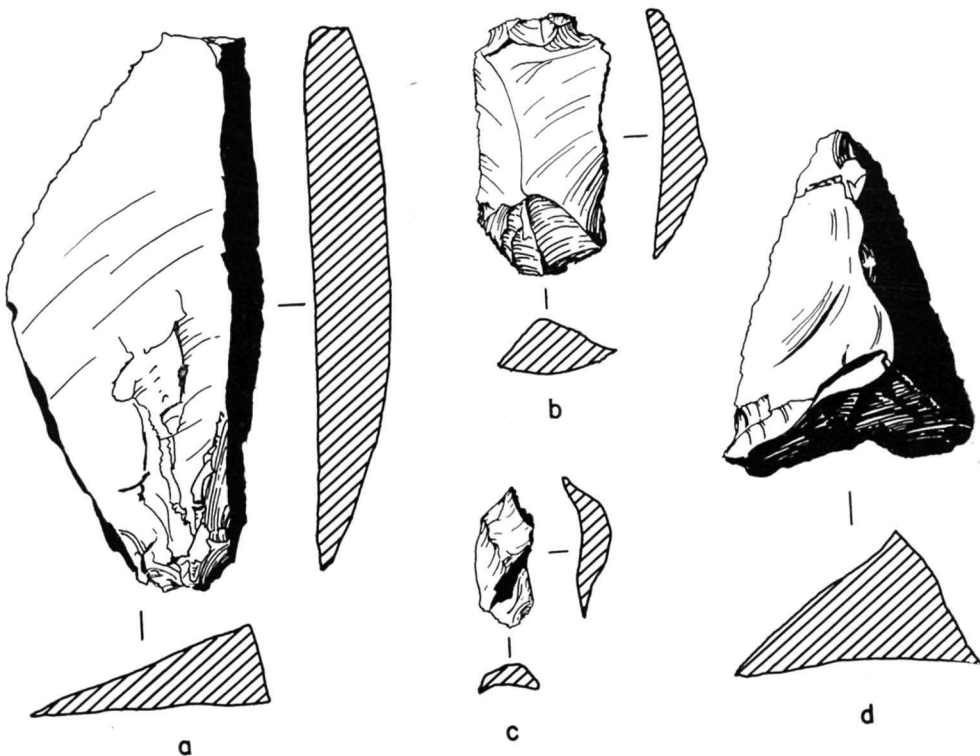


FIGURE 35. Random flakes utilized as knives (a, b, and d) and graters (c).
Length of c, 2.5 cm.

- | | |
|---|---|
| 6. (Figure 36l) | 1 |
| Triangular, straight base. Length, 2.8 cm. Width, 1.7 cm. Thickness, 0.2 cm. Chert. Surface. | |
| 7. (Figure 36i) | 1 |
| Triangular, concave base. Incomplete. Chert. Surface. | |
| 8. (Figure 36f) | 1 |
| Broad, expanding base formed by wide, shallow lateral notches. Pronounced barbs. Incomplete. Petrified wood. Surface. | |
| 9. (Figure 37) | 1 |
| Fluted, both sides. Lateral notches added after completion of fluting. Remnant of striking platform used in removing flutes still evident. Possible reused "Folsom." Length, 3.8 cm. Width, 2.2 cm. Thickness, 0.2 cm. Petrified wood. Found during backfilling of House N. | |
| 10. (Figure 38) | 1 |
| Eccentric. Probably not repointed. Length, 8.5 cm. Width, 4.0 cm. Thickness, 0.5 cm. Chert. Found on floor House H. | |
| 11. Too incomplete to classify | 6 |
| Four petrified wood, two chert. All from surface. | |

COMMENTS. This series of blades and projectile points from the Flat-top Site includes a wide variety of shapes. Despite this non-conformity in the total collection it is evident that the majority form two groups. The first of these groups, the heavy blades, were all broken, suggesting that

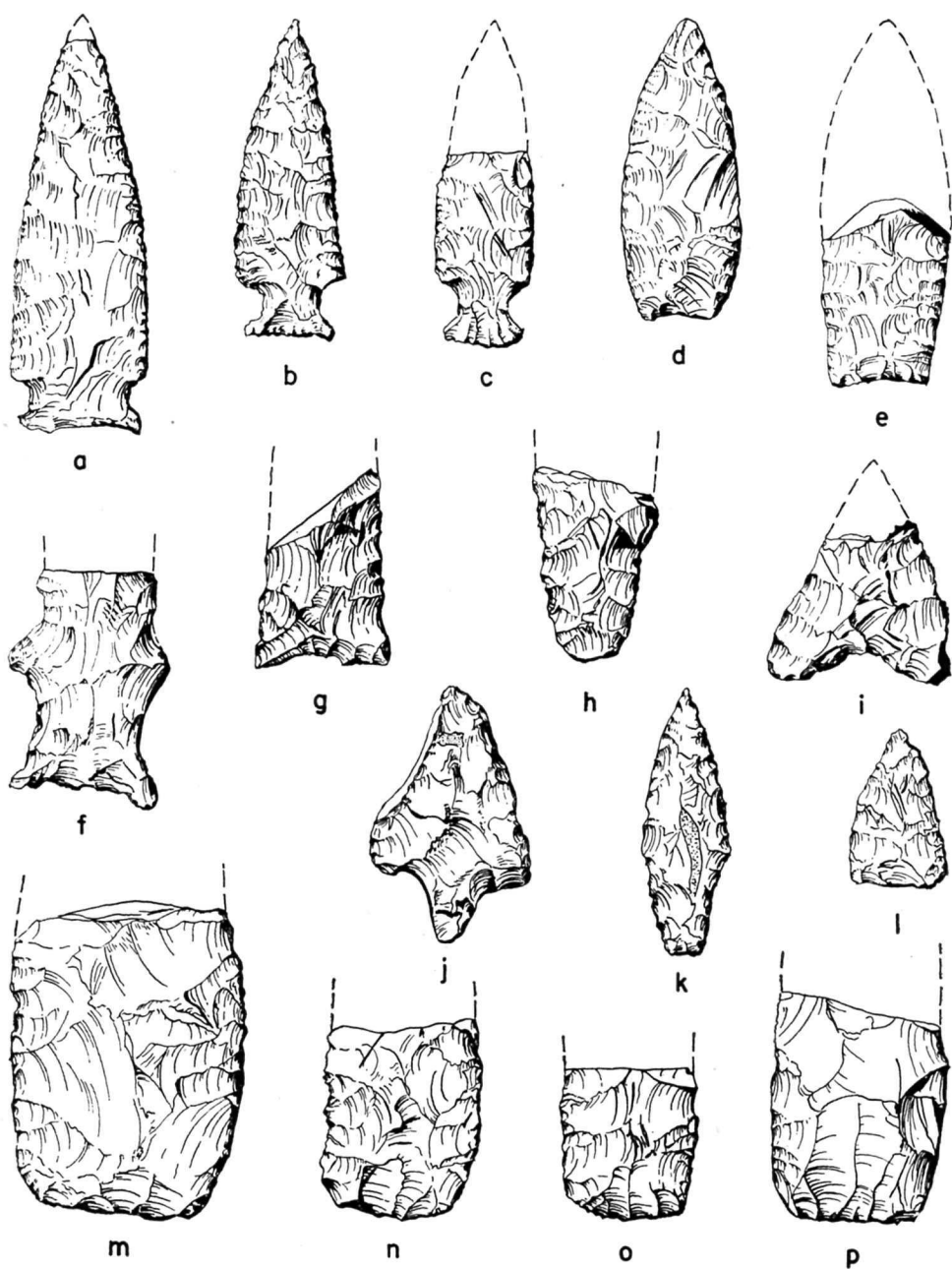


FIGURE 36. *Bifacially worked blades and points.* Length of d, 5.3 cm.

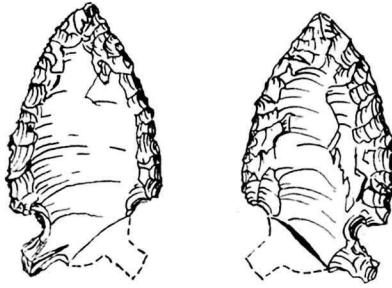


FIGURE 37. *Fluted point.*
Length, 3.8 cm.

they received rough usage. Similar blades were found in the Bluff Site (Haury and Sayles, 1947, p. 74) and Peñasco Phase at San Simon Village (Sayles, 1945, Plate XLII). They also occur in Basket Maker II sites farther north (Kidder and Guernsey, 1919, Figure 90). In the pre-pottery Cochise horizon in southern Arizona this type of blade is a diagnostic of the latest or San Pedro Stage (Sayles and Antevs, 1941, p. 27). A similar chronological placement was noted in Ventana Cave (Haury, 1950, p. 269). They were not, however, found at Snaketown (Gladwin, et al., 1937, pp. 111-112). In the previously mentioned sites also occur projectile points similar to the diagonal corner and lateral notched points which comprise our second group here. Of particular interest is the fact that these two



FIGURE 38. *Eccentric point.*
Length, 8.5 cm.

implements have closely related spacial and chronological distribution. Together they have a special chronological value. They appeared in this area prior to the introduction of pottery and remained through the early stages of the ceramic era. In the Petrified Forest they were rare in the Anasazi Basket Maker III site discussed later (See p. 140). Apparently by this date they were no longer in common use.

Of the remaining points, the fluted example is of special interest because of its possible implications for Early Man in this area. As is evident from descriptions and drawings, this point was intentionally fluted on both faces. In size and general appearance it falls well within the range of Folsom points (Renaud, 1934, p. 3). Folsom points are considered one of the earliest types known in North America (Wormington, 1949) and are often found associated with extinct fauna. Our example differs from the typical Folsom only by the presence of two lateral notches clearly made after the removal of the flutes suggesting that the Flattop people had found a Folsom point and re-used it, making notches in the sides so that the point could be hafted in the same manner as their other points. Since this point is made from apparently local petrified wood, we may surmise that groups making and using Folsom Points were in this area at an earlier date. Unfortunately, however, our survey failed to locate other evidence for the presence of "Folsom man" within the boundaries of the monument, although similar points were located in adjacent areas (Wendorf and Thomas, 1951).

The large size of all of these points is particularly noticeable when compared with those found in the later Twin Butte Site. While size cannot be regarded as a definite criterion, it may indicate, when this is considered with the absence of evidence for the bow and arrow in Basket Maker II sites containing similar points (Kidder and Guernsey, 1919, pp. 207-208), that the bow and arrow was also unknown to the Flattop people. Like the Basket Maker (*Ibid.*) they may have employed the atlatl.

DRILLS (6).

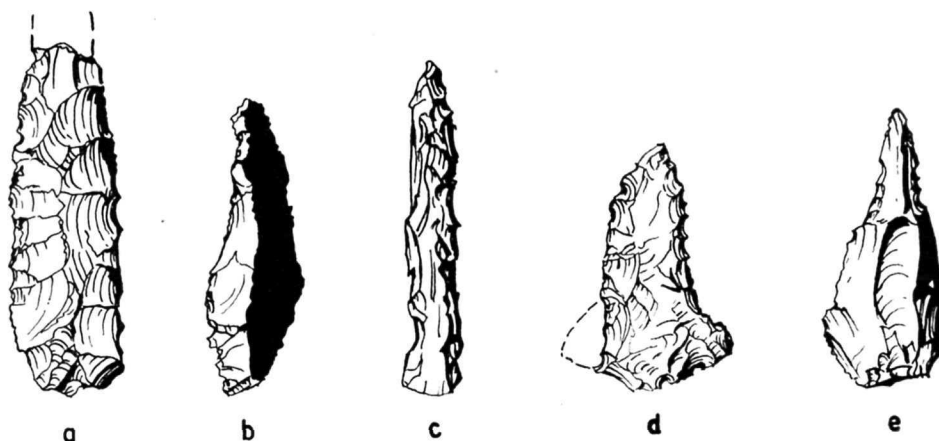
Random flakes retouched to form perforating tool.

- a. (Figure 39a-c) 3
Plain shafted. Long, parallel sides, gradually tapering to point. Sides and points worn from use. Estimated dimensions: Length, from 3.9 to 5.5 cm. Widths, from 0.8 to 1.5 cm. Thicknesses, from 0.4 to 0.7 cm. All petrified wood. All from surface.
- b. (Figure 39d-e) 3
Flanged. Similar to above but with expanded base. Lengths, from 3.3 to 4.6 cm. Widths, from 1.6 to 3.1 cm. Thicknesses, from 0.4 to 0.9 cm. One chert, two petrified wood. All from surface.
- c. (Figure 40) 1
Beveled. Random flake retouched along two opposing but alternate faces to form wide-angled point. One edge also retouched to form graver. Length, 4.1 cm. Width, 4.0 cm. Thickness, 0.5 cm. Chert. Surface.

SCRAPERS (8).

Selected flakes steeply retouched along one or more edges.

- a. (Figure 41a-c) 4
Side scrapers. Principal working edge along one or both sides. In three (b, c) examples two working edges are brought together in a point; however, point does not indicate use. Single example (b) has one apparently accidentally formed concave working edge but evidence of use is not extensive. Lengths, from 5.7 to 6.2 cm. Widths, from 3.2 to 4.4 cm. Thicknesses, from 1.1 to 1.5 cm. Three chert, one petrified wood. All from surface.

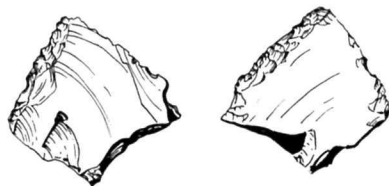
FIGURE 39. *Drills*. Length of e, 3.7 cm.

- b. (Figure 41d-e) 2
 End scraper. Principal working edge at right angles to long axis of implement. One (e) may have been hafted. Lengths, 4.8 and 5.7 cm. Widths, 3.5 and 5.1 cm. Thicknesses, 0.8 and 1.7 cm. One petrified wood, one chert. Both from surface.
- c. (Figure 41f) 2
 Hollow edge scrapers. Working edge concave. Lengths, 3.1 and 4.3 cm. Widths, 1.7 and 3.8 cm. Thicknesses, 0.4 and 1.1 cm. Both petrified wood. One from floor House J, other from surface.

MANUFACTURED BY PERCUSSION

CHOPPERS (6).

- a. (Figure 42h-i) 2
 Large, heavy percussion flakes trimmed from one side forming a wedge-shaped and ragged cutting edge. Worked edge strongly convex in outline. Utilization flake scars suggest that tool served primarily as heavy scrapers rather than planes. Lengths, 9.4 and 11.5 cm. Widths, 8.4 and 11.3 cm. Thicknesses, 5.7 and 5.5 cm. Both petrified wood. One each from floor Houses M and P.
- b. (Figure 42f-g) 2
 Similar to a. above but with straight rather than convex cutting edge. Incomplete. Found in fill House A.
- c. (Figure 42j) 2
 Spikes. Large, pointed percussion flakes used without further modification. Both show battering and flaking near point. Lengths, 4.3 and 15.0 cm. Widths, 7.0 and 7.2 cm. Thicknesses, 3.3 and 6.5 cm. Both petrified wood. Surface.

FIGURE 40. *Beveled drill*. One edge also used as a graver.
 Length, 4.1 cm.

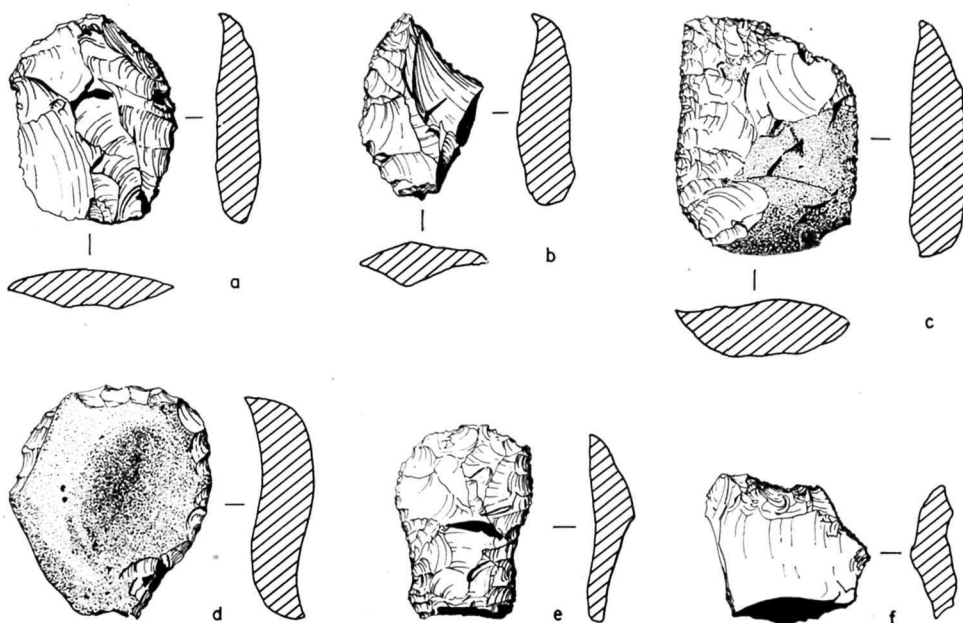


FIGURE 41. Retouched scrapers. Length of a, 5.2 cm.

POINTS AND OVATES (8). (Figure 42a-e).

Thick, crude, roughly fashioned. Possibly rejects. Chipping removed from both faces leaving a sharp, sinuous edge. Evidence of battering visible on one example only. Lengths, from 6.0 to 8.7 cm. Widths, from 2.7 to 5.0 cm. Thicknesses, from 1.5 to 2.8 cm. All petrified wood. Two from floor House P, one from floor House L, remainder from surface.

MINERALS

Four small pieces of limonite and hematite were found in the excavations. One piece of limonite (from floor House P) and one of hematite (floor House M) had abraded edges and sides. The two other pieces, both of limonite, were unworked. They came from the entrance of House J and the floor of House M.

COMMENT. Both hematite and limonite may be used in decorating pottery. Indeed hematite was occasionally rubbed on the exterior of Adamana Brown vessels after they had been fired (See p. 48). Apparently no pigment, however, had been applied prior to firing of the pottery. In view of the widespread tendency for primitive peoples to decorate their bodies with bright colored minerals we may postulate that similar use was made of these pigments by the Flatop people.

FLORAL REMAINS

A few very small charred corn cobs were recovered from Houses A, J, N and P. Dr. Paul C. Mangelsdorf has examined these specimens; however, his report has not yet been submitted.

Roofing material recovered from those houses which had burned indicated that the major roof supports were of juniper (probably *Juniperus monosperma*) and cottonwood (*Populus, spp.*). Reeds (unidentified) and juniper branches were also noted.

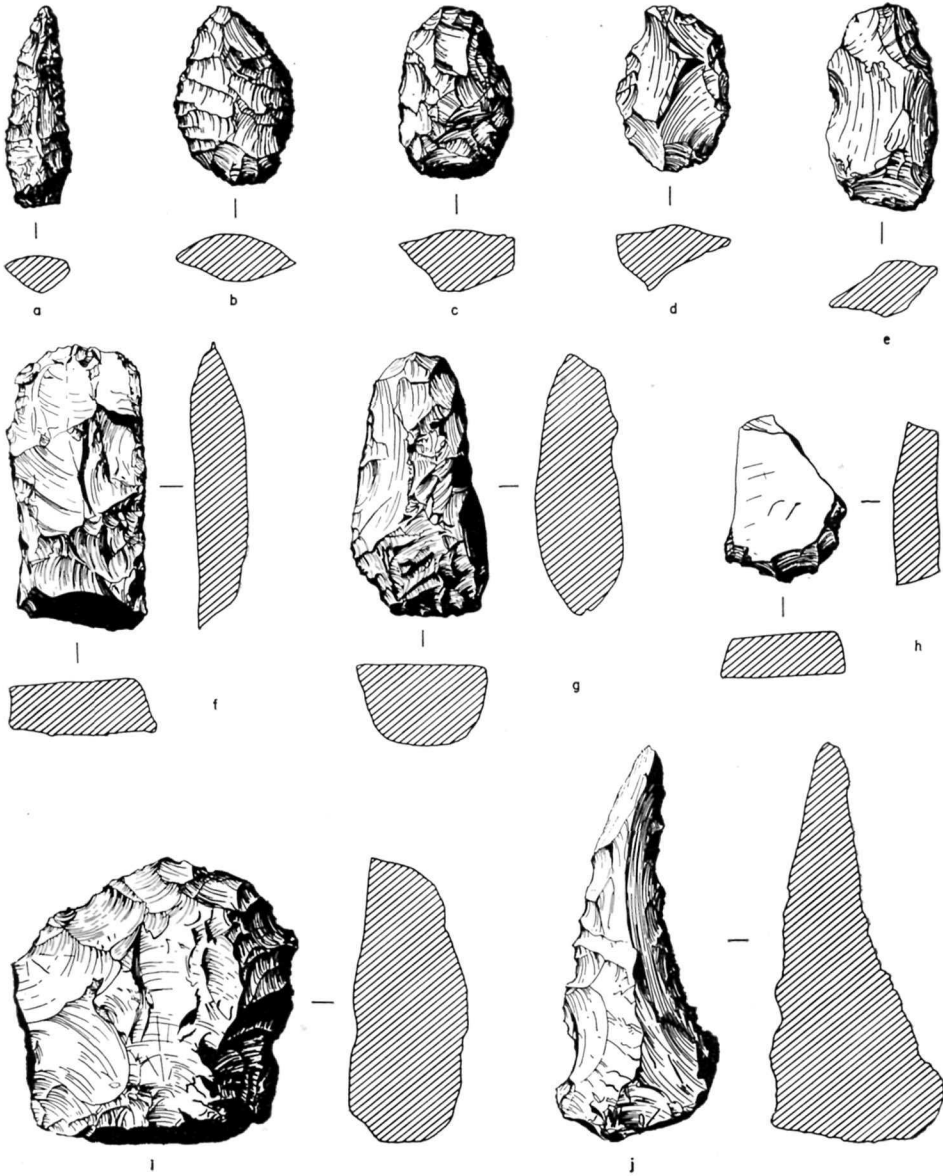


FIGURE 42. *Points, Ovates and Choppers*. Length of a, 8.0 cm.

FAUNAL REMAINS

Surprisingly, animal bone was rarely encountered in the Flattop excavations. Although particular efforts were made to save all animal bone encountered, there were only a scant half-dozen unidentifiable splinters recovered from all the excavations at the site. Only one small fragment could be tentatively identified and this was probably a femur of a cottontail rabbit (*Sylvilagus auduboni*) (Identified by Milton Wetherill, Museum of Northern Arizona).

ANALYSIS OF SOIL SAMPLES

Two samples of the soil at the Flattop Site were collected for chemical analysis:³

Sample	Location	pH factor
1	Fill House P	8.1
2	Surface adjacent House H	7.8

The pH factor is a measure of alkalinity. In this case a factor of 8 means that the sample is 10 times more alkaline than a neutral sample. Since the Flattop soil was evidently not acid, bone was not decomposed by the soil. The near absence of animal bone in the Flattop refuse would indicate, therefore, that the Flattop residents made little use of animals as a source of food.

SUMMARY OF THE FLATTOP SITE

The foregoing discussions and descriptions of the material excavated at the Flattop Site have indicated the general chronological position of the site and have enabled a collation to be made with others of comparable age elsewhere in the Southwest.

The archaeological manifestations represented by the Flattop Site may be classified as the Flattop Phase (Aspect). Allocation to a "Branch" or "Root" will not be attempted at this time. At the present time sites of this Phase are known only from the Petrified Forest National Monument where there are eighteen other sites which may have been occupied during this time interval. The chronological position of the Flattop Phase has been estimated at pre-600 A.D., perhaps continuing back in time until before 300 A.D. Sites of the Flattop Phase are small villages usually, but not always, situated on high, defensible mesas.

The houses are small, round to oval, slab-lined pit houses with long lateral entryways, wing walls and slab-lined storage bins, the latter located both inside and outside of the houses. These houses lack, except for one example, defined fire pits. The type of superstructure is not known, although the placement of the artifacts (principally metates) within the houses and the few traces of charred material from those houses that had burned have indicated that these houses may have had open brush side-walls. It is possible that the Flattop Site was only seasonably occupied.

Charred corn and numerous metates, manos and other grinding implements, together with the rarity of animal bone in the refuse, have suggested that the major subsistence was derived from the practice of agriculture. Some gathering may have been practiced, but there was apparently very little hunting. The paradox of numerous projectile points, but little evidence for hunting, may indicate that the Flattop people were not on friendly terms with all of their neighbors. It is possible that the projectile

3. Analyzed by Dr. T. F. Buehrer, Head of the Department of Agricultural Chemistry and Soils, University of Arizona.

points at this site were used primarily for war rather than hunting. The location of the site, on one of the more defensible mesas, also contributes to this feeling that social unrest was prevalent.

Ceramically the Flattop Phase has been classified with the Southwestern Paddle and Anvil Ceramic Tradition. The absence of painted decorations, slips, and smudging has been shown to be a general characteristic of early ceramics of this tradition.

Table I contains a listing of the Flattop artifacts and compares, by means of simple presence or absence notation, these materials with those from other early sites in the Southwest. The table indicates that the majority of the lithic artifacts found at the Flattop Site were types that were widespread throughout the Southwest. With the exception of pottery, surprisingly close resemblances are to be noted between this site and the pre-pottery Anasazi of Basket Maker II, the Hilltop Phase of the Bluff Site and somewhat less, the Pinelawn Phase as represented by the SU Site. In the important field of ceramics, however, the Flattop Site differs from Anasazi Basket Maker II which lacked pottery; from the Bluff Site in the finishing techniques, the absence of red wares and the absence of smudging; from the SU Site by the differing finishing techniques and the absence of red wares. Differences in vessel forms have also been noted.

It is disappointing that greater similarities cannot be demonstrated between the Flattop Site and the Pioneer Hohokam of Snaketown. It would have been of considerable interest had there been a close resemblance, other than in ceramics, between these two sites. Unfortunately excavations in other early sites with paddle and anvil pottery are rare, and where attempted, the results have not yet been published. The determination of the taxonomic position of the Flattop Phase relative to other early sites with paddle and anvil pottery will be greatly facilitated when these data are available.

In view of the close resemblance between the lithic complex of the Flattop Phase and that of Anasazi Basket Maker II it may be fruitful to consider the possibility that the Flattop people did not make the pottery which we found in their houses. This possibility is further supported by the comparative scarcity of ceramics in the site and by the use of slab-lined storage cists among both the Basket Maker II and Flattop groups. Since we know so little about Basket Maker II houses, however, architectural differences or similarities are as yet of little value to this problem. The possibilities raised by this question are indeed significant; however, until further data is available it would perhaps be the wiser course to merely refer it to future workers as a problem warranting their consideration.

TABLE I

	Flattop Site	Bluff Site, Hilltop Phase	Pinelawn Phase	Peñasco Phase	Georgetown Phase	Basket Maker II	Snaketown Pioneer
POTTERY							
Paddle and Anvil Finished	X						X
Incised	X				X		X
Slipped		X	X	X	X		X
Painted					X		X
Smudged		X					
Absence of Anasazi Pottery	X	X	X	X	X	X	X
MISCELLANEOUS CLAY OBJECTS							
Fiber Tempered, Unfired Vessels	X					X	
Worked Sherds	X	X	X	X	?		X
Figurines		X	X				X
Pipes			X				
STONE ARTIFACTS							
Trough Metates, "Utah Type"	X	X				?	
Trough Metates, Closed at One End	X	X	X		X	X	?
Basin Metates	X	X	X	X	X	X	
Two-handed Rectangular Manos	X	X	X		X	X	
One-handed Manos	X	X	X	X	X	X	
Hammerstones	X	X	X	X	?	X	
Sandstone Discs	X	X	X				
Balls	X	?	?	?			
Bowls	X	X	X	X			
Tubular Pipes	X	X	X		X	X	
Lapstone	X						
Ornaments	X	X	X	X		X	
Notched Stones	X						
Awls	X						
Utilized Random Flakes	X	X	X	X	?	X	
Bifacially Worked Blades	X	X	X	X	X	X	
Lateral Notched Points	X	X	X	X	X	X	
Stemmed Points, Large	X	X	X	X	X		
Fluted Points	X						
Eccentric Points	X						
Drills, Plain Shafted	X	X	X		?	X	
Drills, Expanded Base	X	X	X		X	X	
Scrapers	X	X	X	X	?	X	
Choppers	X	X	X	X	?	X	
Points and Ovates	X	X	X	X	?	X	
MINERALS							
Limonite, Hematite, Etc.	X		X	?	X	X	
Pestles		X	X	X		X	
Mortars		X	X	X		X	
Mauls			X	X			
Ground Edge Scraper	?			X			
BONE							
Awls, Simple			X	X		X	
Awls, Notched			X			X	
Scraper			X				
Die			X			X	
Tube				X			
Needles			X				
SHELL							
Bracelet, Glycimerus				X		X	
Bead, Olivella			X			X	
DISPOSAL OF THE DEAD							
No information	X				X		?
Cremation (?)							?X
Flexed Inhumation		X	X	X		X	

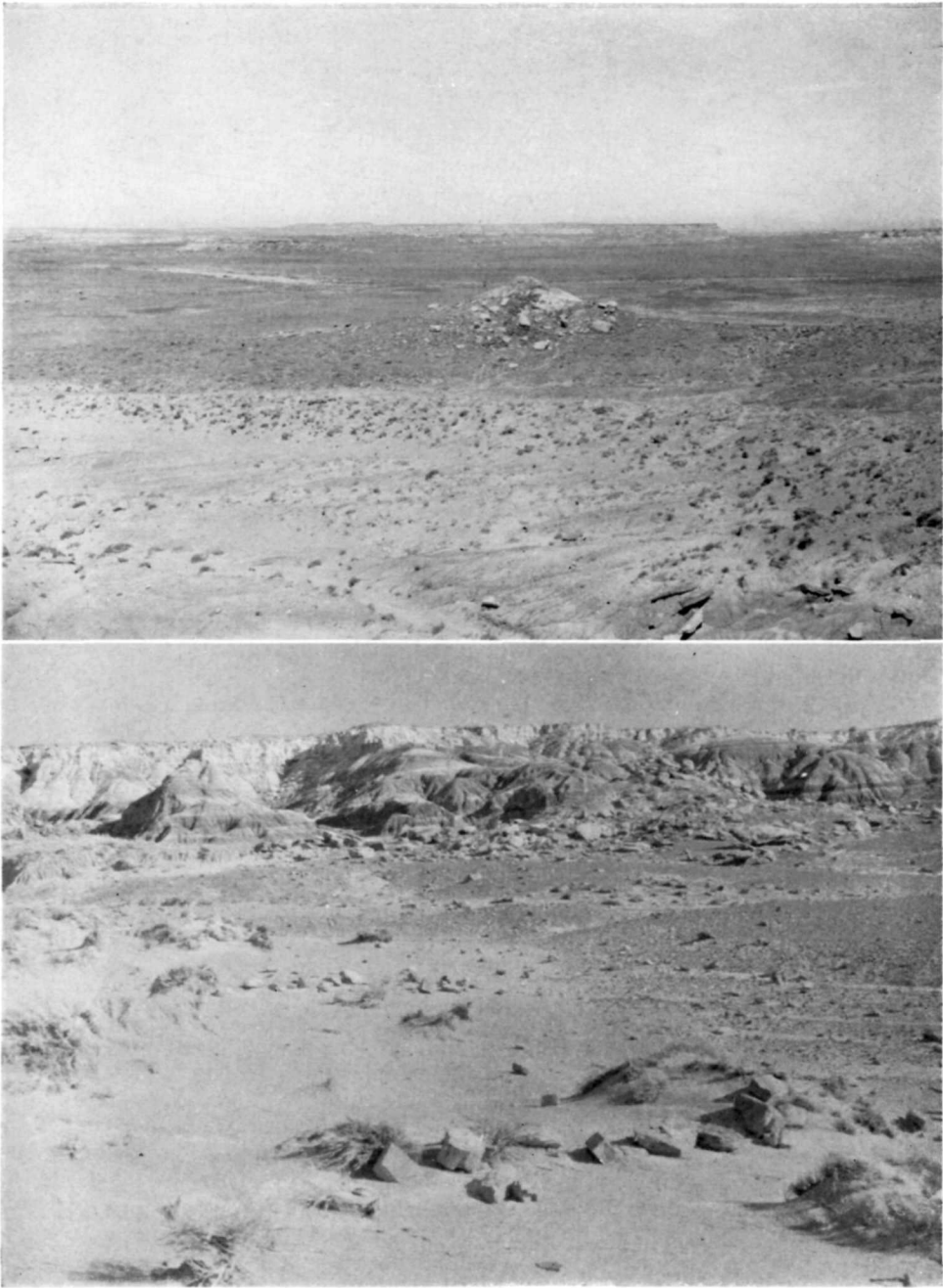


FIGURE 43.

Upper, The southern section of Petrified Forest National Monument looking northwest. Twin Butte Site in foreground.

Lower, Rock alignments in eroded area, possibly an abandoned agricultural field. Northern edge of Twin Butte Site.

CHAPTER III

TWIN BUTTE SITE

INTRODUCTION

THE Twin Butte Site, so named because of the two small cone-shaped remnants, the most conspicuous topographical features within the site area, is located some three airline miles north and east of the Flattop Site (See Figure 2).¹ In contrast to the lofty position of the Flattop Site, this second village is situated along the base of a long, low sandstone escarpment. Here the valley is broad and almost flat. It is drained by a small ephemeral stream, known as Dry Creek, which winds its way northward following a slightly eroded channel to eventually empty into the Puerco River about ten miles northwest of the site.

Except where it has been removed by erosion, a thin, stabilized sand canopy covers much of the valley. Bunch grass, an occasional Yucca, and clumps of Mormon Tea are dominant forms of vegetation. In favorable localities, and particularly along the edges of the escarpment, a few junipers have managed to establish themselves.

Evidence of occupation was detected over a sizable area and consisted of scattered house groups, indicated by rows of vertical wall slabs, thousands of broken pieces of pottery, flakes and tools (Figure 46 lower). Within this immediate area, houses were noted near the base of the escarpment and eastward for over a quarter of a mile out into the valley. It is probable that even more distant house groups were a part of this same general "community"; however, for the sake of convenience the area of the site was limited to that indicated in Figure 44. Beyond this limit, widely scattered house groups were noted over the entire valley which, on the basis of the ceramics, may be dated as contemporary with the main site concentration.

A considerable portion of the site, particularly that near the base of the escarpment, has been destroyed by erosion. In these eroded areas the barren bentonite shales, littered with fallen wall slabs and other debris, are exposed to the surface. Along the northern margin of the site the exact limits of some of the architectural units are masked by later sand dunes. These later dunes are today being eroded, principally through the action of water. Here, in profile may be seen the earlier sands, cemented with calcium carbonate, the cultural debris on top of these fossil sands, and the overlying uncemented later sands (See Figure 46 upper).

From the concentration of broken pottery and the numerous structures evident from the surface, it was believed that the most intensive occupation was centered along the southern slope of the low ridge connecting the escarpment with the northern "butte." In this area were noted several architectural units, isolated structures and a puzzling array of stone alignments set at intervals of from five to ten meters and at right angles to the long axis

1. NW $\frac{1}{4}$ of NE $\frac{1}{4}$, Sec. 15, T. 17N., R. 24E.

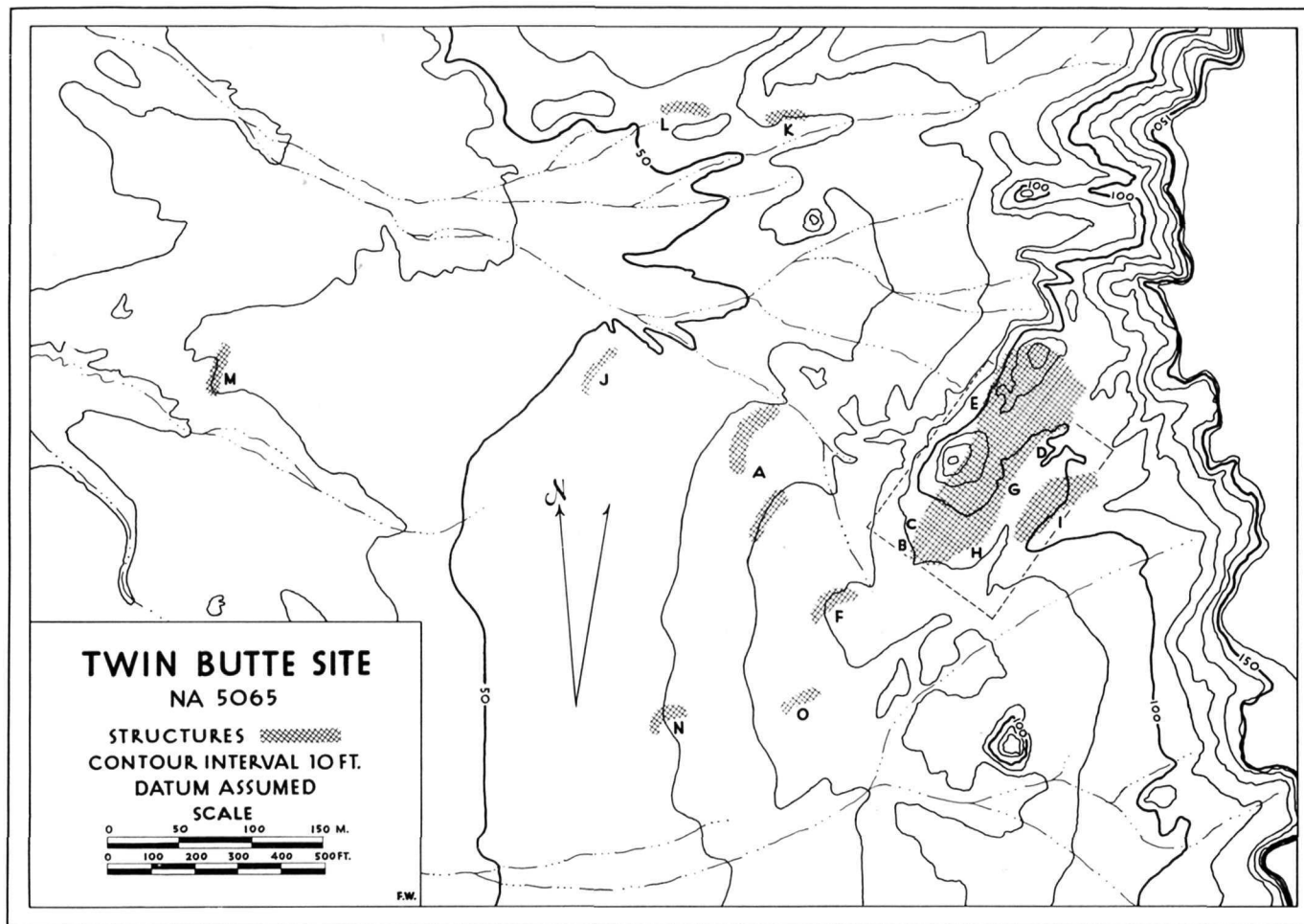


FIGURE 44. Map of Twin Butte Site. Broken lines enclose area of Figure 45.

of the ridge. At first, we suspected that these alignments might be large living units but when examined further this explanation seemed most unlikely.

Our excavations at the Twin Butte Site, because of the tremendous size of the village and the limitations of the resources available for our investigations, were more in the nature of "tests" than complete excavations. The first two weeks spent at this site were during the first season when the major effort was expended in determining the general character of the architectural remains and in locating the more chronologically significant portions of the site. Several (A1, B, C, E1) slab-lined structures of varying sizes and shapes were cleared and a test pit sunk in an area of deep trash. As luck would have it, not only was the trash deep in this test but the pit was placed squarely in the center of a circular adobe and stone-walled granary (D1), the top of the walls of which were just below the surface while the floor was nearly three meters lower. By the time this and the other structures were cleared we had expended our time; but we had definitely confirmed the potentialities of the site.

The second season we returned with a larger crew, and spent six full weeks in our excavations. Three major problems were attacked, each by a group of two or more students. First, a long, deep test trench (No. 1) was begun across the area our previous testing had indicated to have deep trash. Here we hoped to make several stratigraphic tests. Second, the problem of the stone alignments was explored by excavating a trench (No. 2) alongside and down one of these rows of stones. It was not long, however, before this trench had to be abandoned—burials seemed to be everywhere, and they were in such fragile condition that far too much time was required to excavate them properly. Before this section was closed, however, we had determined the general character and probable purpose of the alignments. Simultaneously, the third group began excavating in one of the crescentic units of slab-lined structures (f). This proved to be by far the most difficult task, for the deposits in this area of the site were firmly cemented.

TEST TRENCH I

(Figures 45 and 48)

Our preliminary testing suggested that very deep trash was to be found along the south slope of the long spur which juts out from the face of the escarpment into the village proper. To further explore this area, we excavated a long trench, cut at right angles to the axis of the ridge and extending from its crest to just short of the base. Along its entire length the floor of the trench was cut to underlying sterile bentonitic shale.

During the course of clearing the trench, four burials, two deep pits (for clay?), two granaries, a buried channel or irrigation ditch and one, possibly two houses were discovered. In addition, when two stratigraphic tests were made, one at each end of the trench, a buried stone alignment (in Test I) and a shallow cist (in Test II), probably at one time roofed with branches and twigs, were uncovered. So much complicated evidence was encountered that the projected length of the trench could not be completed and a short section had to be left unexcavated.

A simplified profile of the trench is reproduced in Figure 47. It is suggested that the reader follow these remarks with the aid of this diagram.

The earliest structures were the two adobe and stone-walled granaries D2 and D3, both erected prior to the accumulation of trash in this section of the site. During the period these structures were in use trash and water-deposited silt accumulated around their bases until it reached a depth of

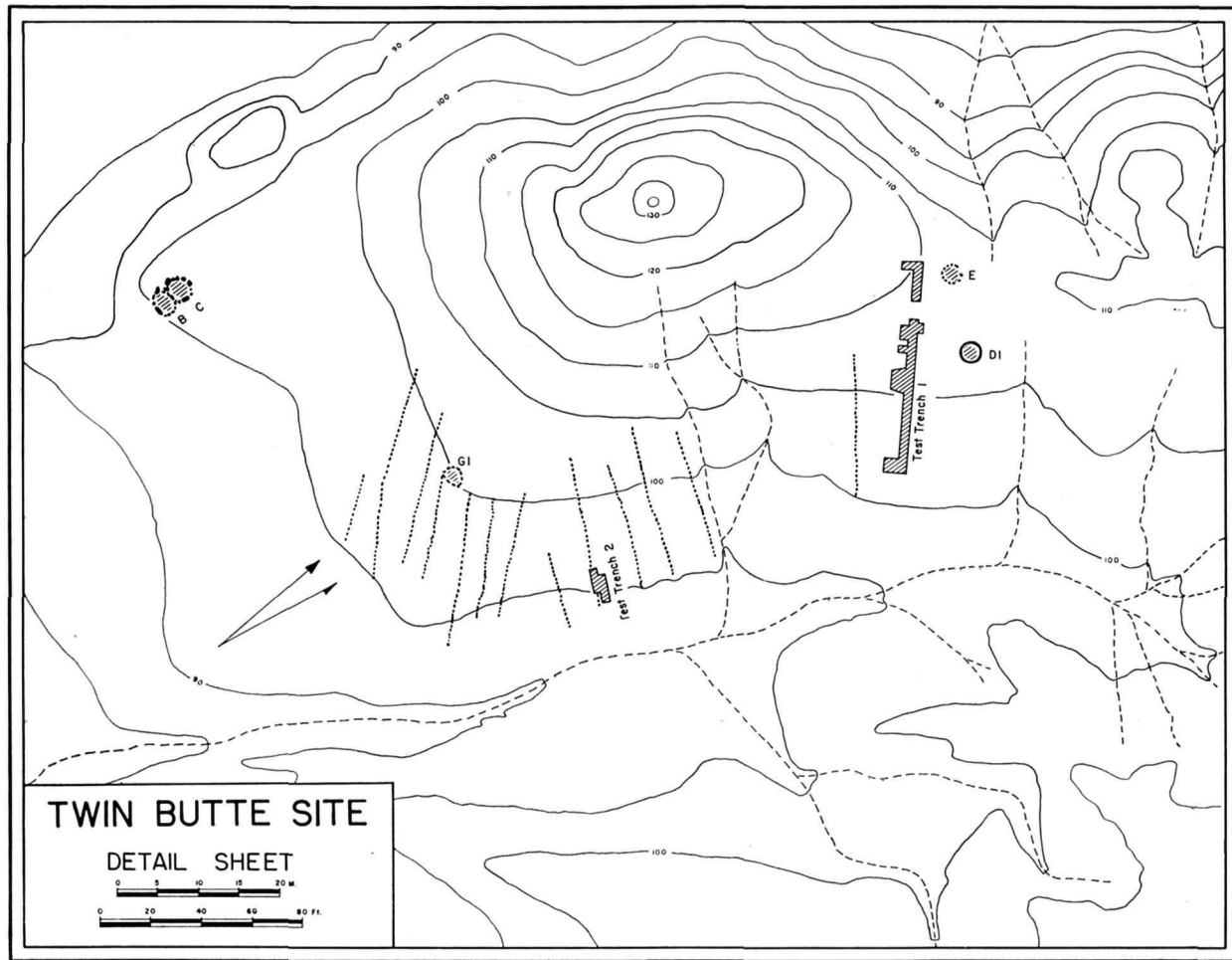


FIGURE 45. Detail map of small area in Twin Butte Site showing location of test trenches and rock alignments.

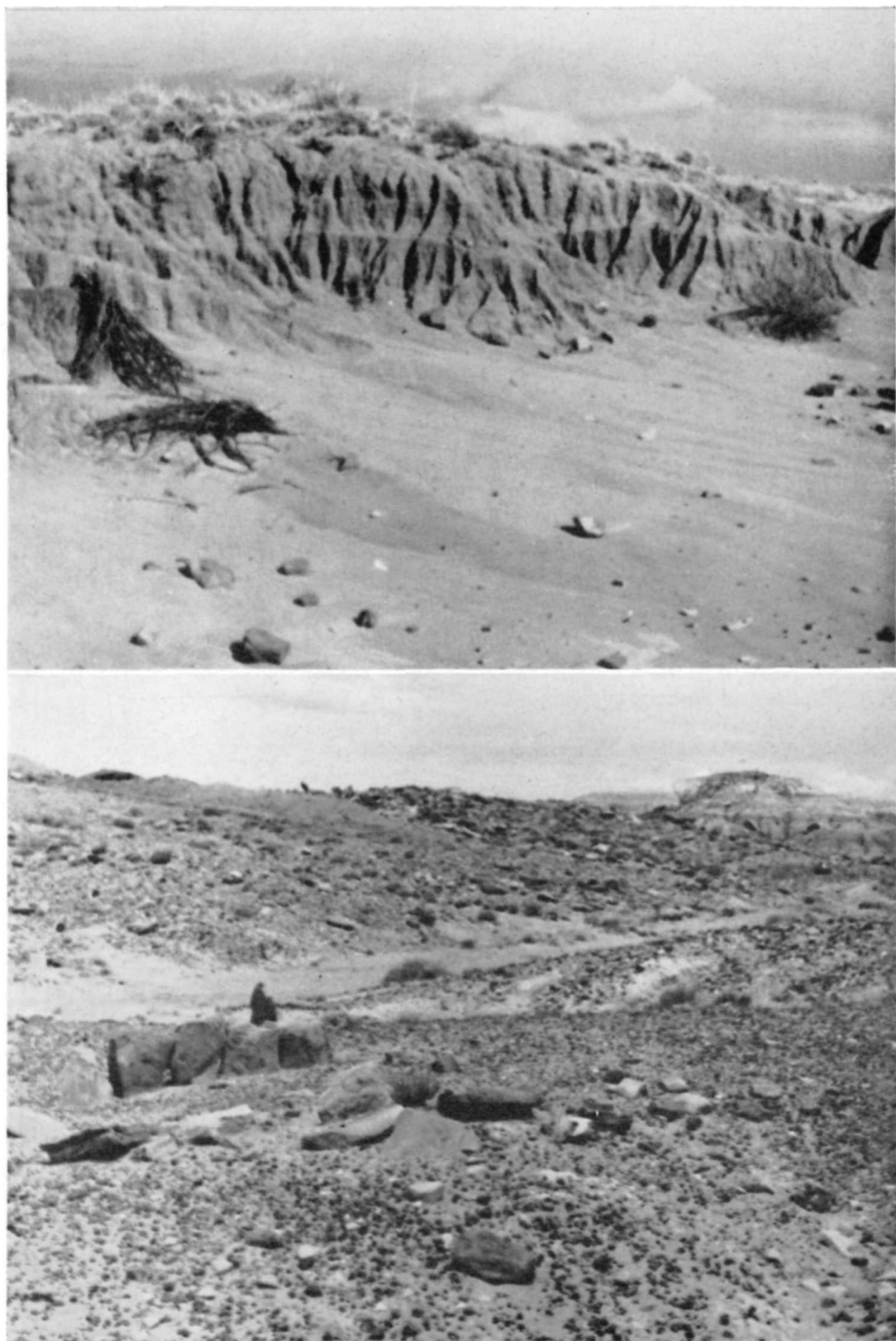


FIGURE 46.

Upper, Eroding dune sand on north edge of Twin Butte Site. Cultural debris is eroding from occupation zone immediately underlying white layer in center of profile. Lower, View of Twin Butte Site, looking southeast. Note cultural debris on surface and vertical wall slabs.



FIGURE 48. *Test Trench I.*

almost a meter. At this point the disposing of trash in this section of the site was for some reason discontinued for a time and a relative stable surface was reached. During this period a shallow trench was excavated around the granary D2 and this trench was filled with nearly sterile bentonite. Whether or not this bentonite was the result of a further deepening of the granary could not be determined, but significantly the bentonite was placed in a *previously prepared* trench which completely encircled the granary. Mr. D. McClanahan, Park Service ranger at the Petrified Forest, suggested that the use of this bentonite may have been an attempt to waterproof the granary. He suggested that some observant individual may have noted that water will penetrate bentonite only a short distance. If so, then the experiment must have failed, for no other incidence of such "waterproofing" techniques have, to my knowledge, been observed.

It was also during this relatively stable interval that the buried stone alignment was set up, Pit 1 was excavated and House D4 built. House D4 has a complicated history itself. Prior to the excavation of the deep pit house there was apparently in this same location a shallow slab-sided structure of unknown shape which was burned and rebuilt three separate times (note the three burned areas framed by the slabs).

The area apparently again became a popular dumping ground and debris rapidly accumulated. The granaries and pits were filled and all traces of the former houses obliterated. The locality then became a common area for the disposal of the dead. Four burials were encountered, all in pits sunk from very near the present ground surface.

Directly above structure D2 lay a small hemispherical stream channel, filled with clean, water-laid sand. An attempt was made to follow the course of this old channel but it soon disappeared. The possibility that the channel might represent an irrigation ditch was considered, but it could not be proved. Possibly the most serious objection to such a theory lay in locating a suitable source from which the Twin Butte people could have derived water to use for irrigation. It must be admitted that even an indication for such a source was not obtained. We must conclude, therefore, that the channel may have resulted from nothing more than a minor erosion. A short distance west of the trench the stone alignments were present on the surface of the ground, suggesting, together with the geological evidence noted by Bryan, that in this section of the site the present ground surface is probably reasonably close to that of the time of abandonment.

It will be noted that the upper or northwest end of the trench was not considered in the foregoing discussion. This omission is the result of my inability to correlate the strata separated by the unexcavated section of the trench. It is possible that Pit 2 dates from the same general period of "stability" described above although we could not conclusively establish this as a fact. It seemed, therefore, the prudent course to just record the data as we saw it without benefit of speculation.

TEST TRENCH II AND THE STONE ALIGNMENTS

The score or more rows of unshaped boulders which were evident on the southern slope of the ridge connecting the northern "butte" with the escarpment, was one of the puzzling features of the site. All of the rows, while not perfectly straight, were roughly parallel to each other and followed the slope of the hill (See Figure 45). Each row consisted of an alignment of rough stream boulders and sandstone slabs, from twenty-five to fifty cm. in diameter, with no evident mortar or other material bonding them together.

To determine the sub-surface features, a small trench one meter wide was begun at the southern end of one of the alignments. The excavation of this trench, known as Test Trench II, soon disclosed that the alignments were not related to any sub-surface features, but were confined to the rocks which were visible on the surface. The possibility, that they were wall slabs for houses or storage structures was, therefore, eliminated.

A similar alignment was also noted at a depth of fifty cm. in Stratigraphic Test I. This buried alignment was first thought to be a portion of a structure, but when the excavation was completed we found that this alignment, like those on the surface consisted of a simple row of rocks.

Milton Wetherill, while visiting our excavations, noted that these alignments reminded him of the rock and brush windbreaks used by the Hopi to shield their fields and orchards from the prevailing winds (See Hack, 1941, pp. 32-34). It is my belief that this resemblance is more than superficial.

As may be seen in Figure 45, the alignments at the Twin Butte Site are placed parallel to the slope of the ridge and are, therefore, of no value as check dams. Significantly, however, they are at right angles to the prevailing winds. A low, compact brush and stone fence, similar to those used today by the modern Hopi, would, if placed in the same position as the stone alignments, serve as a very effective windbreak. Since all traces of any possible associated brush have long deteriorated, these possibilities must remain speculative. Hack (1941, Plates V and VI) has illustrated several abandoned fields in the Hopi country. As may be seen in Figure 43b, there is a close resemblance between these modern Hopi fields and the rock alignments at the Twin Butte Site.

We are faced with several major difficulties, however, when we attempt to determine the correct chronological age for the alignments. Since they were on the surface of the site it is possible that they date either from the close of the occupation or represent a re-use of this area by a later group. At best our evidence on this problem is far from conclusive. The absence of materials which one might expect the supposed later utilizors of the site would have left, and a possible buried alignment, surely contemporary with the site, found in Stratigraphic Test I, both argue for a contemporaneity between the stone alignments and the remainder of the site. On the other hand, would it be necessary for the supposed later builders of the alignment to leave artifacts which we could recognize as later than the principal occupation of the site? Also, the question may be raised as to whether or not we excavated a sufficient amount of the buried alignment to conclusively determine that it was similar to those found on the surface. At the time of the excavation we believed the evidence to be conclusive, but in retrospect it seems probable that a more extensive excavation of this feature would have been desirable.

ARCHITECTURE

The typical architectural pattern of the Twin Butte Site, determinable from surface indications, consisted of fifteen or more presumably unconnected architectural groups located in the sandy flat in front of the escarpment and around the base of the long bentonite remnants (Figure 44). Other units, suggestions of which were noted in our excavations, may be present but hidden from view by later debris. Almost surely erosion has destroyed many structures, particularly any of those which might have been located either on the north slope of the larger remnant or the spur connecting this remnant with the escarpment.

Each group consisted of several connected semi-subterranean, slab-lined storage units, arranged to form a crescent, and one or more pit houses located in front of the arc formed by these storage structures. Storage pits, fire pits and perhaps other less substantial structures probably were also associated with these groups.

In addition to these units there were also several apparently isolated storage units of two types: 1) small, circular or oval slab-lined structures similar to those units which collectively form the larger storage groups and 2) large, deeply excavated circular pits with adobe and stone-walled superstructures.

No "Great Kivas" or similar large ceremonial or communal structures were excavated and none were evident from surface indications.

Figure 49—*Structure A*

Walls: Vertical sandstone slabs. Superstructure undetermined but possibly of adobe.

Entrance: Not determined.

Floor: Packed sand.

Hearth: Burned area slightly off-center toward the east side.

Fill: Firmly consolidated adobe and wind and water deposited sand.

Associated Floor Artifacts: Stone—metates (2); manos (4); ball (1); pipes (2); hammerstone (3). Horn and bone—antler cores (2); awl (1). Pottery: whole or restorable vessels—Forestdale Smudged bowls (2); Lino Gray jar (2).

Type of Structure: Unit of large crescentic storage and living groups. Associated structure not excavated but wall base visible on surface of ground.

Remarks: Stratigraphically below the floor of this structure were traces of an earlier slab-lined unit. Time did not permit the complete clearing of this earlier feature.

Photograph: Figure 50.

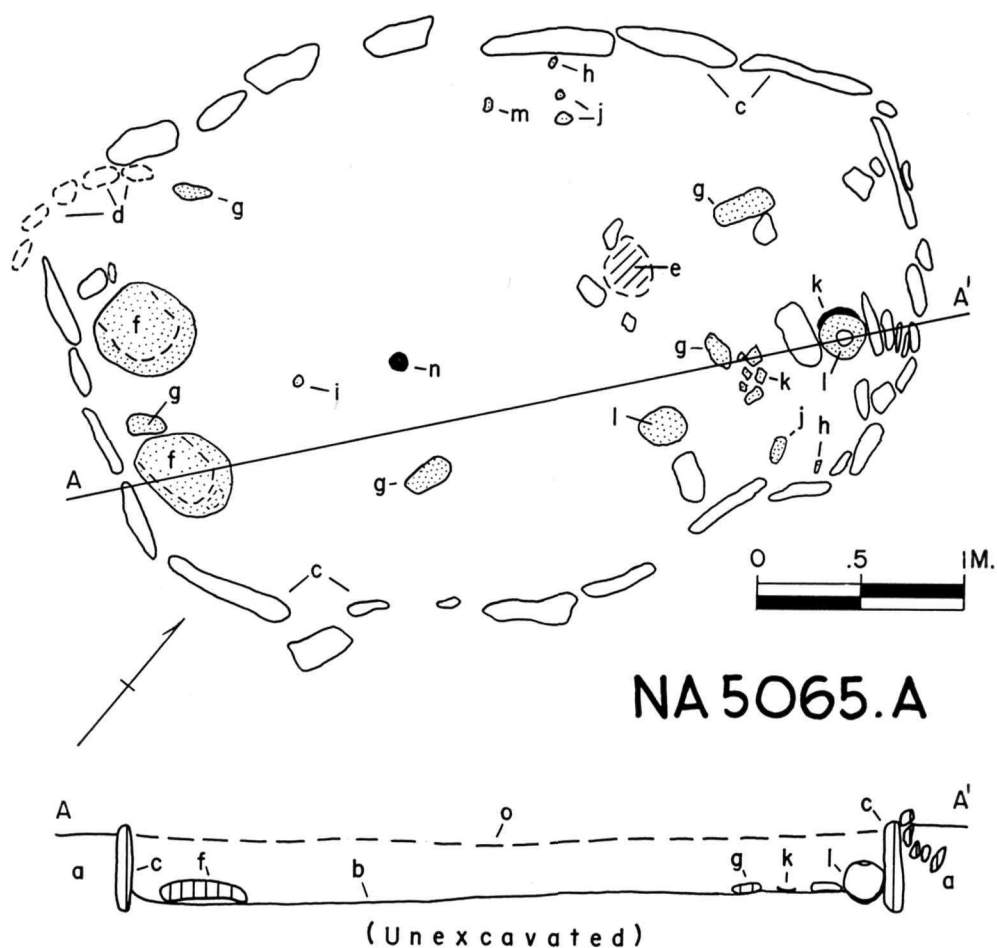


FIGURE 49. Plan and section of Structure A.

- a, Trash. Unexcavated.
- b, Floor, packed sand.
- c, Vertical wall slabs.
- d, Vertical slabs stratigraphically below Structure A.
- e, Burned area, possible hearth.
- f, Trough metates.
- g, Manos.
- h, Unfinished pipe.
- i, Stone ball.
- j, Hammerstone.
- k, Forestdale Smudged bowl.
- l, Lino Gray jar.
- m, Petrified wood core.
- n, Post hole.
- o, Surface of the ground prior to excavation.



FIGURE 50. *Structure A.*

Figure 51—Structures B and C

Walls: Large boulders and vertical sandstone slabs. Superstructure undetermined.
Traces of plaster visible along bases of wall boulders.

Entrance: Not determined.

Floors: Plaster.

Hearth: None.

Fill: Firmly consolidated adobe and wind and water deposited sand.

Associated Floor Artifacts: Stone—metates (1 in B); mano (1 in B). Pottery—Lino Gray pitcher (1); Forestdale Plain pitcher (1); mass of vessels in northeast corner of C. The following separate vessels were identified: Small Lino jar (1); Forestdale Rough jar (1); Forestdale Plain small jar with lug (1); Forestdale Plain pitcher (1); Forestdale Plain neckless jars (2); Forestdale Smudged bowl (1); Forestdale Black-on-Red neckless jar (1).

Type of Structures: Units of crescentic storage group. Three, or possibly four, units plus the associated pit house, probably comprised the total for this small unit. Remaining units not excavated.

Photograph: Figure 52.

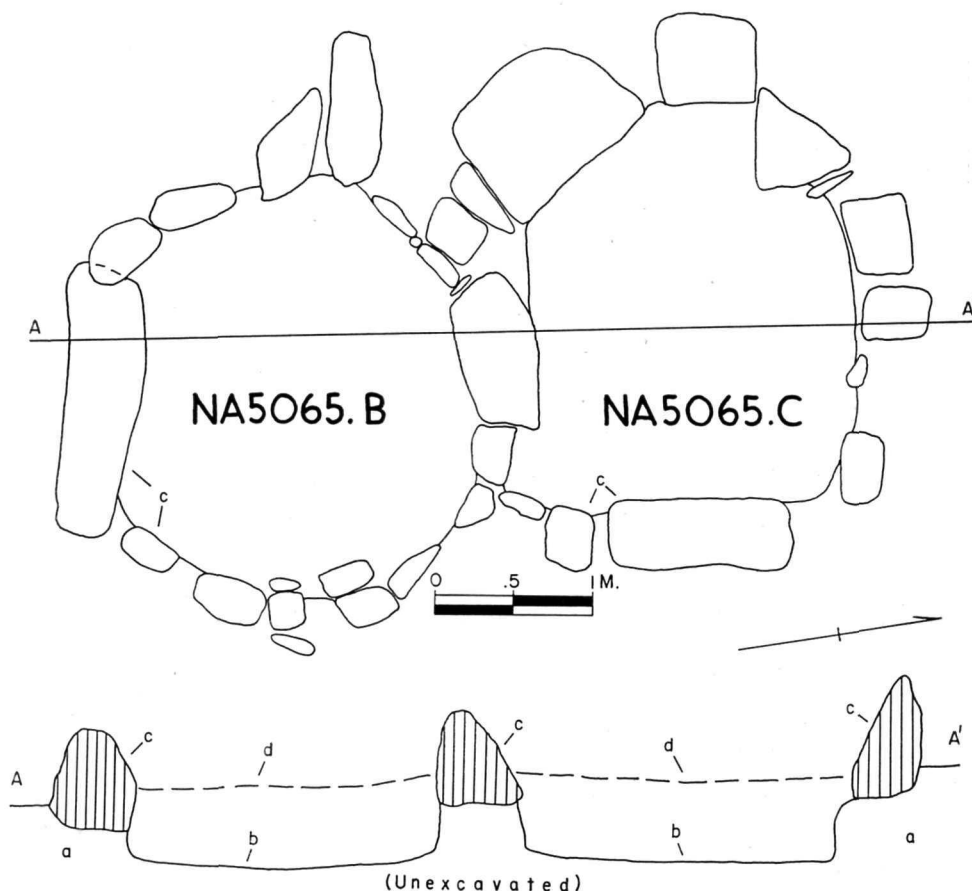


FIGURE 51. Plan and section of Structures B and C.

- a, Trash. Unexcavated.
- b, Floor.
- c, Wall blocks and slabs.
- d, Surface of ground prior to excavation.



FIGURE 52. Structures B and C.

Figure 53—Structure D1

Walls: Base, vertical sandstone slabs. Above vertical slabs, alternating courses of adobe and stone. Exterior profile not cleared, probably similar to structure D3. Adobe appeared as a continuous band separated from bands above and below by a layer of irregularly spaced, unshaped small sandstone blocks.

Entrance: Roof only.

Floor: Irregular bedrock. Excavated 70 cm. below base of wall.

Hearth: None.

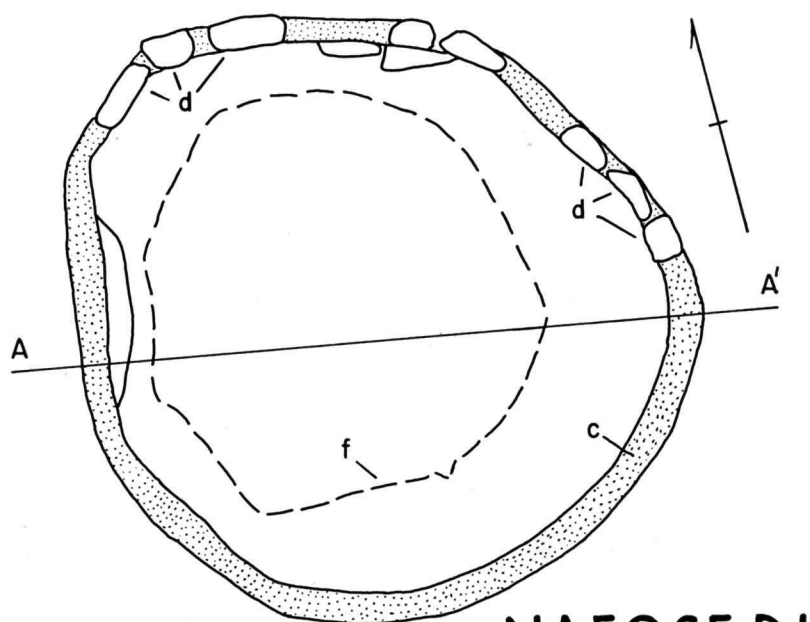
Bench: Of unplastered bedrock, completely encircling structure from 20 to 55 cm. wide. Average 65 cm. above floor.

Fill: Primarily redeposited trash.

Associated Floor Artifacts: None.

Type of Structure: Deep granary. Structure located in final week of 1949 season and, due to limitation in time, the exterior was not cleared. It is believed, but not proven, that it, like D2 and D3, was not connected with other units.

Photograph: Figure 54.



NA5065.D1

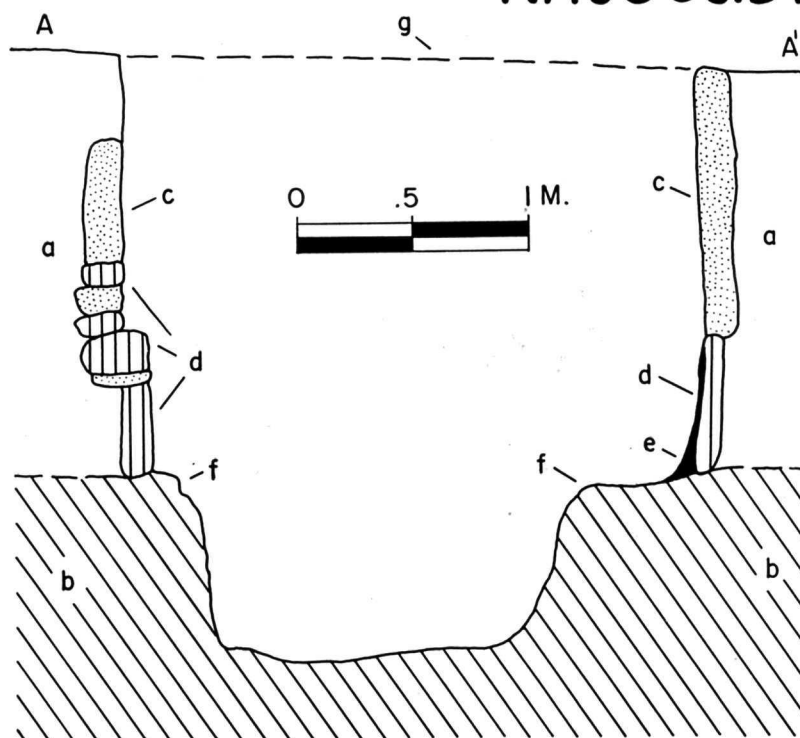


FIGURE 53. Plan and section of Structure D1.

a, Trash. Unexcavated.
b, Sterile shale bedrock.
c, Adobe.
d, Sandstone blocks and slabs.

e, Plaster.
f, Bench.
g, Ground surface prior to excavation.



FIGURE 54. *Structure D1. Assistant is standing on floor.*

Figure 55—*Structure D3*

Walls: Alternating courses of adobe and stone. Probably standing at approximate original height.

Entrance: Roof only.

Floor: Irregular bedrock. Excavated 175.0 cm. below base of wall.

Hearth: None.

Bench: None.

Fill: Primarily redeposited trash.

Associated Floor Artifacts: None.

Remarks: This structure and the located but unexcavated structure D2 (See plan of Test Trench I) were apparently built before any appreciable amount of trash had accumulated in this section of the site (See profile of Test Trench I, Figure 27). Structure D3 continued to be used while approximately 1 meter of trash had accumulated around its sides. At that time a pit which completely encircled the house was excavated and sterile bentonite clay was used to fill this pit (f). Sometime following the excavation of this pit the structure fell into disuse and was allowed to fill with trash. When the site was abandoned no traces of the structure were visible from the surface. Turkey burial found in fill (depth unrecorded).

Type of Structure: Deep granary.

Photograph: Figures 56 and 57.

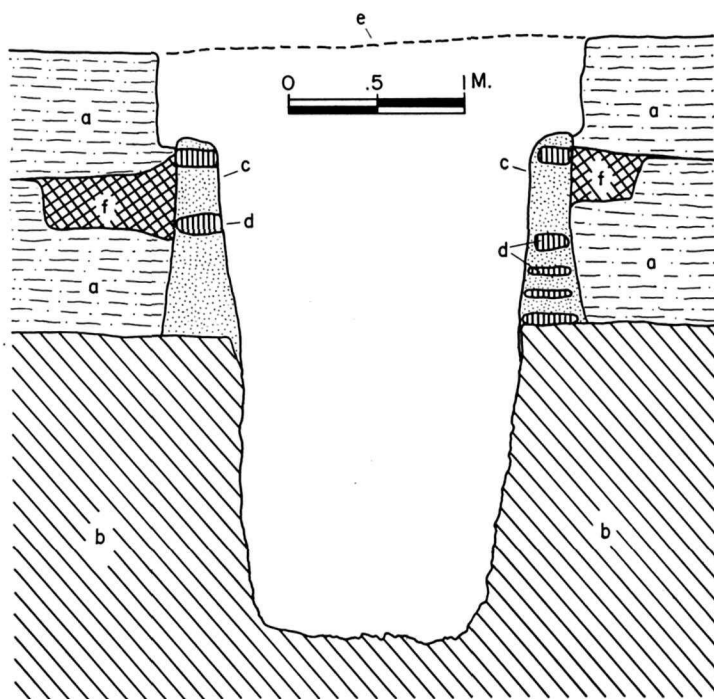
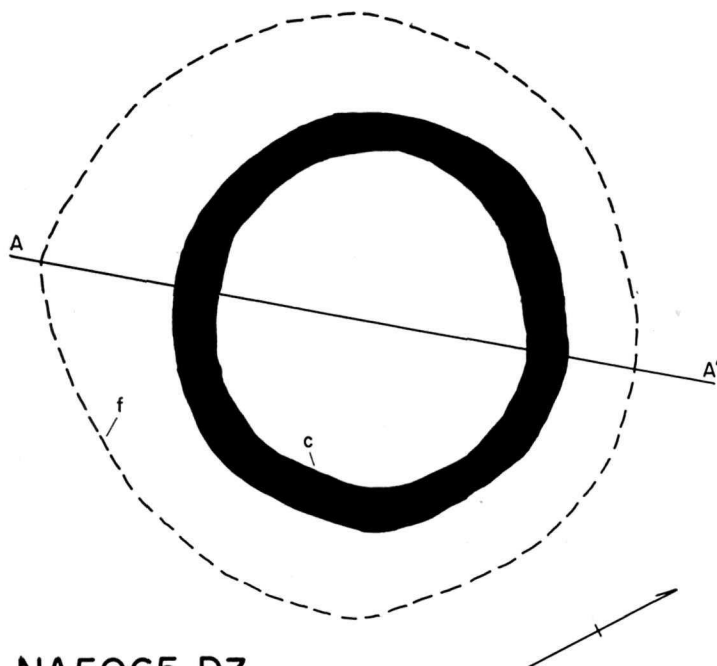


FIGURE 55. Plan and section of Structure D3.

- | | |
|-----------------------------------|---|
| <i>a</i> , Trash. | <i>d</i> , Sandstone blocks. |
| <i>b</i> , Sterile shale bedrock. | <i>e</i> , Surface of ground prior to excavation. |
| <i>c</i> , Adobe. | <i>f</i> , Sterile bentonite clay collar. |



FIGURE 56. *Test Trench I. Assistant in foreground is cleaning wall of deep granary D3.*



FIGURE 57. *Deep granary D3.*

Figure 58—*Structure D4*

Walls: For the most part unplastered, native earth. Occasional sandstone slabs.

Entrance: Undefined.

Floor: Plaster over sterile sub-soil.

Hearth: Deep bowl-shaped pit, circular in outline. Lined with clay.

Ash Pit: Adjacent to fire pit on southeast side. Contained ashes. In floor of pit were two depressions, possibly ladder rests.

Sipapu: Northwest of fire pit. Jug shaped. Filled with clean sand.

Sub-Floor Pits: One located south of fire pit.

Post Holes: Only one located. Small. Near wall.

Bench: None.

Ventilator: If present not defined. No deflector.

Associated Floor Artifacts: Stone—metates (2). Pottery: sherds—Lino Gray (Fugitive Red—1); Forestdale Plain (1); Forestdale Smudged (1).

Remarks: As indicated by drawing, structure only partially cleared. An earlier structure, indicated by the three burned levels, was cut through when this house was built. This earlier structure was apparently large, shallow, slab-lined, and had been burned and rebuilt three times. A turkey burial was found slightly above the floor southeast of the ash pit in the area where either a lateral entryway or ventilator might be expected.

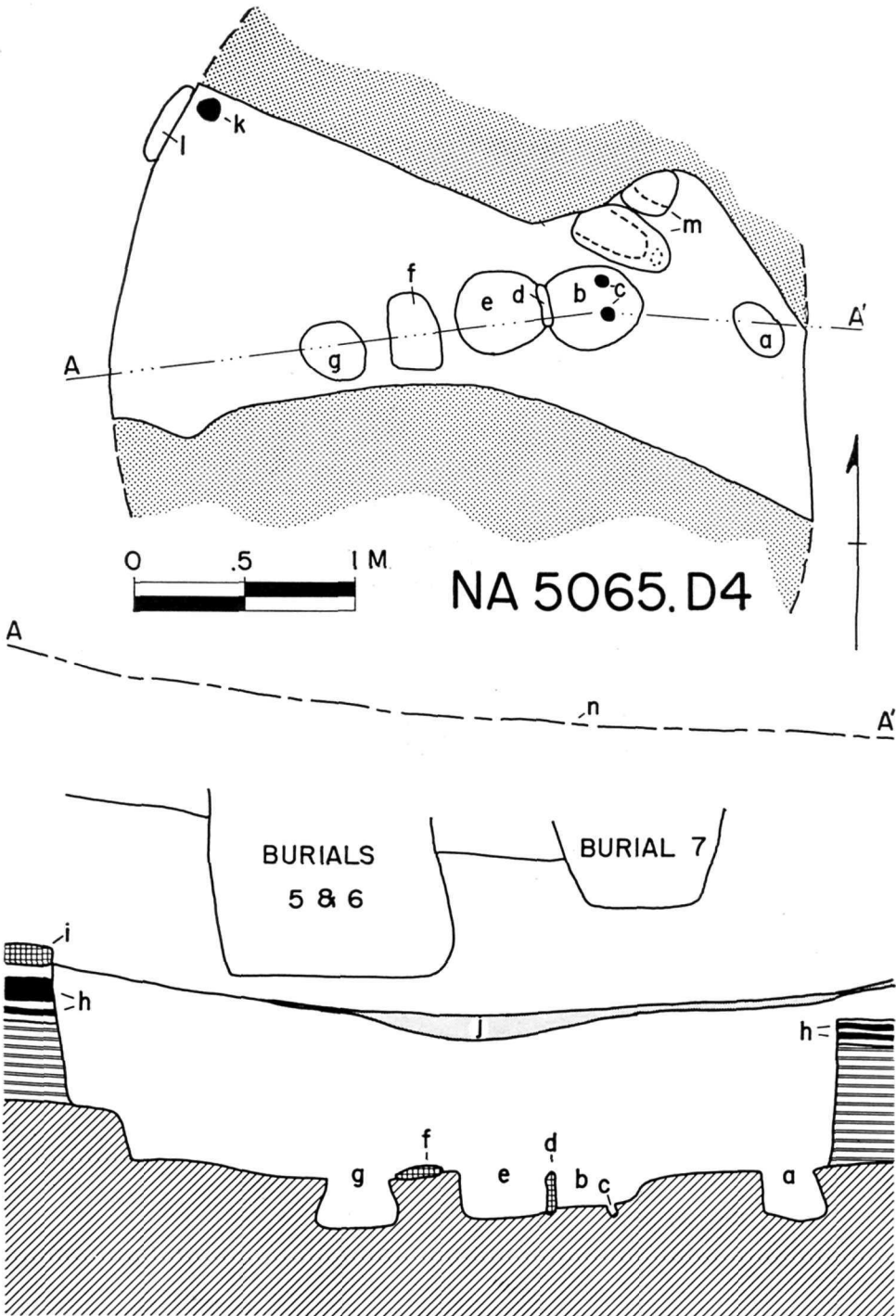


FIGURE 58. Plan and section of Structure D4.

- | | | |
|------------------------|----------------------------|----------------------------|
| a, Sub-floor pit. | g, Sipapu (?), filled with | i, Slab. |
| b, Ash pit. | clean sand. | j, Charcoal and sand. |
| c, Ladder holes. | h, Charcoal layers, prob- | k, Post hole. |
| d, Slab deflector (?). | ably floor levels of | l, Vertical wall slab. |
| e, Firepit. | burned structure con- | m, Metates. |
| f, Slab. | structed prior to pit | n, Surface of ground prior |
| | house. | to excavation. |

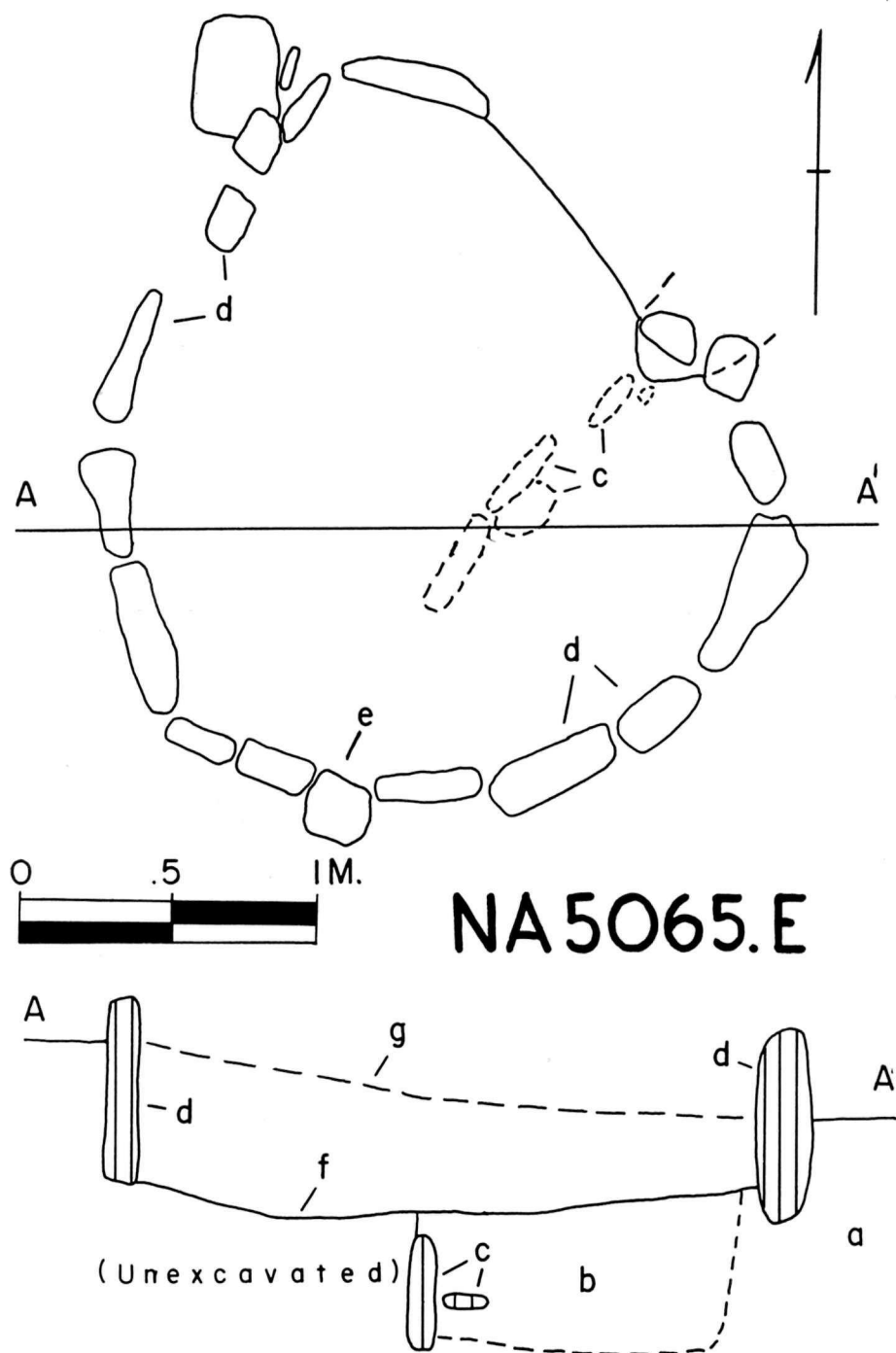


FIGURE 59. Plan and section of Structure E.

- a, Unexcavated Trash.
- b, Sub-floor test pit.
- c, Wall slabs presumably belonging to earlier structure.
- d, Vertical wall slabs of Structure E.
- e, Petrified wood wall slabs.
- f, Packed floor level.
- g, Surface of ground prior to excavation.

Figure 59—*Structure E*

Walls: Vertical slabs.

Entrance: None defined.

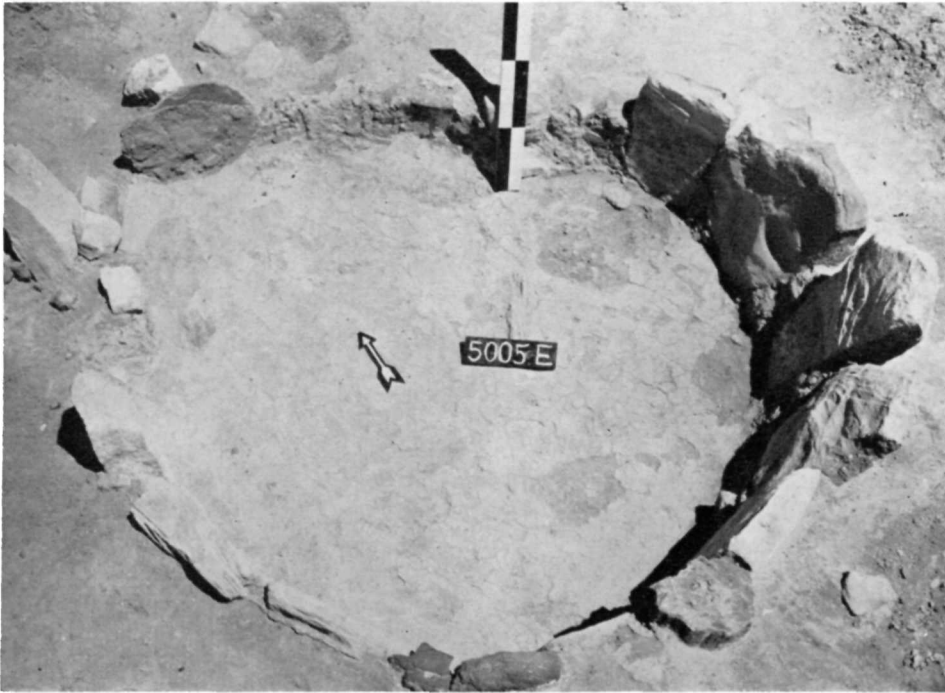
Floor: Packed level, not clearly defined.

Fill: Adobe chunks, trash and wind and water deposited sand.

Associated Floor Artifacts: None.

Type of Structure: Isolated storage cist.

Photograph: Figure 60.

FIGURE 60. *Structure E.*Figure 61—*Structure F*

Structures F1a and F1b: Pits with undercut sides.

Associated Artifacts: a, Fill sherds—Lino Gray (100); White Mound Black-on-White (2); Forestdale Plain (33); Forestdale Smudged (31).

b, In fill—Forestdale Plain jar (Incomplete).

Structure F1c: Unexcavated.

Structure F2: Two occupations.

Walls: First occupation: Sides of excavation, superstructure unknown.

Second occupation: Vertical sandstone slabs.

Entrance: None defined.

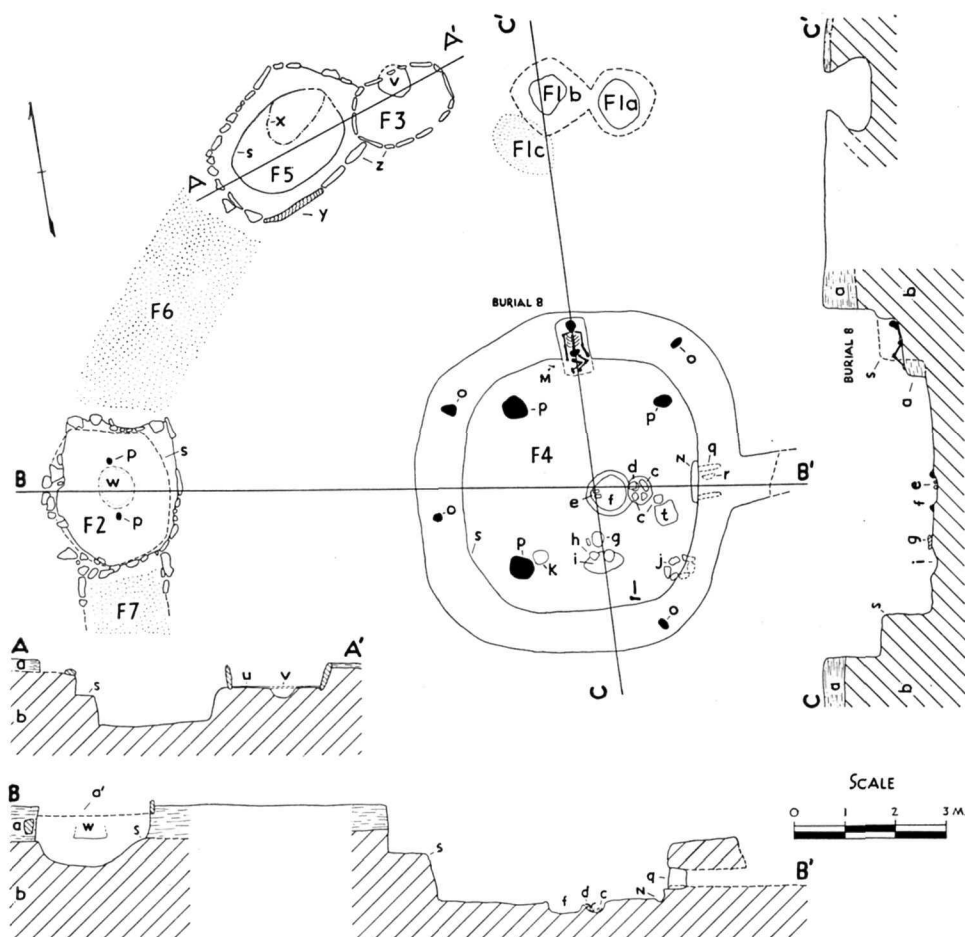


FIGURE 61. Plan and section of Group F.

- | | |
|---|---|
| a, Trash. | o, Secondary post holes. |
| b, Sterile clay sub-soil. | p, Major post holes. |
| c, Water-worn cobble stones. | q, Sandstone slabs lining ventilator outlet. |
| d, Forestdale Plain jar (incomplete). | r, Large disc of red ochre. |
| e, Unfinished tubular pipes. | s, Bench. |
| f, Clay-lined hearth. | t, Sandstone slab, probably used to close ventilator. |
| g, Lino Gray jar. | u, Yellow stained floor of Structure F3. |
| h, Forestdale Smudged bowl (incomplete). | v, Pit, probably pre-dates Structure F3. |
| i, Shallow pit. | w, Pit with undercut sides. Probably cut from upper-floor Structure F2. |
| j, Slab-lined post hole or storage cist. | x, Shallow pit. |
| k, Shallow pit or secondary post hole. | y, Adobe wall. |
| l, Bone spoon. | z, Vertical sandstone slab. |
| m, Bone awl. | a', Upper-floor Structure F2. |
| n, Shallow trench. Probably held slab (t) which closed ventilator outlet. | |

Floor: First occupation: Plaster on sterile clay sub-soil.

Second occupation: Packed layer, not clearly defined. Located primarily by presence of artifacts.

Post Holes: Two in first occupation floor; shallow oval pits. None defined in second occupation floor.

Bench: Possibly in first occupation.

Sub-floor Pits: In upper floor only. Undercut sides, contained circular unbaked clay disc 35cm. in diameter which possibly at one time served as seal or plug for pit.

Fill: Between first and second occupation—primarily redeposited trash. Above second occupation—firmly consolidated adobe and wind and water deposited sand.

Associated Floor Artifacts: Upper occupation: Stone—mano (1); rubbing stone (1); discs (2); ground axe (1); grooved maul (1); hammerstones (9); pendant (1); cone-shaped objects (9); projectile points (7); bifacially worked blade (1); ovate (1). Horn and bone—awls (4).

Pottery: whole and/or restorable vessels—Lino Gray pitcher (1); tall neck Lino Gray jar (1); Woodruff Red seed jar (1); Forestdale Red jar with fragmentary effigy (1); Forestdale Plain jars (2); Forestdale Plain doubleneck jar (1).

Type of Structure: Unit of crescentic storage group.

Structure F3.

Walls: Vertical sandstone slabs.

Entrance: None defined.

Floor: Yellow-stained compacted layer resting directly on the clay sub-soil.

Floor Features: None associated with structure. Shallow pit along and under north wall of structure probably pre-dates building of this unit.

Fill: Firmly consolidated adobe and wind and water deposited sand.

Floor Artifacts: None.

Remarks: Position of west wall of structure F3 suggests that structure F5 was added to structure F3.

Type of Structure: Unit of crescentic storage group.

Structure F4.

Walls: Native earth plastered.

Entrance: Probably through roof.

Floor: Plaster over sterile sub-soil.

Hearth: Slightly off-center toward east side. Circular shallow bowl surrounded by lip 15 cm. high and 20 cm. wide.

Ash Pit: Between hearth and ventilator contained four water-worn cobbles which showed evidence of heat.

Sub-Floor Pits: Three. One, shallow irregular, to south of fire pit. Second, circular and shallow, located near major post hole. Third, slab-lined, may be major post hole. Only first contained artifacts; 2 pottery vessels, 1 complete.

Post Holes: Three, possibly four, major roof supports located near each corner. Four minor supports in bench.

Bench: Completely encircling structure. Average 75 cm. wide and 1 meter above the floor. Plastered.

Ventilator: In east side through bench. Inlet not defined. Outlet was framed on two sides with vertical sandstone slabs. No deflector but when needed outlet could be closed with sandstone slab lying nearby.

Fill: Primarily wind and water deposited sand and rubbish. Two adjoining vertical sandstone slabs, apparently part of a later structure which could not be defined, were noted in the fill. The exact location of these was not recorded but the bases of the slabs were about 50 cm. above the floor of the structure.

Remarks: Group F had obviously been occupied and reoccupied for a comparatively lengthy span of time. The fire pit beneath the wall of structure F3, which was built prior to Structure F5, the reoccupation of Structure F2, the vertical slabs, trash and burial in fill of Structure F4 all indicate succession of continuous occupation and modification. Judging from the associated ceramics, the entire span of this occupation and use of this portion of the site (except possibly the intrusive burial) was during Basket Maker III times.

Associated Floor Artifacts: Stone—mano (1); milling stone (1); pipes (2). Bone—spoon (1); awl (1). Pottery: whole or restorable vessels—Lino Gray jar (1); Forestdale Plain jar (1); Forestdale Smudged bowl (1).

Type of Structure: Pit house.

Structure F5.

Walls: Vertical sandstone slabs and adobe.

Entrance: None defined.

Floor: Plaster on sterile sub-floor.

Bench: Completely encircling structure. Averages 25 cm. wide, and 50 cm. above the floor.

Floor Features: Shallow irregular depression along north side of floor.



FIGURE 62. *Unit F.*

Remarks: Structure F5 probably added to Structure F3.

Type of Structure: Unit of crescentic storage group.

Structures F6 and F7: Unexcavated.

Type of Structure: Unit of crescentic storage group.

Photographs: Figures 62 and 63.



FIGURE 63. Protokiva, Structure F4.

Figure 64—Structure G1

Walls: Vertical sandstone slabs.

Entrance: Not determined.

Floor: Not clearly defined but packed trash may possibly indicate level.

Floor Features: None.

Associated Floor Artifacts: One Forestdale Smudged bowl; one Forestdale Plain jar exact location on floor unknown. Sherds, Lino Gray (14 of which 4 have Fugitive Red on exterior).

Type of Structure: Isolated storage cist.

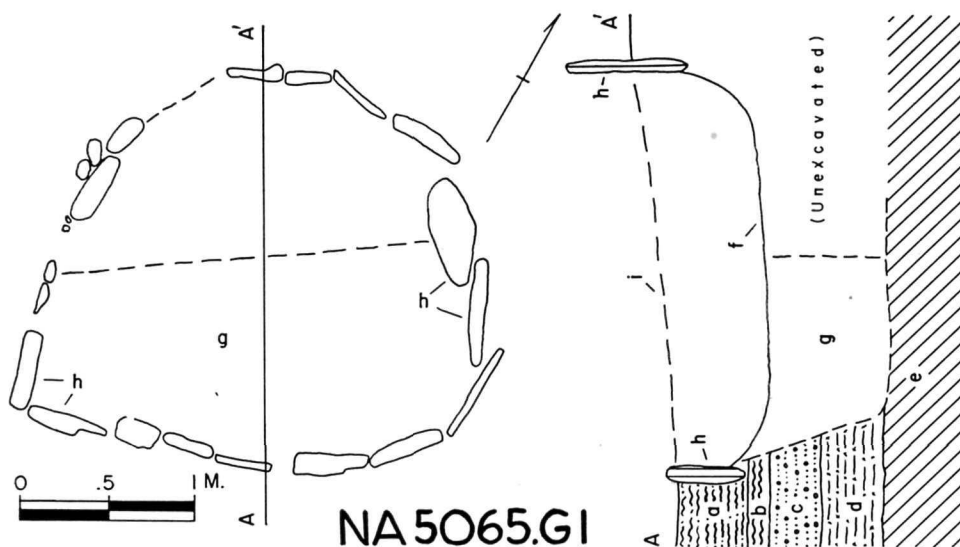


FIGURE 64. Plan and section of Structure G1.

- a, Bentonite clay with some charcoal.
- b, Trash.
- c, Bentonite clay, charcoal rare.
- d, Stratified trash.
- e, Sterile shale bedrock.
- f, Floor ?
- g, Sub-floor test pit.
- h, Vertical sandstone wall slab.
- i, Surface of ground prior to excavation.

ARCHITECTURE: DISCUSSION

Although many details are still not clear, the broad outline of the sequence of the development of architecture among the Anasazi is now fairly well known. Both Roberts (1939b) and Brew (1946, p. 216) have traced this development of which the following comments by Brew (*Ibid.*) are relevant in our immediate discussion.

... the small oval and circular slab-lined storage cists of the Basket Maker II period in the Pecos Classification developed into the similarly shaped larger storage chambers, still isolated, which are considered to be diagnostic of Basket Maker III. Then these storage chambers were put together, at first crudely with little change in form or construction, and large, irregular rooms were attached to series of 2, 4 or 6 of them. The new rooms provided domicile and represented a coming up out of the pit houses of some of the aspects of family life. Soon the storerooms, by then contiguous, were squared up, the outside walls were aligned, and a single common wall served as partition between them. A single common wall also served as partition between the storage rooms and the new-style living rooms. The living rooms at the same time became more regular and the 2 kinds of rooms appeared as long double rows, usually arranged in a slight curve, with the storerooms at the back and the living rooms in the front, generally facing the south. In a plaza in front of the latter, or at the ends of the rows, were the pit houses, by then smaller, deeper, and more closely resembling in form and specialized function the kivas into which they were to develop. Other small buildings, sheds, pits, bins, etc., were to be found in the plazas, as well, but the main line of development for Pueblo house type was fairly well set.

It is evident that the grouped storage units described earlier from the Twin Butte Site may be fitted into this general pattern. All of these structures which were excavated here were more or less oval in outline and thus

had not yet attained the aligned walls which Brew noted soon followed the linking of the units together. That domestic activities were already being conducted in some of these oval units is apparent from the presence of several metates and a fire area on the floor of Structure A. Structures B and C, though possibly contemporary with Structure A, lacked evidence suggesting use other than for storage. Structures E1 and G1, although stratigraphically among the last structures built at the site, were isolated units of the type which Brew noted occurred in Basket Maker II and early III. These structures are evidently a carry-over of an earlier architectural mode into later periods.

The storage rooms of Group F are particularly interesting in that the superposition of the floors in Structure F2 illustrates how in the later structures the floor levels were gradually raised until they were nearly even with the ground outside. In this case, as well as Structure A, this was accomplished before the walls had been aligned. At the White Mound Site (Gladwin, 1945, Figure 2), on the other hand, the straightening of the walls had already been completed although the floors of many of the rooms were excavated some distance below the surface of the ground. All of this variability suggests that the Twin Butte Site during its later years represented a period of rapid architectural change and instability.

The adobe-walled granaries D1, D3 and the located but unexcavated example D2, are apparently unique in the Southwest. When constructed, no trash had accumulated in their section of the site, suggesting that they were among the first structures built. In some respects, particularly in the adobe and stone superstructures, these granaries resemble the cists found by Guernsey and Kidder (1921, pp. 39-40) in a Basket Maker II cave in the Kayenta. They do not mention, however, if the floors of these Kayenta cists were deeply excavated. Since this would be an obvious feature, we may assume that these Basket Maker II cists and the granaries from the Twin Butte Site are different in this respect. What may be even more closely similar structures are reported by Morris (in Wormington, 1947, p. 36) as features of his Basket Maker II houses near Durango, Colorado. There, storage cists with adobe and stone superstructures and excavated floors were found as part of a house unit. While we found no indication that the granaries at the Twin Butte Site were associated with a pit house, the preliminary descriptions of these Durango walled-cists are more reminiscent of the Twin Butte granaries than any other structures so far reported. Similar granaries have not, to my knowledge, been reported from other Basket Maker III or later sites in the Southwest.

Storage pits with undercut sides, similar to F1a and F1b, have been considered a Mogollon characteristic (Rinaldo, 1941, p. 11). While this feature at the Twin Butte Site may be attributed to Mogollon stimulation, other interpretations are equally, if not more, plausible. Storage pits with undercut sides were a common feature in Basket Maker II sites (Guernsey and Kidder, 1921, Plate 9b) and have been found in Pueblo I sites in the Piedra district in southwestern Colorado (Roberts, 1930, p. 27). Further, in view of the widespread distribution of this feature in western North America, it is doubtful if this type of pit can be considered diagnostic of any one group.

Only two structures (D4 and F4), indentifiable as pit houses, were excavated at the Twin Butte Site. Of the two, only one (F4) was completely cleared. It will be recalled that this house (Structure F4) was a meter and a half deep, and equipped with a ventilator, a bench which completely encircled the house and a four-post roof support arrangement. Storage pits, a

firepit and an ash pit completed the floor features. There was neither a *sipapu* nor a partition wall. Of these features the ventilator is perhaps the most surprising. A discussion of the implications of this feature is offered further on in this section.

The absence of the *sipapu* and the partition wall, both features which are commonly found in Basket Maker III pit houses (Roberts, 1929), has at best only doubtful significance. While contemporary Mogollon pit houses (Haury, 1940, p. 52) also usually lack these features and are thus similar to Structure F4, it should be pointed out that Anasazi pit houses (for example, see Roberts, 1931, pp. 22 and 24) have been excavated which lack partition walls and, although a careful search was made at the time of excavation, it is possible that the *sipapu* was present in Structure F4 but overlooked. Interestingly, the partially excavated pit house D4 (Figure 58) had a *sipapu*.

Brew (1946, pp. 203-214) and Roberts (1939b) both have also outlined the stages through which the Basket Maker III pit house was modified into the kiva of Pueblo times. The later steps in this sequence are of little concern to us here since they took place after the Twin Butte Site was abandoned. A re-examination of the beginning steps, however, will aid us in correctly evaluating Structure F4 in this sequence.

In contrast to the cellular storage groups and elementary pueblos discussed above, which can be traced from the simple Basket Maker II slab-lined cists, the developmental steps which led to the pit house among the Anasazi are not yet known. Excavations in sites of Basket Maker II age thus far have been concentrated in caves rather than in more open and unprotected dwelling sites where houses of some sort might be expected. In only one site, located near Durango, Colorado, have excavations been conducted at an open Basket Maker II dwelling site. There Morris (1941) found several houses located on the slope of a hill. In order to level the floors of the houses the rear portions had been cut into the hillside. A superstructure of cribbed timbers had been erected which rested directly on the floors. Morris does not consider these structures as "pit houses," however, it remains to be determined if this atypical site location may not have significantly modified the house type of these people. If not, then, in the light of our present evidence the idea may be entertained that Anasazi pottery and pit house architecture may have been introduced at the same time and perhaps, though not necessarily, from the same source.

Pertinent to this problem is the recent discussion by Daifuku (1951) of the world distribution of the pit house. Significantly, he points out that many of the features of southwestern pit houses have parallels in the Upper Paleolithic and later pit houses found in northeastern Asia. He suggests that the pit house is probably far older in North America than Basket Maker or Mogollon or any of the pit houses thus far excavated in this area. Should Daifuku be correct in this interpretation, and the evidence tends to confirm his conclusions, then pit houses in Basket Maker II sites are to be expected.

In 1937 Harrington reported briefly on several non-pottery pit house villages located on the Muddy and Virgin Rivers in southern Nevada. One of these was excavated by the National Park Service in 1936. Harrington visited the site after the close of excavation and recorded the following (1937, p. 123) :

The pits vary in size from 10 feet in diameter and 14 inches deep to 20 feet in diameter and 5 feet deep. Adobe floors and central fireplaces—usually circular bowl-shape depressions—were the rule, with occasionally a stone-lined fire-place; but there was no wall

plastering and no indication in the way of post-holes or otherwise to show how the roof was constructed. Entrance must have been through the top, because there were no side entrance-ways.

No pottery was found during the excavations; however, geological or dendrochronological or other evidence supporting the possible early date for the houses was not obtained. In commenting on the structure Harrington expressed the belief that they were not just a local variety of Basket Maker II houses since the projectile points associated with these houses were slightly different from the typical Basket Maker II style point.

In southern Arizona Sayles (1945, pp. 1-4) has cleared several pit houses which he considers to belong to the San Pedro Stage of the Cochise Culture (Sayles and Antevs, 1941). These houses are shallow, roughly circular in outline and were entered by means of a wall-step or side-step entry. Fire pits, or better, fire areas were noted on the floors. If Sayles is correct in assigning these houses to the San Pedro Stage, then by Basket Maker II times, and possibly before, the pit house was present south of the Basket Maker area. In view of this distribution and the presumably northern origin for the pit house, it would be strange for the Basket Maker II groups to lack pit houses. It is evident that further work is required in Basket Maker II open sites before this problem can be satisfactorily solved.

With the advent of Basket Maker III, pit houses are a consistent feature of Anasazi sites. Associated with these houses usually are several slab-lined shallow cists. These cists, together with many other elements, such as metates, projectile points, and basketry, which are similar in both Basket Maker II and early III, tie the pre-ceramic and ceramic horizons together and indicate that one is but a development (with new things added, *i.e.*, ceramics, etc.) of the other.

The earliest of Anasazi pit houses usually are shallow, often slab-sided pits, equipped with a fire pit, ash pit, *sipapu*, deflector, four post roof support pattern, and either an antechamber or lateral entryway. These early houses presumably served not only as dwellings but also as ceremonial chambers as well. It has been suggested that the portion of the house next to the antechamber or entryway served primarily as domestic quarters, while the remainder, where the *sipapu* is located, was mostly of a ceremonial nature. Later, a bench was sometimes added which encircled all or part of the house. Through time, the houses became deeper but the characteristic floor features mentioned above, although modified in the later houses, remained throughout this development. Eventually, a ventilator replaces the lateral entryway or antechamber and the house is well on its way to being a kiva. Concurrently with this development, the slab-sided cists, as noted previously, were grouped together in crescentic units and more and more of the domestic activities were gradually transferred from the pit house to the above-ground structures. This transformation was so gradual that it is difficult to select any one point in the development and say that from there on the pit house was no longer a pit house but a kiva.

It is possible, however, to trace several of the later kiva features through their development in a local area and their diffusion from this area to the remainder of the pueblo area. Of these, the ventilator, because of its presence at the Twin Butte Site in a Basket Maker III horizon, is of special significance here. Before proceeding with this discussion, however, it will be well to recall our earlier comments (See pp. 7-8) regarding relative chronology and the Pecos Classification. The stated criterion for determining the beginning of Pueblo I (*i.e.*, neck-banding) has been followed here in chronologically arranging sites in adjacent areas. In sites where it is be-

lieved an adequate sample of the ceramic assemblage was recovered, the presence or absence of neck-banding is assumed to have chronological significance.

THE IMPLICATIONS OF THE VENTILATOR. In the eastern half of the area occupied by peoples of Basket Maker III affinities, from Mesa Verde (O'Bryan, 1950, pp. 55-61), Alkali Ridge (Brew, 1946, pp. 152-197) and the Ackmen-Lowry (Rinaldo, 1950, p. 93) area in the north to Chaco Canyon (Roberts, 1929) and probably below in the south, the earliest houses associated with pottery thus far excavated are all shallow, more or less rectangular in outline and equipped with a large antechamber on the east or southeast side. A partition wall divides the house into two unequal parts, with the smaller part adjoining the antechamber. Generally, the antechambers are almost half as large as the house itself and were perhaps used as sleeping or general sitting and work rooms. The floor of the antechamber was at a higher elevation than that of the house proper with a short passageway and step which connected the two together. Entrance to the house probably was gained through this antechamber (Brew, 1946, p. 206). Storage structures associated with these houses were either isolated units or small crescentic groups.

Through time the houses became deeper and the antechambers markedly reduced in size until by the close of Basket Maker III or very early Pueblo I the antechamber could have served as little more than an entryway. Brew (*Ibid.*, p. 207) has suggested that this reduction in the size of the antechamber may be correlated with the increased use of the above-ground structures. This seems a likely explanation, for the associated groups are large and often evidence of use other than for storage is indicated.

In the final step considered here, which in this eastern area occurs only in sites of Pueblo I or later date, the ventilator replaces the antechamber, taking the form of an "L" shaped tunnel cut horizontally a short distance through the wall of the house at or near floor level and then abruptly vertical to the surface outside. Sequential stages which might suggest a local development of the ventilator in this area are lacking. It is assumed that when the ventilator replaced the antechamber the entrance to the house was shifted to the roof.

In the western portion of the Basket Maker area the sequence as outlined above may not be valid. Northeast of Flagstaff, along the Little Colorado River at Site NA 1293 (Colton, 1946, pp. 101-102), in the Hopi country at Site 264 (Daifuku, 1951), and Group 16 in the Whitewater district in eastern Arizona (Roberts, 1939, pp. 149-160), pit houses are reported which, although similar in most respects to those found further east, differ from their eastern counterparts in that they have long, lateral entryways rather than antechambers. Except for several much later structures in the Flagstaff area (McGregor, 1941) the presence of the antechamber has never been demonstrated in this area² and it seems likely that the long, lateral entryway may have been the initial form. The Petrified Forest lies in the midst of this area typified by the long lateral entrance and it may be suspected that other, perhaps earlier, houses at the Twin

2. Daifuku (1951) considers two houses ("A" and "E") at Site 264 in the Jeddito Valley to have antechambers. I question, however, the identification as antechambers. Here, of course, we are handicapped by the absence of a generally agreed upon definition of an antechamber. Since the description of these houses has not yet been published and is unfeasible to do so here, it would perhaps be wise to withhold further comment. It is significant, however, that these two "antechamber" houses were among the last to be occupied at that site and are definitely of Pueblo I date. Earlier houses at this site (of Basket Maker III age) and one house apparently contemporary with the "antechamber" houses, all have long, lateral entrances. Thus, even if the antechamber label suggested by Daifuku is allowed to stand, they probably were only a trait borrowed in early Pueblo I times from their northeastern neighbors.

Butte Site had this style of entrance. Sufficient work has not been done, however, to define a possible boundary between the areas occupied by these two types of houses.

It is to be noted that the long, lateral entryway found on the western Anasazi pit houses provided entrance directly at the floor level of the house. This was accomplished by either one of two methods: 1) either the entryway sloped gradually from the ground surface or a level slightly below the ground surface to the floor of the house; or else 2) the entryway along its entire length was horizontal and the same distance below the surface of the ground as the floor of the house. Those entering the houses with the second type of entrance either stepped down into the entrance (if the house was not too deep) or else climbed down a ladder or steps placed at the far end of the entrance.

In contrast to the lateral entryway, the floor of the antechamber while often level, was generally at a higher elevation than the house floor. Thus, when moving from the antechamber to the house it was necessary to step down from the floor of the antechamber to the floor of the house.

In so far as is known at present the ventilator on all early Anasazi pit houses and kivas, like that in Structure F4 at the Twin Butte Site, opened out at or near the floor level of the house. It is apparent, therefore, that the antechamber, because of its generally higher elevation above the floor of its associated house, does not resemble the ventilator as closely as does the long, lateral entrance. Indeed, the resemblances between the long, lateral entryway and the ventilator are often so close that only the differences in size can be used to determine whether it is an entrance or a ventilator (Colton, 1946, p. 269; Nesbitt, 1938, p. 33). Significantly, transitional long, lateral "entryway—ventilators" have also been found (House "D," Site 264 in Jeddito Valley, Daifuku, 1951; Pit house 16 in the Whitewater District, Roberts, 1939a, pp. 152-154). One of these (Pit house 16, in the Whitewater District) had a long, lateral entryway with a ladder at the far end of the entrance to allow easy access from the ground surface. From there the floor of the entry gradually sloped from the base of the ladder to the house proper. Roberts further noted:

The passage was of the trench type and had been covered with small poles along that part of its length where it cut through the bench, *thus forming a short tunnel*. [Italics mine.]

By reducing the size of the entryway this feature is simply transformed into the ventilator. It is my belief that the long, lateral entryway, rather than the antechamber, provided the structural background for the development of the ventilator.

A survey of the literature suggests the area where this feature made its initial appearance and the direction it took in diffusing from this general area of origin. At White Mound (Gladwin, 1945, pp. 14-21), located fifty miles up the Puerco River from the Twin Butte Site, houses occupied during late Basket Maker III and Early Pueblo I, are reported. Interestingly, both the Basket Maker III and the Pueblo I houses had ventilators. Further east and again before the end of Basket Maker III times the ventilator had reached Chaco Canyon. At Shabik'eschee (Roberts, 1929, pp. 17-22) one pit house (C) had a ventilator. This house is generally (Brew, 1946, p. 209) considered to be later than the remainder of the houses in the village because the slab-lined storage structures associated with it are grouped together while those with the other houses (equipped with antechambers) are isolated. Thus, while the Shabik'eschee houses

are all apparently of Basket Maker III age, the ventilator house is presumably later in the Basket Maker III period. Farther north, however, in the Tsegi Canyon in northeastern Arizona (Beals, Brainerd and Smith, 1945, pp. 24-42), on Alkali Ridge in southeastern Utah (Brew, 1946), in the Ackmen-Lowry (Martin and Rinaldo, 1939), La Plata (Morris, 1939), Piedra (Roberts, 1930), and Mesa Verde (O'Bryan, 1950) areas of southwestern Colorado, and the Largo-Gobernador district (Hall, 1944; Hibben and Dick, 1944) of northwestern New Mexico, the ventilator is not reported from any sites of Basket Maker III age and is even lacking from some early Pueblo I houses (Site 13 on Alkali Ridge, Brew, 1946, Figure 27). In the extreme western portion of the then occupied Anasazi area, along the Little Colorado River north of Flagstaff (Colton, 1946, pp. 101-102) and in the Jeddito Valley (Daifuku, 1951), the long, lateral entrance apparently remained in vogue into Pueblo I times.

Pursuing the distribution of the ventilator into the Mogollon area south of the Petrified Forest we find that the long, lateral and short, wall-step modes of entrances are predominant in the earliest ceramic stages in the Mimbres and Upper Gila drainage areas of southwestern New Mexico and southeastern Arizona (SU Site, Martin, 1943; Cave Creek Site, Sayles, 1945). In this area the ventilator does not make its appearance until late, that is, until the Mimbres Phase (Haury, 1936, Figure 30) or perhaps slightly earlier (Nesbitt, 1938, pp. 33-34).

North of the Mimbres-Upper Gila area, however, in the Forestdale Valley located less than fifty air line miles south of the Petrified Forest, Haury (1940) uncovered several Mogollon houses with ventilators and other structural features reminiscent of Anasazi houses. Unfortunately, the relative dating of this site is a peculiarly complex subject, in part hinging on the question of the relative priority of neck-banding between the Mogollon and Anasazi. Haury (1940, pp. 93-94) contends that neck-banding occurred earlier in the Mogollon than in the Anasazi and, thus, although there is neck-banding present in the Bear Ruin, he feels that the site is contemporary with at least a part of Basket Maker III. As we shall discuss in a later section this suggested priority of neck-banding among the Mogollon has not yet been conclusively established and for our purposes here we are justified in taking a conservative position and chronologically placing this site contemporary with Basket Maker III and early Pueblo I. It probably does not date later since intrusive Anasazi Basket Maker III-early Pueblo I pottery was found at the site (*Ibid.*, pp. 84-85). The presence of ventilators here within a few miles of the Twin Butte Site should not be surprising. Ceramic evidence, both at the Twin Butte (See pp. 125-128) and Bear Ruin, indicates that trade was active between these two areas. Influences in other lines of endeavor also might reasonably be expected.

In the Flagstaff area several sites, probably contemporary or slightly later than the Twin Butte Site, have been excavated. Colton (1946, pp. 268-269) has summarized the data from these Flagstaff sites as follows:

The dwellings which have been excavated were pit houses with floors about 30 in. below the original ground level and with central firepits. Two were more or less circular, 13 and 17 ft. in diameter respectively, and the third was rectangular with rounded corners. Each had a long sloping entrance on the east side. The roof was of poles sloping towards the center of the room, and covered with earth. Dr. de Laguna visualized a sort of tipi construction as there was no indication of a regular system of support posts as found in later houses. The architectural features are very different from those of houses of the better known contemporary Anasazi Lino Focus, like N.A. 1293.

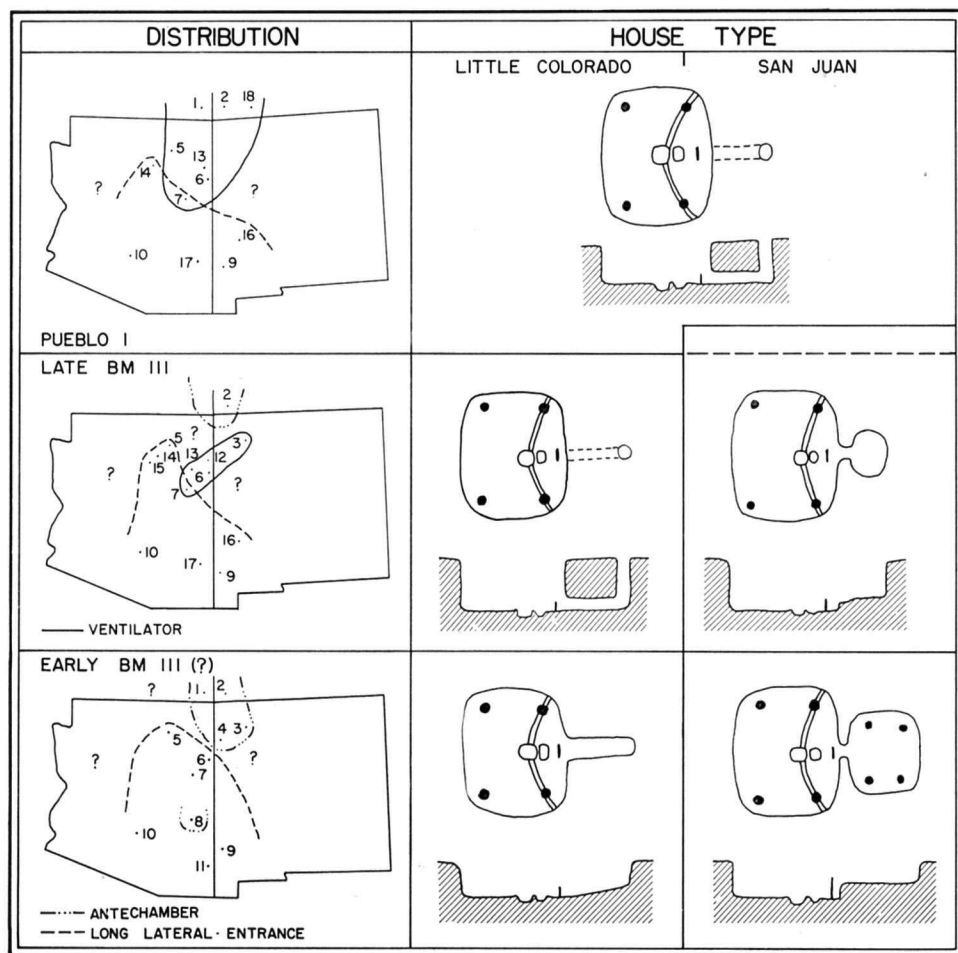


FIGURE 65. Chart giving distribution and type of pit house in Anasazi and Mogollon areas. Houses slightly idealized.

- | | |
|---|--------------------------------|
| 1, Alkali Ridge. | 9, Reserve area. |
| 2, Mesa Verde area. | 10, Snaketown. |
| 3, Chaco Canyon. | 11, Cave Creek. |
| 4, Pit house excavated during archaeological salvage program of El Paso Natural Gas Co. | 12, White Mound. |
| 5, Jeddito Valley. | 13, Twin Butte Site. |
| 6, Kiatuthlanna area. | 14, Little Colorado (NA 1293). |
| 7, Forestdale Valley. | 15, Cinder Park. |
| 8, Point of Pines area. | 16, Mimbres area. |
| | 17, San Simon. |
| | 18, Piedra District. |

Here, as among the southern Mogollon, the long, lateral entrance apparently remained in vogue considerably later than in the Anasazi area to the east. Present evidence indicates that the ventilator was not present in this area until after the eruption of Sunset Crater when numerous other Anasazi traits also made their appearance (Colton, 1946, p. 270).

Farther south, in the Hohokam area of southern Arizona, the ventilator has not been reported (See Gladwin, et al., 1937). There, as among the Mogollon, the lateral and wall-step methods of entry prevailed.

The results of this architectural survey, when plotted on a map as in Figure 65, point to an early (late Basket Maker III) appearance of the ventilator in the plateau area drained by the Little Colorado and Puerco Rivers. From this center it spread both north and south, to the San Juan in one case and the Forestdale Valley in the other, during the early years of the Pueblo I period.

In all essential respects the architectural pattern of the Twin Butte Site parallels that reported from several other Anasazi late Basket Maker III-early Pueblo I sites. The crescentic arrangement of the storage units as well as the placement of the associated pit house is a feature generally found in Anasazi sites of this period. At White Mound, located but a few miles up the Puerco River from the Twin Butte Site, this same arrangement was noted (Gladwin, 1945, Figures 2 and 3). Similarly, in the White-water district (Roberts, 1939a, Figure 1), at Site 13 on Alkali Ridge (Brew, 1946, Figure 27), and at Morris' Site 23 in the La Plata district (Morris, 1939, Figure 8) this is the reported pattern. A comparable complex probably also accompanied the pit house remains at Kiatuthlanna but interpretation there was handicapped by the advanced disintegration of the remains (Roberts, 1931, p. 16).

Among the Mogollon and Hohokam a significantly different pattern is reported. Here, instead of the grouped storage units and associated pit houses as is consistently found in Anasazi sites of this period, houses are scattered around the site area without any apparent relationship with each other and storage units are either pits or isolated structures (Haury, 1940, p. 52). These differences are important for as we have seen above the crescentic groups of storage units led to the eventual development of pueblo architecture among the Anasazi, and the absence of these among the Mogollon and Hohokam accounts for the retarded appearance of the pueblo building style among those groups. This architectural configuration, which is peculiarly Anasazi, plays a major role in our understanding of the cultural cohesiveness of the Anasazi and our consequent taxonomic segregation of this pattern from the Mogollon and Hohokam.

Sufficient work has been done in early Mogollon sites to indicate that the pueblo style of architecture did not develop in this area. Instead the people continued to live in unit pit houses, probably, as has been suggested for the early Anasazi, carrying on both ceremonial and secular activities in the houses. When the pueblo was introduced, and it apparently was introduced "full-blown," all of these domestic and ceremonial activities were transferred from the pit house to the pueblos. Unlike the Anasazi, who gradually shifted their domestic activities from the pit house to the pueblo leaving the pit house primarily with ceremonial functions and thus a kiva; the Mogollon transformation was sudden (this has been repeatedly demonstrated; see Haury, 1936, pp. 82-84 and Wendorf, 1950a, p. 114; Martin and Rinaldo, 1950, p. 551) and replaced the pit house in all of its functions, both secular and ceremonial. Since it was not necessary, and even unlikely, that the Mogollon (Western Pueblo) would adopt the Anasazi (Eastern Pueblo) specialized kiva ceremonial

complex when they adopted the pueblo, it seems likely that this *in toto* transference by the Mogollon of domestic and ceremonial activities from pit houses to pueblos accounts for the absence of kivas in many Mogollon pueblos. It may also account for the prevalence of rooms which seemingly occasionally functioned as ceremonial chambers in these southern (or western) pueblos. That such rooms are not confined to the Mogollon pueblos, at least in the late periods in the southwest, may be due to diffusion of this idea into these other areas.

This thesis, of course, does not account for the rectangular kivas sometimes found with Mogollon pueblos (Reed, 1949). It is possible, however, that the rectangular kiva was a comparatively late development in this area and was either a result of a merging of the Anasazi kiva concept and the Mogollon specialized room or a re-interpretation of the kiva concept by the Mogollon. It is evident that multiple factors are to be considered in this problem, all facets of which are not yet sufficiently well known.

POTTERY

The ceramics of the Twin Butte Site may be divided on the basis of surface color into two groups: gray and brown. These two groups are represented in nearly equal percentages with the gray pottery having a slight majority. Each of these groups is composed of several types, most of which have been described elsewhere.

With the exception of a few sherds of Adamana Brown, all pottery at the Twin Butte Site, both gray ware and brown ware, was finished with the scraping technique.

At the close of our first season's excavations, when it was realized that the Twin Butte Site had probably been occupied for a considerable time span and that differences from early to late might be detected in the pottery at the site, an attempt was made to define types in the collection. It was felt that the brown ware was probably intrusive in the site and, since it was so generously represented, differences of areal as well as chronological significance were possibly present.

It has long been recognized, however, that early Mogollon brown wares, because of their superficial uniformity in surface color, method of finishing and paucity of painted decoration, are extremely difficult to segregate into significant types. Our preliminary examination of the Twin Butte pottery suggested that the group was no exception. Since surface color and finish offered but little opportunity for classification, it was suggested that differences in paste might be determined. With this view in mind, a study of a sample collection was made by Anna O. Shepard. Through microscopic and petrographic analysis, Shepard was able to recognize two distinctive types of temper in the Twin Butte collection. The first of these, and by far the most numerous, was rounded quartz sand of varying sizes. The second was crushed igneous rock. As Miss Shepard pointed out, these two temper types apparently have different areal distributions. Sand temper, in this section of the Southwest, is more characteristic of the brown ware found in the area lying between the Little Colorado River and the White Mountains, while rock tempered pottery is concentrated in the mountainous areas farther south.

With a little experience, distinctions can readily be made with a hand lens or a binocular microscope between angular crushed volcanic rock and rounded water-worn sand, and although it is inconvenient and sometimes impractical to examine tens of thousands of sherds with a microscope, the return in information will in most instances far outweigh the difficulties in the study.

At the Twin Butte Site all pottery from test pits, floors of structures, stratigraphic tests and burial associations was examined with a microscope. The data gained, it must be admitted, were in some respects disappointing. The rock tempered pottery was so rare in the site that few conclusions regarding its significance could be offered. The great mass of pottery remained unsegregated. It should be noted, however, that the weight of those conclusions which may be drawn from these studies are considerably strengthened by this additional data.

GRAY WARE

LINO GRAY (Colton and Hargrave, 1937, pp. 191-192) and LINO FUGITIVE RED (*Ibid.*, p. 193) (Figure 73c). These two types may be discussed together since they differ only in the presence or absence of an impermanent red wash applied to the vessel exteriors. To judge from the stratigraphic tests (See p. 117) and the sherds from the surface of the site, these two types were the most popular varieties of pottery at this site. Bowls, jars, and pitchers are represented in vessels of both these types, with jars predominant. They may be briefly described (see above references for detailed descriptions) as having a dark gray to light cream surface color, smoothed, but unpolished surface, and abundant temper (at this site) of rounded quartz sand (see Appendix I, pp. 182-187, for further data on temper used in Twin Butte ceramics). These types were among the first, if not the first, ceramics made by the Anasazi and were made not only during Basket Maker III, but continued with little or no change into Pueblo I. With only minor variations they have widespread distributions, from the Rio Grande on the east to southern Nevada on the west.

KANA-A GRAY (Colton and Hargrave, 1937, pp. 195-196). Represented in the Twin Butte Site by three sherds. One of these sherds was picked up on the surface, the other two (both from the same vessel) were found in the uppermost level of Stratigraphic Test II (See p. 119). This type, here considered the diagnostic for Pueblo I, differs from Lino Gray only in that coils which formed the vessel were not obliterated on the exterior of the neck.

LINO RED.³ Although a name is offered for this type, sufficient sherds were not recovered at the Twin Butte Site (four only, two from surface) to permit description. Those sherds that were found indicate that they had come from vessels made from a paste that was indistinguishable from that used in Lino Gray. They differed from Lino Gray in that a polished red slip was added to both the exteriors and interiors of bowls and to the exteriors of jars. Superficially, therefore, they resembled the brown wares found at the site, but were easily distinguished by inspection of the unslipped surfaces or cross section of the sherd. Similar sherds have been reported by Brew (1946, p. 294) and Morris (1939, p. 23) from other Basket Maker III (and Pueblo I) sites.

LINO SMUDGED (Haury, 1940, pp. 84-85) (Figure 74b). This type is closely similar to Lino Gray but differs in that the interiors (only bowls represented) have been smudged and polished. Similar vessels have been reported from Shabikeshchee (Roberts, 1929, pp. 117-118), Site 264 (Daifuku, 1951), Kiatuthlanna (Roberts, 1931, pp. 117-118), Allentown (Roberts, 1940, p. 48), and the Bear Ruin (Haury, 1940, pp. 84-85); represented at the Twin Butte Site by several restorable bowls and sherds.

3. Pottery of this type will be described under the name of Tallahogan Red in a forthcoming report by Daifuku. This information was received as the present manuscript was in press, too late for the use of the name Tallahogan Red here. It is suggested that Tallahogan Red be the type name for this pottery.

LINO BLACK-ON-GRAY (Colton and Hargrave, 1937, pp. 194-195). One of the earliest Anasazi decorated types (Basket Maker III). Designs are simple panels and centipedes executed in black carbon paint on an unslipped and unpolished gray surface. Although widespread in its distribution, its area of concentration seems to be in the western portion of the Basket Maker III Anasazi area. Represented only by sherds in Twin Butte Site.

WHITE MOUND BLACK-ON-WHITE (Gladwin, 1945, pp. 22-23) (Figure 74e). Most common decorated type at the Twin Butte Site. Designs are simple geometric and rectilinear figures usually framing the vessel rims and executed in black mineral paint. White Mound Black-on-White has a similar chronological position to Lino Black-on-Gray, but occurs primarily in southern Anasazi sites.

BROWN WARES

Forestdale Series: Rounded quartz, sand temper.

Synonym: Woodruff Brown (Mera, 1934, p. 6).

FORESTDALE PLAIN (Haury, 1940, pp. 69-72; 75-77) (Figure 73b, c). Under this category is included all of the sand tempered, unsmudged, unslipped and undecorated "brown" (See Forestdale Red, below) pottery found at the Twin Butte Site. It undoubtedly includes what others might consider to be several types. Specifically, this type probably includes two types defined by Haury (*Ibid.*) in his study of the Bear Ruin ceramics: Alma Plain (Forestdale Variety) and Forestdale Plain. According to Haury's description, these two types differed from each other primarily by the absence of pebble polishing on the vessels of Forestdale Plain and its presence on the other. After repeated attempts I was unable, however, to successfully segregate this material into a series of consistent and, to me, meaningful types. It seemed whenever the material was divided as suggested by Haury's classification that all that had been accomplished was to separate the poorer from the better finished pieces of the same type. In short, I could not define a point from which I could consistently segregate this collection into Haury's two types. I have, therefore, lumped all such pottery into one type: Forestdale Plain.

FORESTDALE SMUDGED (Haury, 1940, pp. 73-75). Synonym: Woodruff Smudged (Mera, 1934, p. 6) (Figure 74a, c). Simple deep bowls with polished, unslipped (none were noted with slipped exteriors, see *Ibid.*) exteriors and polished smudged black interiors. Temper ranges from fine to medium coarse rounded quartz sand. Range similar to Forestdale Plain.

FORESTDALE RED (Haury, 1940, pp. 77-79) (Figure 73d). Vessels of this type are distinguished from Forestdale Plain by the highly polished red-brown surface and the very fine sand temper. Large sherds of complete vessels are easily distinguished but individual small sherds are sometimes difficult to segregate due to the prevalence of fire clouds. Woodruff Red, a closely related type, differs from Forestdale Red by having a red slip.

WOODRUFF RED (Mera, 1934, p. 6). Distinguished from Forestdale Red by the presence of a slip. Mera described the temper as "coarse to medium fine sand" (*Ibid.*, p. 6); however, no vessels or sherds were examined by me which had coarse sand temper. Both bowls and jars (neckless) represented.

Both Forestdale Red and Woodruff Red have known ranges which extend from the Arizona-New Mexico boundary on the east to Winslow, Arizona in the west and from the Hopi country in the north to below Forestdale in the south. Their principal area of concentration lies south of the Little Colorado River.

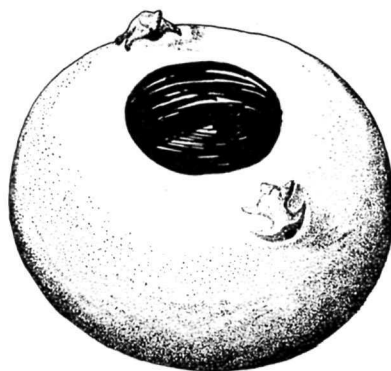


FIGURE 66. *Forestdale Red jar*
with quadruped effigy lugs.
Diameter, 27 cm. (Estimated from
sherds).

FORESTDALE BLACK-ON-RED (new type) (Figure 74d). Differs from Forestdale Red by the addition of a simple curvilinear design in faint black organic paint. Represented by two vessels, one jar and one bowl. Designs on jar consisted of two balanced simple scrolls, one on each side of the exterior. Bowl design was similar except that four scrolls quartered the interior of the vessel.

WOODRUFF INCISED (Mera, 1934, p. 6). Similar to Forestdale Plain (Woodruff Brown) in paste characteristics and surface finish but is decorated on exterior (only jars recorded), apparently near the rim, with a series of crossed incised lines which form a panel completely encircling vessel. Represented in Twin Butte Site only by sherds.

WOODRUFF ROUGH (new type) (Figure 73a). Similar in paste characteristics to Forestdale Plain (Woodruff Brown) and Woodruff Incised. Exterior of vessel (only jars recorded) was roughened by using some irregular surface, such as a corn cob, while clay was still plastic. Where determinable, striations are vertical.

Alma Series: Crushed volcanic rock temper

ALMA PLAIN (Haury, 1936a, pp. 32-34). Distinguished from Forestdale Plain primarily by the angular (crushed) rock temper. Represented at the Twin Butte Site by only a few sherds. The range of this type is concentrated in the mountainous area of east-central Arizona and west-central New Mexico.

SAN FRANCISCO RED (Haury, 1936a, pp. 28-31). This type was represented at the Twin Butte Site by one sherd found on the surface. It is distinguished from Woodruff Red by the crushed volcanic rock temper. The sherd differed from San Francisco Red as originally defined in that it lacked the characteristic finger dimpling on the exterior surface.

STRATIGRAPHIC TESTS

METHODS. Following the excavation of Test Trench I, two localities were selected, one at each end of the trench, for stratigraphic tests. Test I, lo-

cated at the south end, and, therefore, the lower end, was initially begun as a two meter square; however, in one corner of the test, at a depth of seventy-five centimeters below the surface, there was encountered a row of unshaped boulders which at the time were thought to be the remains of a buried structure. In order to avoid this evident disturbance, the test below that level was reduced to half its original size. As a result and in order to make each level the equivalent of the others it was necessary to divide in half the total sherd counts of the upper levels in this Test (see Figure 69).

In the second test another disturbance was encountered (See Figure 67), but because the test was small to begin with, a rectangle two meters long and one meter wide, and time was at a premium, we could not avoid continuing the test despite the disturbance. Fortunately the disturbed area was limited to only two layers and did not invalidate the test.

In both tests the debris was removed in horizontal layers, twenty-five centimeters in width. Horizontal strings provided visible control for the edges of the tests. Another string, equipped with a level and with one end free and the other tied to a control point, enabled the excavator to accurately check the center of each layer. By this method the layers were kept relatively uniform and satisfactory accuracy was maintained.

As each layer was removed it was shoveled onto a canvas tarpaulin where the clods were broken and the larger sherds removed and placed in a sack on which was noted the proper data for the site and the level in the test. The dirt on the tarp was then passed through a quarter-inch screen. From the debris remaining on the screen, all sherds and other artifacts were carefully collected and placed in the sack for this level. While the use of the tarpaulin required that all of the dirt had to be handled twice, the hardness of the deposits forced us to abandon ordinary means in screening the material. Furthermore, the use of the tarpaulin precluded any possibility that sherds from outside of the level being tested might accidentally be included with the lot.

An interesting experiment was performed to check on the necessity of a screen. For several layers, the debris was placed on the tarpaulin as described above, but before the material was screened it was carefully gone over several times and all of the sherds which were noticed were removed and placed in a sack. The debris was then screened and those sherds which had been missed in the prior search were collected from the screen. In almost every case the screening nearly doubled the collection from that layer—conclusive proof for the necessity of using a screen if reliability is to be obtained in making stratigraphic tests.

RESULTS. Below are listed the total sherd counts for each level, the uppermost level at the top, the lowest at the bottom.

<i>Test I</i>		<i>Test II</i>	
Level	Sherd Count	Level	Sherd Count
G	245*	H	226
F	187*	G	92
E	378*	F	88
D	283	E	112
C	233	D	57
B	177	C	64
A	158	B	54
		A	93
Total	1,661	Total	786

* Totals from first three levels divided in half. Grand total for Test I: 2,470 sherds.

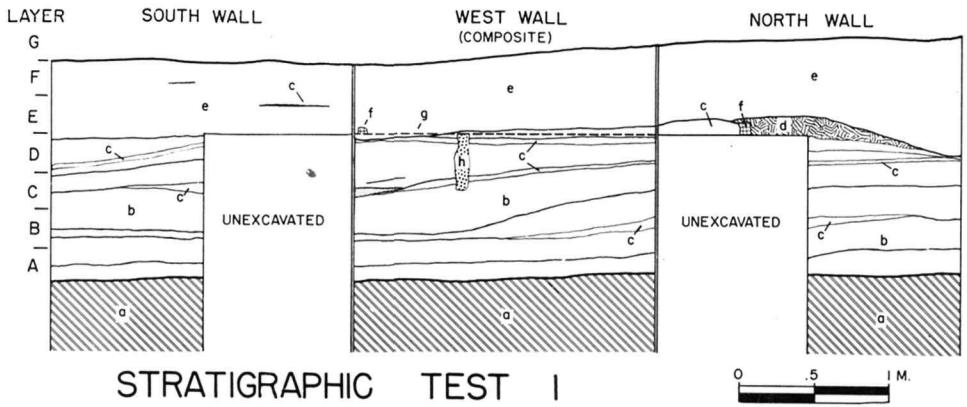


FIGURE 67. Soil profiles in Stratigraphic Test I.

- a, Sterile.
 b, Consolidated stratified trash.
 c, Dark sand with charcoal.
 d, Bentonite.
 e, Loosely consolidated stratified trash.
 f, Rock.
 g, Line separating upper profile from lower.
 h, Clean sand.

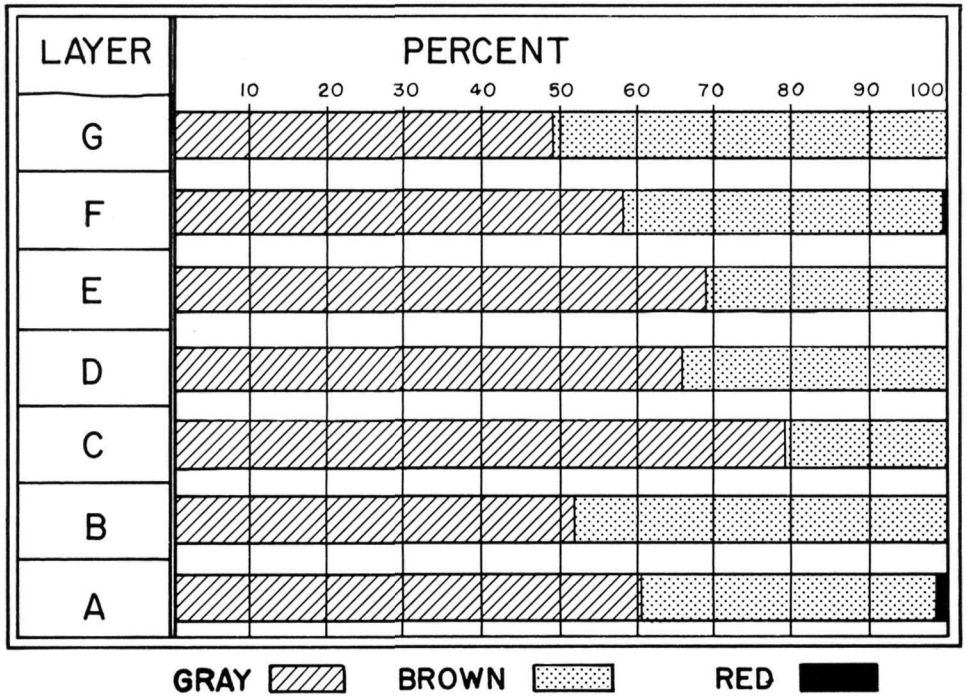


FIGURE 68. Relative percentages of gray, brown and red ware found in Stratigraphic Test I.

Figures 68 and 70 record by level the relative percentage of gray ware, brown ware and red ware (slipped red, including both buff firing paste and brown firing paste). Interestingly, although the percentages vary considerably from layer to layer, there is no consistent trend evident. The percentage of brown ware in the lower levels of both tests does not vary significantly from that recorded from the topmost levels. Considering the total sherd counts, from all levels, the brown ware in Test I amounted to 39 percent of the total; in Test II, 40 percent. Red slipped pottery was less than one percent in both tests.

In order to compare the relative frequency of each type *within its group*, the percentage of each type of gray pottery, including the red slipped type Lino Red (previously considered as a red ware), of the *total gray* sherds in each level is portrayed in Figure 71. Similarly the percentage of each type of brown pottery (also including the red slipped type) of the *total brown* sherds in each level is recorded in Figure 72.

Significantly, the majority of the types had a relatively uniform popularity during the entire occupation of the site. Three types, however, have important stratigraphic positions: Kana-a Gray, Adamana Brown and Forestdale Rough.

Kana-a Gray was represented by two sherds, both from the same vessel, found in the top level of Test II.

Adamana Brown, the dominant ceramic type found at the Flattop Site described earlier, was stratigraphically early in both tests.

Woodruff Rough, although represented by only three sherds, was confined to the two lowest levels of Test II.

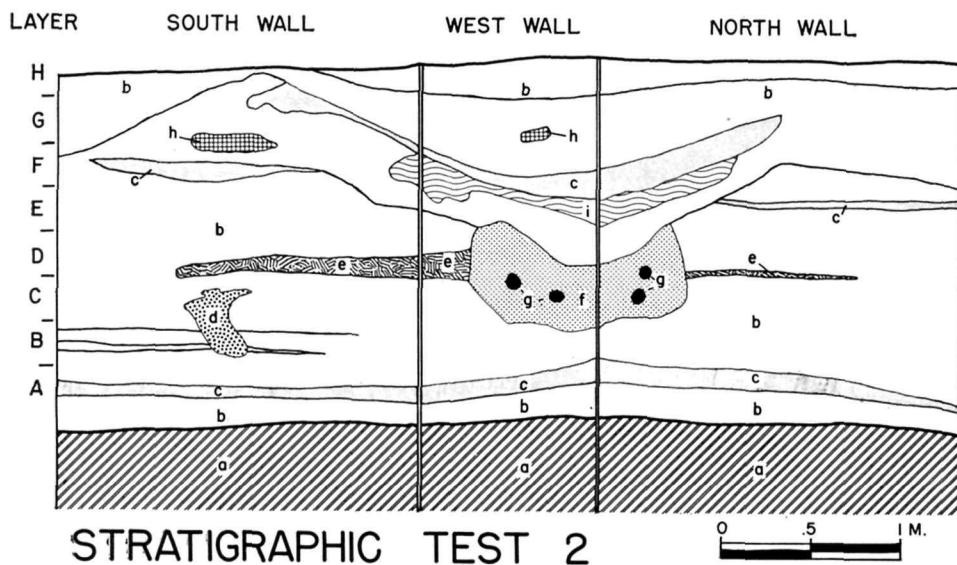


FIGURE 69. Soil profiles of Stratigraphic Test II.

- | | | |
|-----------------------------|---|------------------|
| a, Sterile. | d, Sterile sand. | g, Wooden beams. |
| b, Stratified trash. | e, Bentonite. | h, Rock. |
| c, Dark sand with charcoal. | f, Sand, adobe and decomposed organic material. | i, Light sand. |

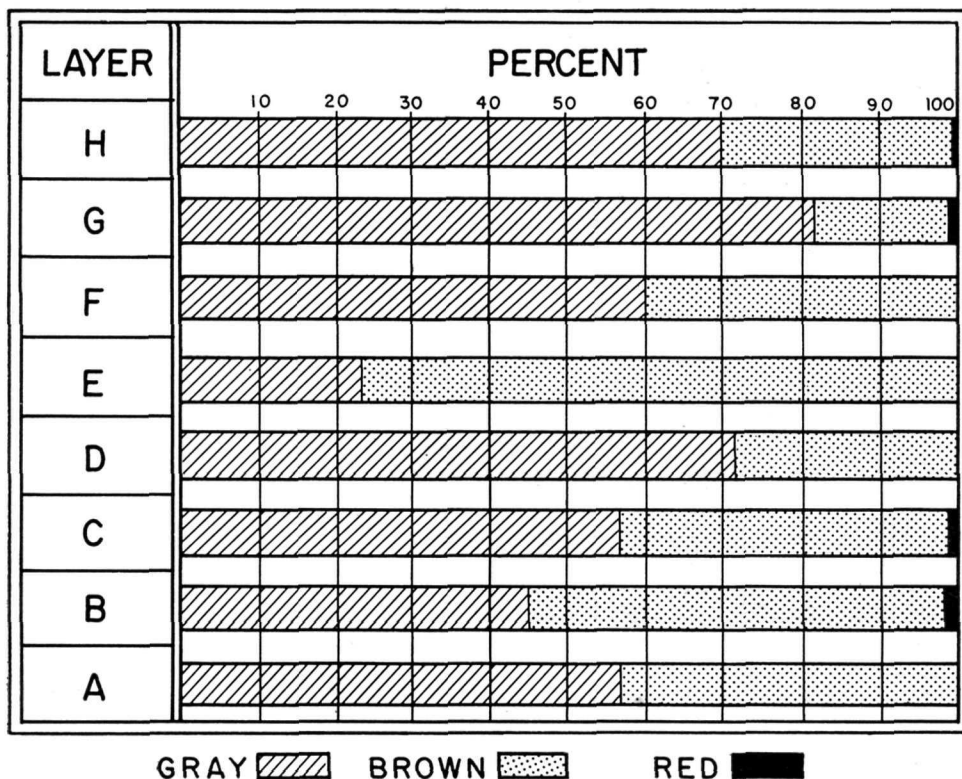


FIGURE 70. Relative percentages of gray, brown and red ware found in Stratigraphic Test II.

STRATIGRAPHIC TESTS—DISCUSSION. Due to the absence of suitable material for tree ring dating, major reliance must be placed on ceramics in the determination of the correct relative chronological position for the Twin Butte Site. From the general character of the pottery, *i.e.*, the types represented, and the absence of other types, which because of their widespread distribution and chronological position would have undoubtedly been present in the site had it been occupied at a slightly later date, it is possible to approximately date the site within the defined sequence in the Anasazi area.

All of the ceramic types found at the Twin Butte Site, with the exception of three sherds, all found either on the surface of the site or at a depth not exceeding twenty-five centimeters, were types which are characteristic of Basket Maker III. The aberrant sherds, of neck-banded gray colored pottery (Kana-a Gray), provide us with a convenient terminal date for the site.

Neck-banding is technologically but a simple modification of the completely smoothed vessel necks characteristic of Basket Maker III. Instead of obliterating all visible traces of the coils used in constructing the vessel, the potters simply left unsmoothed a half-dozen or so of the coils below the rims of some of the jars, giving the necks of these vessels a clapboard effect. Even during Pueblo I not all jars had banded necks, a few, perhaps even a majority, of the jars continued to be smoothed over their entire surface. The change, however, even on a few of the vessels, had important implica-

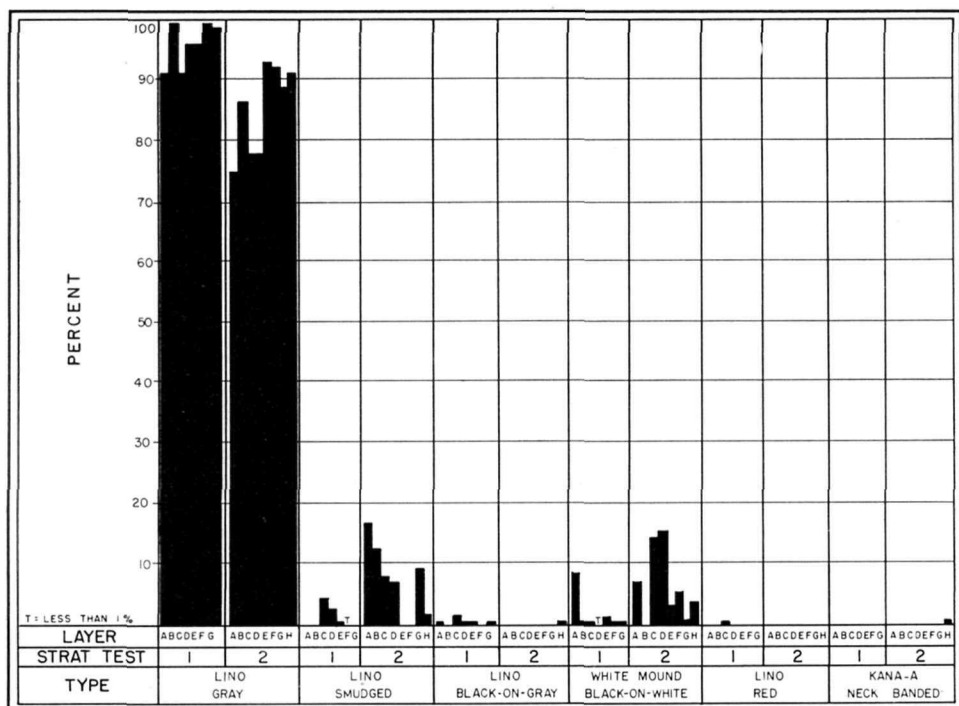


FIGURE 71. *Relative percentages of each type of gray ware of the total gray pottery recovered from Stratigraphic Tests I and II.*

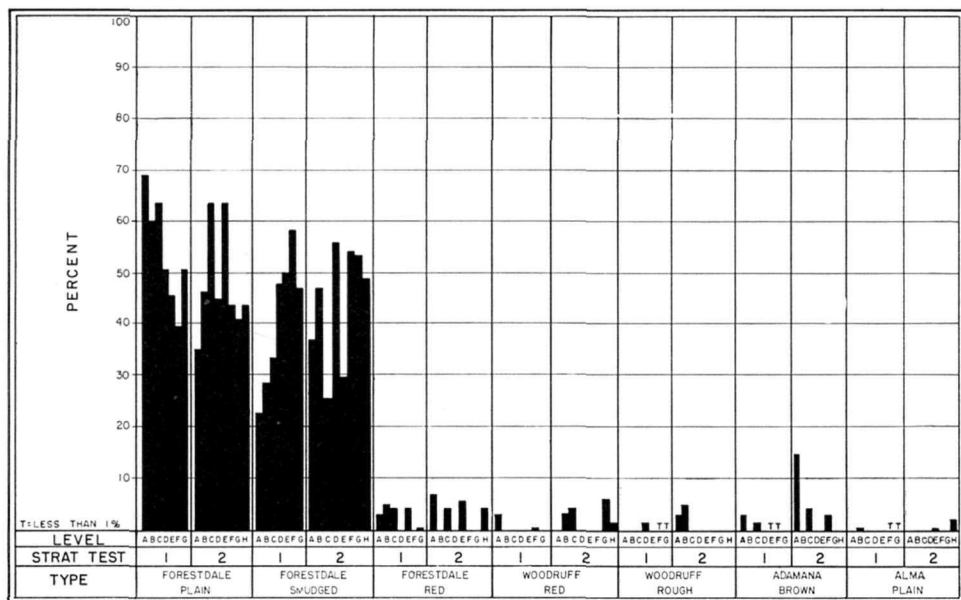


FIGURE 72. *Relative percentages of each type of brown ware of the total brown pottery recovered in Stratigraphic Tests I and II.*

tions for the future developments in Anasazi ceramics. It was but the first of a series of steps that eventually led to the characteristic corrugated pottery of later pueblo periods. This easily recognized and chronologically significant modification has been selected for the diagnostic criterion marking the beginning of Pueblo I among the Anasazi. It was so chosen because: a) it was previously considered to be one of the multiple diagnostics for Pueblo I; b) it had a widespread geographic distribution; and, c) it was a common ceramic feature. Thus samples of this type would probably be found in any large unselected sample of sherds from a site occupied during the time interval it was characteristic. We may expect that there was some time lag between the time neck-banding was first introduced, or discovered, and its spread over the entire Anasazi area, but the determination of the amount of the lag will be very difficult. We may speculate, however, that because of the ease with which pottery was traded from one area to another this lag was negligible when compared with the rate of diffusion of other traits. Neck-banding is, therefore, a particularly useful chronological indicator, permitting comparisons between sites over a wide area.

From the stratigraphic evidence and the pottery found in the excavated structures it is evident that the occupation of the Twin Butte Site endured,

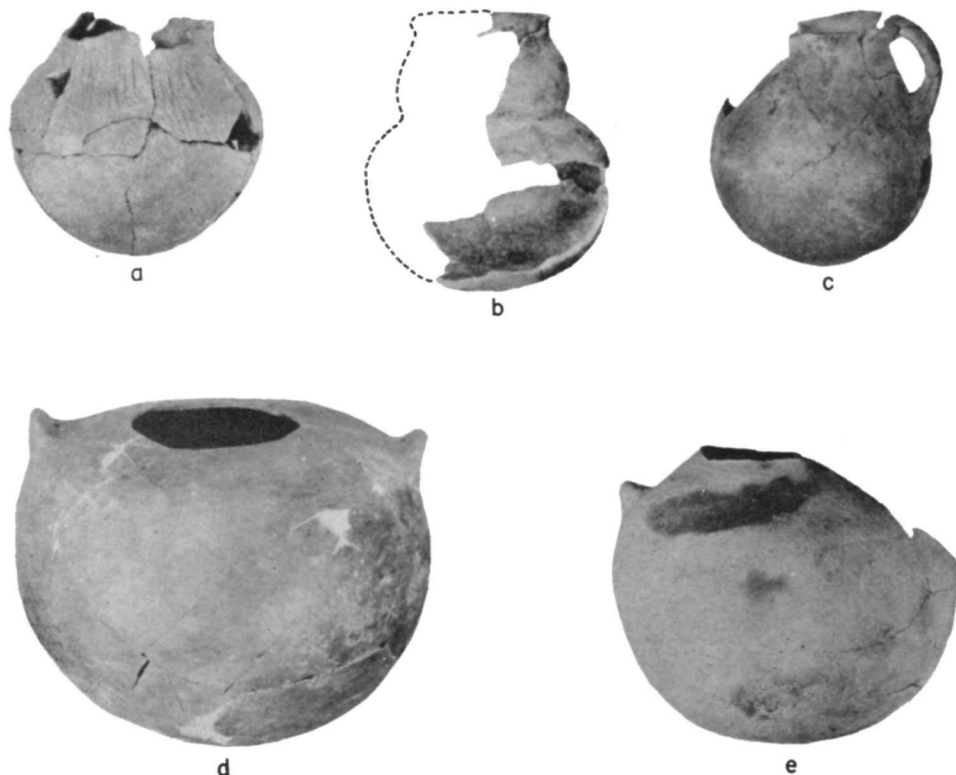


FIGURE 73. Pottery from Twin Butte Site, jars.

- a, Woodruff Rough.
- b, c, Forestdale Plain.
- d, Forestdale Red.
- e, Lino Gray.

except just prior to its abandonment, entirely during the Basket Maker III period of the Pecos Classification. Since the three sherds diagnostic of Pueblo I were recovered from the topmost levels of the site, we may assume that the site was occupied until the end of Basket Maker III and into the initial years of Pueblo I. Had the site been occupied longer into the Pueblo I period, in all probability, more Kana-a Gray would have been found.

When the site was first occupied cannot be as accurately determined as has its abandonment. The presence of ceramics in the lowest levels of the site precludes any suggestion that it might have been occupied prior to Basket Maker III, but exactly when during this rather lengthy interval it was founded is difficult to determine.

From the surprising depth of the trash and the repeated occurrences of superposition of houses and burials, admittedly unsatisfactory evidence, it is suggested that the site was occupied for a considerable span of time, probably beginning during the early part of the Basket Maker III period.

A further aid in this problem of determining the length of occupation of the site is the evident modifications of designs on the decorated pottery. While the small sample of decorated sherds cannot be considered conclusive, it is interesting to note that the designs increase in complexity from the lower to the upper levels. Although all of those sherds decorated with mineral paint are typed as White Mound Black-on-White, the designs on those in the lower levels seem more reminiscent of the simple centipedes and panels typical of Lino Black-on-Gray, La Plata Black-on-White (Colton and Hargrave, 1937, pp. 194-195; Hawley, 1936, p. 23), and Twin Trees Black-

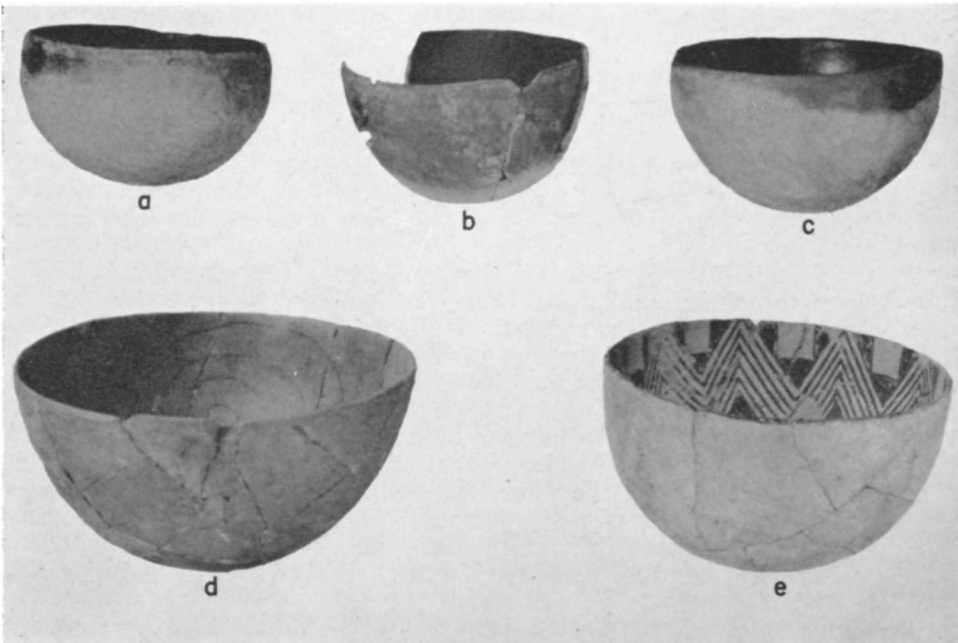


FIGURE 74. Pottery from Twin Butte Site, bowls.

- a, c, Forestdale Smudged.
- b, Lino Smudged.
- d, Forestdale Black-on-Red.
- e, White Mound Black-on-White.

on-White (O'Bryan, 1950, pp. 91-92), all decorated types commonly found in Basket Maker III Sites in areas northwest and northeast, respectively, of the Petrified Forest. These were among the earliest decorated types of the Anasazi and, in the areas where they were most prevalent, last through the entire Basket Maker III period.

The rectilinear style of White Mound Black-on-White, to judge from the stratigraphic tests, may be a local development from one of these other Basket Maker III types. La Plata Black-on-White, because it is decorated with an iron paint and on an unpolished surface, both features of White Mound Black-on-White, is the most logical source. Lino Black-on-Gray, although a possible source for the early designs, has a carbon rather than a mineral paint. Twin Trees Black-on-White has a polished surface and thus differs not only from White Mound Black-on-White, but also most other early Anasazi ceramics.

Of significance is the fact that in the north the Anasazi retained their early decoration styles in their black-on-white pottery almost unchanged until the end of the period, and in some cases later, while the southern Anasazi significantly modified their designs during this same time interval.

Haury (1940, p. 95) suggested that the differences in decoration styles between the northern Basket Maker III, and their southern counterparts (White Mound) was due to Mogollon influence:

. . . Basketmaker III painted pottery, on broad lines, may be identified on the basis of two types, exemplified by Lino Black-on-gray and White Mound Black-on-white. The former, as a rule, shows a few elements of design spotted independently of each other within the decorative field. In the latter this tradition is replaced by prevalent use of small solid triangles, often with lined extensions from the apexes, the solids being framed with sets of parallel lines. This style is undoubtedly Mogollon as will be seen in any San Lorenzo or Mogollon Red-on-brown.

Since these two styles are so incompatible and since the geometric Basketmaker style lies in the southern portion of the Basketmaker area, one cannot escape the conclusion that there has been some interchange.

Haury goes on to explain that it had not yet been determined whether the White Mound or Mogollon style was older. This problem remains even today since tree ring dates have not yet been obtained for the earliest painted pottery of the Mogollon.

In the Twin Butte Site all but three pieces of the Mogollon ceramics found were unpainted and those that were painted had curvilinear, not rectilinear designs. It seems evident, therefore, that if these modifications in Anasazi ceramics were the result of Mogollon influence then this transformation did not occur in the vicinity of the Petrified Forest. This conclusion, however, does not rule out Haury's hypothesis. White Mound Black-on-White has a wide east-west distribution and it is probable that Anasazi villages farther east were in closer contact with Mogollon groups using more painted pottery than the western Mogollon who were responsible for the Twin Butte Site brown wares. Should this explanation prove correct then the stylistic changes in White Mound Black-on-White, suggested by the small sample from the stratigraphic test, reached the Twin Butte Site from the east.

A second possibility for the origin of the White Mound style is suggested by the somewhat baffling Abajo Red-on-Brown. This northern Anasazi decorated pottery, reminiscent not only in its style but also in surface color to early Mogollon ceramics, suggests that the Anasazi potters may have had a geometric rectilinear style developing locally without direct Mogollon stimulation.

CERAMICS: GENERAL DISCUSSION

The presence of two distinctive groups of ceramics each represented in nearly equal percentages is an unusual situation in Southwestern archaeology. It will be recalled that polished brown pottery, such as that making up approximately 40 percent of the ceramics at the Twin Butte Site, is generally considered to be diagnostic of the Mogollon, while the rough gray pottery, which makes up the remainder of the Twin Butte ceramics, is diagnostic of the Anasazi. This mixture at the Twin Butte Site suggests several possibilities:

- a) that the site was occupied twice, once by a brown pottery producing group, and a second time by a gray ware group; or
- b) that two groups, each following different ceramic traditions lived together in the village; or
- c) that the cultural significance attributed to these ceramic differences are non-existent and that the two types of ceramics were made by the same group, at the same time and in the same village; or
- d) that trade across the cultural frontier was active and that either the gray or brown pottery was brought to the site and exchanged for other products.

Two of these possibilities may be quickly dealt with from the evidence already presented. The stratigraphic tests, together with the repeated association of the two ceramic groups in houses and in burial furniture at once conclusively eliminate the possibility that two occupations, each representative of different ceramic traditions, were to be found at the site. Secondly, the overall architectural pattern of the site, of crescentic storage groups and associated pit houses, was peculiarly Anasazi. No evidence for Mogollon architecture was noted. It seems likely, therefore, that the evidence does not support the suggestion that two groups, one making brown pottery, the other gray, were living together at the site, unless, of course, the brown pottery group adopted Anasazi architecture, a possibility to be sure, but to me highly improbable. Why should a group abandon their architectural habits but retain those of ceramics especially when they would have had to make special efforts to secure clays with a high iron content which would fire a deep brown color?

Evidence on the third possibility must be sought from the surveys reported by various institutions. These surveys indicate that the concentration of undecorated polished brown pottery lies in the area south of the Little Colorado River where volcanic clays with a high iron content are also to be found. North of the Little Colorado the undecorated pottery is usually gray in color, a feature at least partially due to the fact that most of the available clays in this area are sedimentary in origin and usually are poor in iron. It must be noted, however, that actual experiments have indicated that if this "gray" pottery is fired at the same temperature and for the same length of time that the "brown" pottery is fired then the color is a creamy buff, not gray. This suggests that while environment perhaps played a major role in guiding the Anasazi toward gray pottery, other factors, presumably cultural in their inspiration, were effective in bringing about the characteristic Anasazi ceramics. In so far as the Twin Butte Site is concerned the differences between the brown and gray ceramic groups are not confined to just the utilized clays but also extend to differences in tempering materials, degree of surface polish or smoothing, and important design differences in the decorated vessels. I submit, therefore, that the technical differences between the two ceramic groups, the differing geographical areas of concentration, and the associated differences in architecture and

perhaps other features are sufficient grounds to warrant our eliminating the possibility that both the brown and gray pottery were made by the same group.

The fourth possibility, that one of these ceramic groups was brought to the Twin Butte Site as an item of trade seems to me to be the most logical explanation. As we noted in the section on burials, most of the pottery placed with the graves was brown ware. That this burial furniture consisted of the individual's most valued possessions would seem to be a reasonable speculation and suggests that the brown pottery was highly prized, much as were the shell beads and other objects obtained through trade which were also used as burial accompaniments.

We have already pointed out that the architectural pattern of the Twin Butte Site closely conforms to that found in Anasazi sites where gray colored culinary pottery was the overwhelming favorite and presumably the local product. It seems logical, therefore, to consider the gray pottery at the Twin Butte site as locally made and the brown pottery to be foreign in origin.

The proximity of the site near the southern edge of the Anasazi area and thus close to brown ware producing centers further south would facilitate such trade. At the same time the abundant and colorful petrified wood adjacent to the site might have provided the inhabitants of the Twin Butte Site with something to offer in exchange. As was previously stated, the great amounts of broken petrified wood and hammerstones found in the site area, when compared to other sites, seemed far beyond the nominal requirements of the group. This is not to suggest, of course, that the Twin Butte Site is to be viewed as a factory turning out great quantities of implements made from petrified wood. What we know of modern Indian economy would not support such a suggestion, but it is conceivable that this petrified wood, because of its color and the ease with which it could be worked, might have been sought after by those neighboring groups to which it was not conveniently available.

Regardless of how the Twin Butte people obtained the brown pottery, we may assume that they did acquire it and, therefore, we should seek to determine the source or sources from which it was derived. The three major groups of brown wares defined for the Twin Butte Site are an attempt in this direction. The majority of this brown colored pottery is identical to that reported from the Bear Ruin in the Forestdale Valley, located some fifty airline miles south of the Petrified Forest. This group, for convenience named the Forestdale Series, was tempered with rounded quartz sand and was present in the Twin Butte Site throughout its occupation. The second group, called the Alma Series, represented by only a few sherds, was tempered with crushed volcanic rock. No consistent chronological position could be determined for this series. The third series, consisting of several sherds of Adamana Brown, also a sand tempered type, was confined to the earliest levels of the site.

Shepard, who made the initial analysis of a sample collection of Twin Butte pottery, has pointed out elsewhere that the distribution of temper types has both chronological and spatial significance (Shepard in O'Bryan, 1950, pp. 89-91). Interestingly, her studies have indicated that the areas where a majority of the pottery was tempered with crushed rock are also those areas where igneous materials predominate in geologic deposits; conversely, those areas where the pottery is usually sand tempered are characterized by sedimentary deposits. Thus it would seem that the potters in each area used those materials which were most conveniently available.

The possibilities are readily apparent. Temper identifications provide useful clues for the determination of trade pottery and its possible area of origin. Caution and restraint, however, must be exercised in utilizing this technique because the occasional erratic nature of human behavior must be considered. Allowance must be made for the experimentalist who might have sought a new kind of tempering material for her pottery. Recognizing the limitations in the technique should not, however, prevent our utilizing its data, particularly when at the present time a more satisfactory method has not, to my knowledge, been suggested.

Surveys by the Museum of Northern Arizona indicate that south of the Petrified Forest the majority of the pottery in sites contemporary with the Twin Butte Site is a sand tempered brown ware similar to that termed the Forestdale Series in this report. Although much of the area has not yet been adequately explored for archaeological material, the present indications are that south of the Little Colorado and north of the White Mountains was occupied during Basket Maker III times by a group using this sand tempered brown colored pottery. Farther south, in the White Mountains, crushed rock temper prevailed.

We may infer from these facts that the majority of the intrusive pottery in the Twin Butte Site probably originated from one or more localities situated generally south of the Petrified Forest area. Contact with this area was continuous and began soon after the village was founded.

The vessels which we relate to the Alma Series probably have as their source villages even farther south, thus accounting for their poor numerical representation in the site.

The Adamana Brown, or third group, may have come from sites in the Petrified Forest area which were using the Adamana pottery, but which lasted later than the Flattop Site, or perhaps from sites outside this immediate area where Adamana Brown may have continued to be made even though the Adamana group had previously abandoned the Petrified Forest. As a matter of choice, I favor the latter possibility. The Petrified Forest archaeological survey, discussed on pp. 18-20 and consisting of over three hundred sites in this limited area, contains no site which I could interpret as a village belonging to the makers of Adamana Brown and occupied during the time Lino Gray was being made. That such a village may exist cannot be denied, but if it does exist, then it has either not been located or else not recognized. Furthermore, the Bear Ruin in the Forestdale Valley produced more Adamana Brown than did the Twin Butte Site, a peculiar situation if the sites producing Adamana Brown were located within a few miles of the Twin Butte Site.

Of perhaps more significance, however, is the stratigraphic position of Adamana Brown in the Twin Butte Site. From Figure 72 it is evident that Adamana Brown, although never present in any appreciable amount, was confined to the lower levels of the site and did not occur in the upper half of either test. This evidence conclusively establishes the early chronologic position for this type and confirms the evidence from the Bear Ruin that Adamana Brown continued to be made after the Anasazi began to make pottery.

The probabilities that a considerable amount (40 percent) of the Twin Butte ceramics were obtained by trade offers new possibilities regarding the development of prehistoric trade in the Southwest. Heretofore it has always been assumed that only a small amount of the pottery in use at any one village had been obtained by trade and that trade pottery was largely confined to decorated vessels. Confronted with the evidence from the Twin

Butte Site, however, we must now concede that a considerable amount of the pottery found in any site *may not* have been locally made. How much of the pottery generally considered to be indigenous to the site was actually made by potters living in that village? Is it possible that some villages producing pottery primarily for trade were present even during the developing stages of Basket Maker III? (See Appendix I for further discussion).

MISCELLANEOUS OBJECTS OF CLAY

PIT COVER (1) (Not illustrated).

Irregular, unsmoothed disc of unfired clay 21.0 cm. in diameter and 6.3 cm. thick. Shallow groove, averaging 2.5 cm. wide, encircles edge. Found in pit in Structure F2.

REMARKS. The circular outline, size, encircling groove (resulting from contact with edge of pit?) and location all indicate that this clay slab probably functioned as a cover for the storage pit in Structure F2.

WORKED SHERDS (131)

a. (Figure 75a-c; e-f; h-i) 10

Unperforated. Small sherds of various kinds of pottery broken to roughly circular or oval shape. On four the worked edge is also ground smooth. One (a) has a series of shallow incised notches encircling edge. Diameters, from 1.5 to 5.2 cm. Five made from Lino Gray, three from Forestdale Plain, two from Forestdale Smudged. Three from surface, two from fill Structure D3, two from fill Structure F2, one from fill Structure F5, two from level 8, Stratigraphic Test II.

b. (Figure 75d, g, j) 3

Perforated. Similar to *a* above but with single hole drilled from both sides, placed near one edge (in two) or center of sherd. Edges rough, only slightly smoothed. Diameters, 3.5 to 4.3 cm. One (g) of Adamana Brown, two (d, j) of White Mound Black-on-White. All from surface.

ARTIFACTS OF STONE

GROUND AND PECKED

METATES (6).

a. (Figure 76b) 8

Troughed, open at far end. Roughly shaped around sides and ends. Shelf-like projection on near end has shallow, but pronounced, depression or secondary grinding surface. Grinding surface roughened by pecking. Lengths, 37.0 and 48.0 cm. Widths, 32.5 and 38.1 cm. Thicknesses, 6.9 and 13.2 cm. Widths of grinding surface, 20.9 and 26.8 cm. All indurated sandstone. One each, found on floor Structures A and D4, remainder from surface.

b. (Figure 76a) 20

Similar to *a* above, but lacks the depression on the projecting shelf. Two examples of this type found on surface (not included in above total) have large circular holes broken through center of trough. Dimensions similar range to *a* above. All indurated sandstone. One each found on floor Structures A, B and D4 (Broken), one in fill Structures F4, remainder from surface.

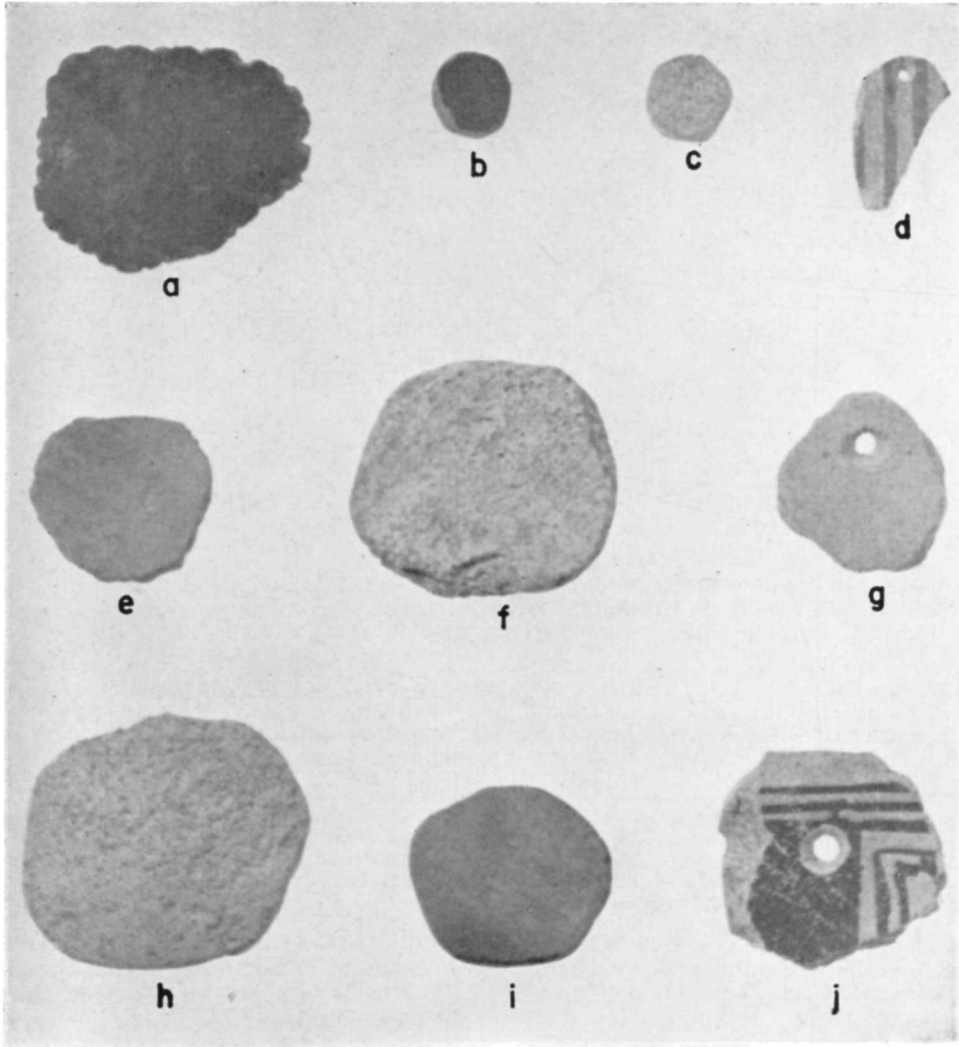
MANOS (48).

a. (Figure 77b) 5

One handed. Circular to oval in outline, lightly abraded around edges. Two opposed slightly to moderately convex grinding surfaces. One example has a long, narrow, "V" type groove in each grinding surface, suggesting secondary use as a sharpener. Lengths, from 9.7 to 14.0 cm. Widths, from 8.2 to 10.3 cm. Thicknesses, from 3.7 to 5.5 cm. All quartzite. Two found in fill Structure F4, one in fill House F2, remainder from surface.

b. (Not illustrated) 1

Similar to above but with only one grinding surface. Indurated sandstone. Fill Structure F2.

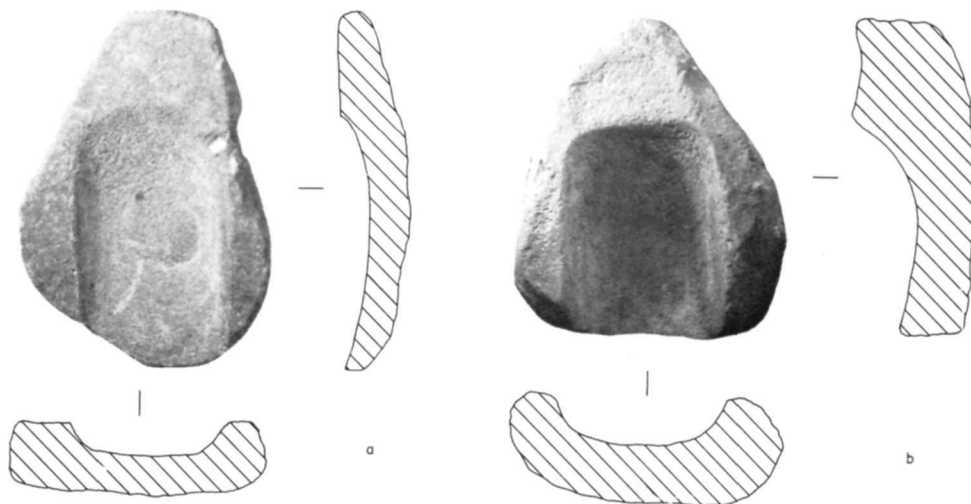
FIGURE 75. *Worked Sherds.*

c. (Not illustrated) 4

Unshaped or slightly shaped blocks used as manos. All show abrasion on ends, perhaps resulting from use in trough metates. In three grinding surface confined to one face. Exception has two opposed grinding surfaces. Lengths, from 15.3 to 21.5 cm. Widths, from 6.7 to 12.0 cm. Thicknesses, from 3.4 to 5.4 cm. Three indurated sandstone; one, quartzite. One each from floor Structure A, fill Structure D, fill Structure F4, and one from surface.

d. (Figure 77a, d) 31

Subrectangular in outline with parallel sides and rounded ends. Single flat to slightly convex grinding surface. Ends are rounded and abraded probably from contact with sidewalls of trough metate. Upper surface convex, may show slight abrasion. Eleven have finger grooves or dents to aid grasping (d). Lengths, from 17.9 to 26.8 cm. Widths, from 9.3 to 11.7 cm. Thicknesses, from 3.2 to 6.5 cm. One basalt, remainder indurated sandstone. Two from floor Structure A, one from floor Structure B, three

FIGURE 76. *Metates*.

from fill Structure C, two from fill Structure D, one from fill Structure E, four from fill Structure F2, eight from fill and one from floor Structure F4, remainder from surface.

e. (Figure 77c) 7

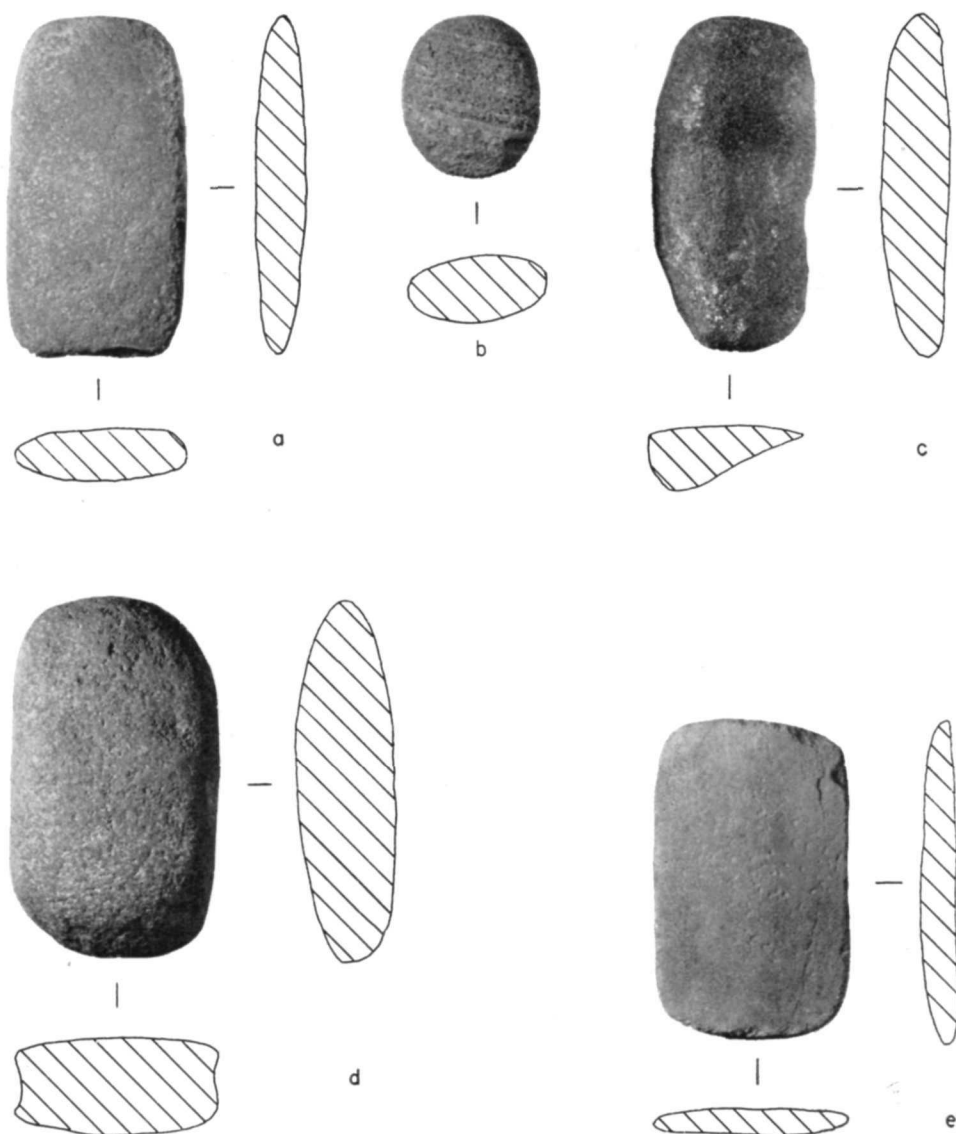
Similar to *d* above, but with a triangular cross section. Probably only excessively worn examples. Lengths, from 18.7 to 21.2 cm. Widths, from 8.0 to 10.8 cm. Thicknesses, from 2.6 to 3.9 cm. All indurated sandstone. One from fill Structure E, two from fill Structure F2, two from fill Structure F4, one from level 13, Stratigraphic Test II, one from surface.

f. (Figure 77e) 1

Sub-rectangular in outline, triangular in cross section. Three grinding surfaces: one grinding surface opposed by two adjoining grinding surfaces. Ends abraded. Length, 17.7 cm. Width, 10.8 cm. Thickness, 1.9 cm. Indurated sandstone. Floor Structure A.

COMMENT. Notably absent from this collection is the basin metate. We may presume, from the presence of an occasional one-handed mano, that a few of the basin variety were in use at the site. It is possible, however, that these one-handed manos were used with the small milling stones rather than basin metates. At any rate, the absence or rarity of the basin metate may be interpreted as a continuation of the trend noted earlier in the Flattop Site, that is, the basin metate was through time gradually replaced by the trough variety.

The troughed metate is the typical variety reported from Basket Maker III sites. They occur at White Mound (Gladwin, 1945, p. 26), Shabik'eschee (Roberts, 1929, pp. 132-134), Site 145 on the Mesa Verde (O'Bryan, 1950, p. 83) and Site 13 at Alkali Ridge (Brew, 1946, p. 233). Among the Mogollon troughed metates are reported from the Bear Ruin (Haury, 1940, pp. 98-99) and in the San Francisco and Three Circle Phases at the Mogollon (Haury, 1936, p. 31) and Harris (*Ibid.*, p. 70) sites. With the exception of the Bear Ruin, however, none of the metates from the above sites have the secondary grinding surface or depression in the platform. It will be recalled that in the discussion of this feature in the metates from Flattop Site it was pointed out that this feature is concentrated, at least in the early horizons, in east central Arizona (See p. 60). With

FIGURE 77. *Manos*.

the exception of the northern periphery (Steward, 1933, pp. 9-10) the secondary grinding surface apparently never reached any degree of popularity outside of this area.

MILLING STONE (1).

Unshaped stream boulder with circular abraded area on both upper and lower faces. Red pigment adheres to one surface. Length, 23.4 cm. Width, 17.2 cm. Thickness, 9.5 cm. Indurated sandstone. Found on floor Structure F4.

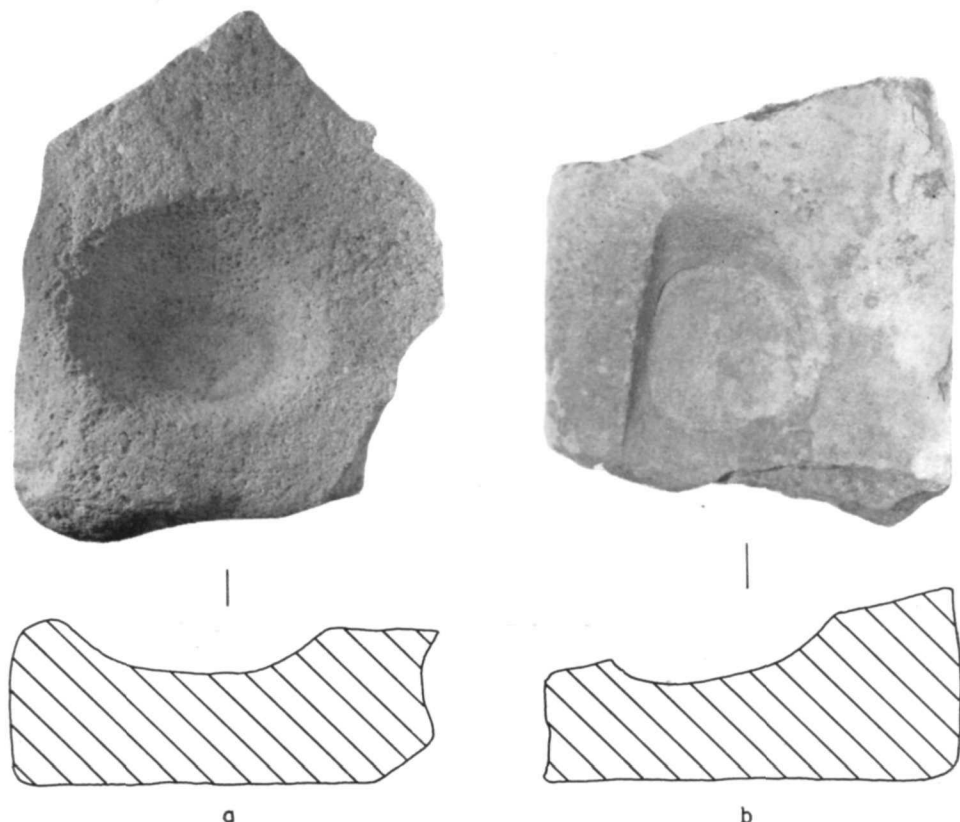


FIGURE 78.

a, Mortar.*b*, Abrader.**MORTAR (1) (Figure 78a).**

Irregular, unshaped stream boulder with deep, circular depression pecked into one face. Maximum diameter, 29.5 cm. Thickness, 10.2 cm. Diameter of grinding area, 16.0 cm. Depth, 3.1 cm. Quartzite. Surface.

ABRADERS (3).

a. (Figure 78b) 1

Axe sharpener (?). Irregular, unshaped slab with elongated trough worn into one face. Length, 25.5 cm. Width, 22.9 cm. Thickness, 14.4 cm. Width of trough, 11.5 cm. Sandstone. Surface.

b. (Figure 79d, e) 2

Grooved sharpener. One, irregular unshaped slab, other reused broken mano. Both have three or more grooves in each opposed face. Grooves both "U" and "V" types. Lengths, 10.7 and 31.5 cm. Widths, 10.1 and 23.2 cm. Thicknesses, 4.1 and 6.5 cm. Sedimentary quartzite. Surface.

REMARKS: Several large boulders were noted at the site which had both troughs and grooves worn into their surfaces. One was used as a wall slab in Structure E1. None of these large abrading stones were collected.

RUBBING STONES (9).

a. (Not illustrated) 5

Small waterworn pebbles with one or more flattened facets resulting from abrasion. Diameters range from 4.6 to 6.8 cm. Quartzite. One from floor Structure B, one each from fill Structures F2 and G1, one from Test Trench I, and one from surface.

b. (Not illustrated) 4

Small, unshaped sandstone (3) or scoria (1) tablets with one or more flattened and smoothed surfaces. Diameters, from 5.4 to 11.1 cm. One each found in fill Structure E1, Structure F5, in Test Trench II, and one from surface.

DISCS (4) (Not illustrated).

Thin sandstone tablets roughly broken to circular outline. Largest also trimmed and smoothed around edges by pecking. Diameters, from 4.3 to 14.5 cm. Thicknesses, from 0.4 to 1.3 cm. Found in fill Structures F2 (2), F5 and D1 (one each).

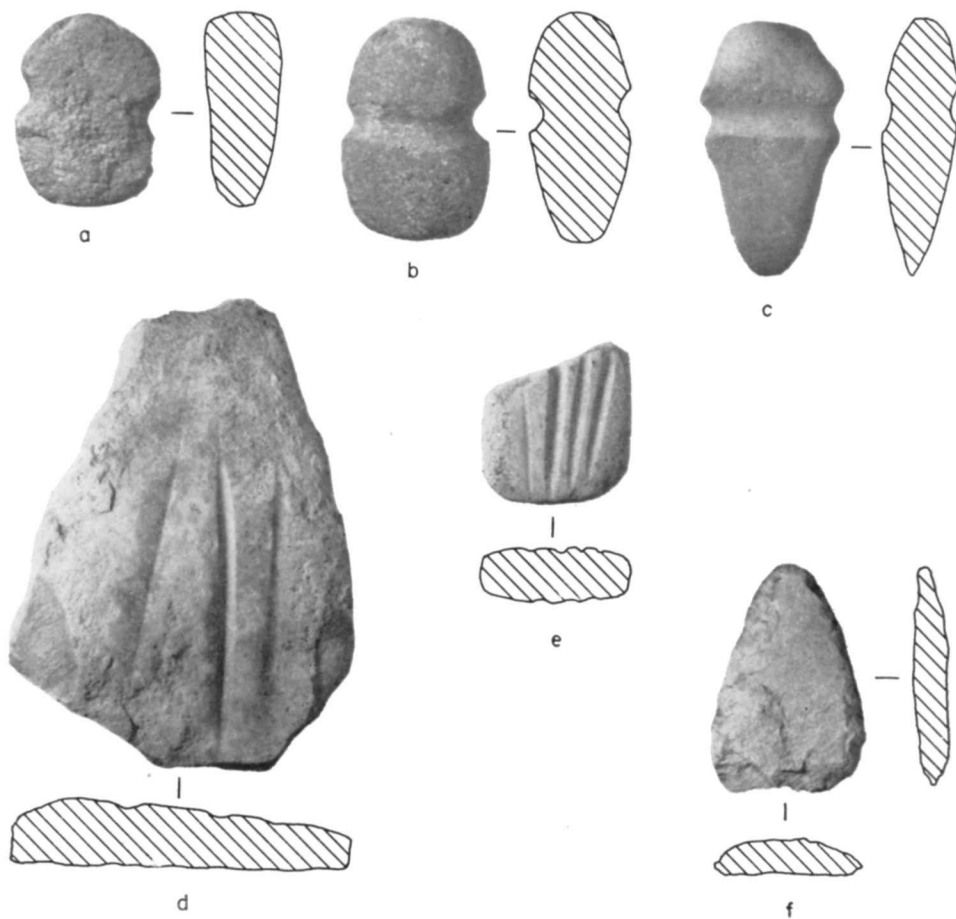


FIGURE 79.

- a, Notched maul.
- b, Maul.
- c, Grooved axe.
- d, e, Grooved sharpeners.
- f, Triangular stone.

COMMENTS. The purpose for which these tablets were used is not definitely known. Similar pieces, however, have been found covering the openings of jars (O'Bryan, 1950, p. 84) and corresponding application may have been made of these specimens. Other uses, such as cooking slabs (*Ibid.*, p. 85) and lapstones (Brew, 1946, p. 241) have been suggested for the larger examples. It is to be noted, however, that none of these discs from the Twin Butte Site showed any evidence of burning, as we would expect had they been used as cooking slabs, or incised lines or other likely results from use as lapstones.

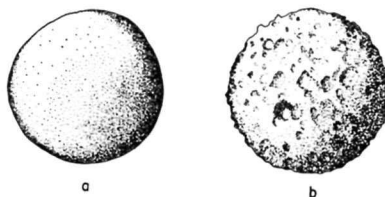


FIGURE 80. *Stone Balls.*
Diameter of a, 4.8 cm.

BALLS (4) (Figure 80).

Carefully shaped, almost perfectly symmetrical. Two of quartzite rubbed smooth; others, of scoria, have rough surfaces. Diameters, from 4.2 to 6.8 cm. Both quartzite balls found in Structure A (one floor, other fill), remaining two from surface.

COMMENTS. These pieces are similar to the small stone balls used by several Southwestern tribes in a "kick game" or race (Culin, 1907, pp. 665-666). They also resemble the balls used by the modern Zuni in their "hidden ball" game (Stevenson, 1904, pp. 333-341). Balls such as these are not common in the Southwest in early horizons. They are, however, widespread (from as far south as South America and north to Alaska) and seem to have considerable antiquity.

PIPES (9).

a. (Figure 81d, f) 3

Short, tubular. Careful workmanship. Sides gradually tapering from top to bottom. Bowl drilled from both ends. One incomplete. Lengths, 2.6 and 4.5 cm. Diameters, 2.2 and 3.4 cm. Diameters of bowls, 1.8 and 1.9 cm. (max.); 1.1 and 1.2 (min.). All vesicular basalt. One from fill Structure G1, remainder from surface.

b. (Figure 81a-c) 5

Long, tubular. Similar to *a* above but with a much greater length. All in various stages of manufacture, none completed. Lengths, from 6.2 to 13.5 cm. Diameters, from 3.1 to 4.5 cm. Sandstone. Two from floor Structure A1, two from fire pit Structure F4, one from surface.

c. (Figure 81e) 1

Incomplete but probably of the long, tubular variety. Decorated with a shoulder encircling bowl 2.8 cm. from top. Maximum diameter (at shoulder) 4.0 cm. Tuff. Surface.

COMMENTS. This series of unfinished pipes suggests the following steps in manufacture: 1) Exterior first blocked out and smoothed to desired shape. This was accomplished through pecking, scraping and/or gouging. 2) Each end roughened or pitted to give footing for drill. 3) Bowl is formed by rotary drilling, working alternately from both ends with greatest depth given to bowl end. Drill apparently long, with tapering sides and pointed end, possibly of stone.

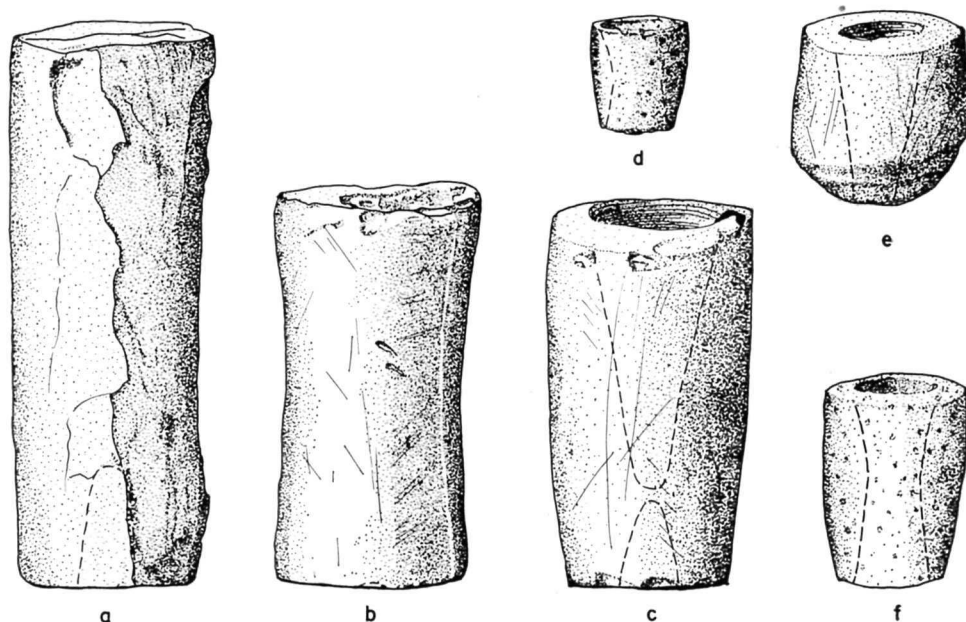


FIGURE 81. *Stone pipes and pipe blanks. Length of d, 2.6 cm.*

It is interesting that all of the long, tubular pipes were made from locally available sandstones, and further, that they were all in the process of manufacture and thus probably were being made at the site. The short tubular type, on the other hand, were of vesicular basalt a material that, although it was available within a few miles, is very common in the Mogollon area to the south.

GROOVED AXE (1) (Figure 79c).

Full-grooved. Pecked over entire surface, blade polished near bit. Blade tapers to a narrow, sharp cutting edge. Poll tapering, slightly flattened on end. Low shoulder on both outer and inner edges above and below groove. Each shoulder bifurcated by short, narrow, vertical groove placed at right angles to hafting groove. Length, 16.8 cm. Width, 9.7 cm. Thickness, 4.1 cm. Diabase. Found in fill Structure 2.

COMMENT. In the Southwest the full-grooved axe first appears during late Basket Maker III or perhaps, very early Pueblo I. While the exact time of its introduction is not known it has not been reported from most Basket Maker III sites (see Roberts, 1929, pp. 135-136). Here at the Twin Butte Site the association is late in the occupation and may correlate with the beginnings of Pueblo I in some sites farther east. Our present evidence suggests that the full-grooved axe reached the Anasazi somewhat later than pottery and pit house construction and may, therefore, have been introduced from a different source (or sources?). Farther south among the Mogollon, where the closest parallels to the Anasazi ceramics and architecture are to be found, axes occur only in the later horizons and then they are predominately of the interrupted or three-quarter grooved variety (Haury, 1936; Martin, Rinaldo and Kelley, 1940). It has been suggested that the Mogollon three-quarter grooved axes may be attributable to Hohokam influence where they have a long history dating

from the end of the Pioneer Period (Haury, 1936, p. 106). The three-quarter grooved axe never spread to the Anasazi (Reed, 1948); however, the full-grooved variety, once introduced, maintained its popularity until the Conquest. Interestingly, the full-grooved axe has a long history in eastern North America where it dates from late Archaic or early Woodland times (Fairbanks, 1949, p. 58). In view of this distribution it seems reasonable to suggest that the full-grooved axe may have reached the Anasazi from some, as yet undetermined, eastern source.

GROOVED MAUL (5) (Figure 79b).

Full-grooved, four roughly shaped cobbles, one carefully pecked and polished over all surfaces. All show battering on ends. One incomplete. Lengths, from 10.8 to 14.2 cm. Widths, from 8.1 to 10.0 cm. Thicknesses, from 5.1 to 7.5 cm. Two quartzite, two sandstone, one basalt. One found in fill Structure F2, two in fill Structure F4, two from surface.

NOTCHED MAUL (1) (Figure 79a).

Crude, unshaped indurated sandstone slab with shallow notches placed on each side equal distance from ends. Both ends abraded from pounding. Length, 12.1 cm. Width, 8.9 cm. Thickness, 4.4 cm. Surface.

COMMENT. The full-grooved maul, in contrast to the axe, is widely spread both in time and space over the Southwest (Woodbury in Kluckhohn and Reiter, 1939, pp. 68-72). While plentiful in Basket Maker III sites (Roberts, 1929, pp. 134-136) it has not been reported from those Basket Maker II sites thus far excavated (see Kidder and Guernsey, 1922; Gaumer, 1937) and probably reached the Anasazi concurrently with pottery and pit house architecture. Interestingly, mauls similar to these from the Twin Butte Site are to be found in most early Mogollon sites (Martin, Rinaldo and Kelley, 1940, pp. 56-57; Haury, 1936, pp. 105-106). They are not, however, reported from the early levels at Snaketown or other early Southwestern sites producing pottery finished with the paddle and anvil (Gladwin, et al., 1937, Plate XLIII; this report, pp. 59-65).

The notched maul is perhaps related to the notched axe, often found in sites producing the full-grooved axe (see Brew, 1936, pp. 237-240). Notched mauls, *per se*, have not been reported from Basket Maker III sites. It is probable, therefore, that this example is either a heavily battered axe or a local variant of this type.

GROOVED STONE (1) (Not illustrated).

Oval quartzite stream cobble, slightly flattened on one face from use as mano. Shallow, roughly pecked groove encircles opposite face at right angles to long axis. One end slightly flattened by pounding. Length, 16.4 cm. Width, 9.1 cm. Thickness, 5.6 cm.

HAMMERSTONES (44).

a. (Not illustrated) 11

Elongated stream cobbles abraded on sides or ends from pounding. Diameters, from 5.5 cm. to 14.0 cm. One sandstone, remainder quartzite. One from fill Structure F2, seven from fill Structure F4, one from Test Trench I, one from level 11, Stratigraphic Test I, one from floor Structure A.

b. (Not illustrated) 33

Angular chunks and cores of petrified wood abraded on ends and angular edges. Diameters, from 5.1 to 14.5 cm. Two from floor Structure A, five from fill Structure D1, one from pit F1a, eight from fill Structure F2, five from fill Structure F3, one from fill Structure F4, four from fill Structure F5, three from Stratigraphic Test II, one from Test Trench II and one from surface. (Many others noted from surface, but not collected.)

COMMENTS. The above hammerstones are but a fraction of the number lying around on the surface of the site. These, together with the great quantities of workshop material also present, suggest a local emphasis on chipping of petrified wood which far surpassed the needs of the local inhabitants as is indicated by the tools recovered in our excavations. The excellent chipping qualities as well as the attractiveness of the petrified wood may have made it in demand by those groups living in adjacent areas where similar material is either rare or unobtainable. Perhaps this may explain why so much trade pottery was present at the site.

BOWL (1) (Figure 82).

Circular in outline, hemispherical in cross section. Possibly a natural concretion with circular depression pecked into flattened upper surface. Diameter, 9.3 cm. Thickness, 4.5 cm. Diameter of cavity, 6.6 cm. Depth, 2.4 cm. Sandstone. Found in fill Structure F4.

TRIANGULAR STONE (1) (Figure 79f).

Thin sandstone slab roughly broken to shape. No evidence of wear or use. Length, 15.5 cm. Width, 10.4 cm. Thickness, 2.3 cm. Surface.

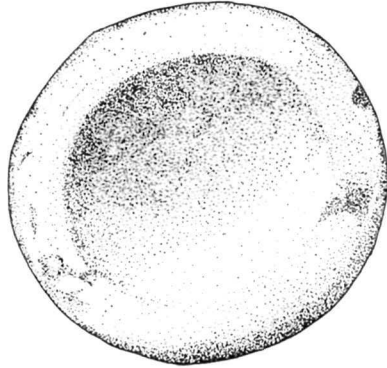


FIGURE 82. *Stone bowl.*
Diameter, 9.3 cm.

PENDANTS (5) (Figure 83c, f, h).

All different in outline. Suspensary holes all perforated from both sides. One (h) decorated with deep, narrow incised lines and resembles a pecten shell. Others undecorated. Only three complete. Lengths, from 1.1 to 3.2 cm. Widths, from 0.9 to 1.6 cm. Thicknesses, from 0.2 to 0.4 cm. One of fossil bone, one of olivine, remainder of shale. One (c) found with cache of petrified wood "cone-shaped objects" in fill Structure F2. One (g) from fill Structure D1, remainder from surface.

BEAD (1) (Not illustrated).

Disc shaped. Perforated in center, drilled from both sides. Diameter, 0.8 cm. Thickness, 0.3 cm. Limestone. From fill Structure F5.

EFFIGIES (2) (Figure 83a, b).

Quadrupeds carved in round. One incomplete represented by tail and one leg only. Other complete, has ears, snout, mouth, front legs and long tapering body and tail. No rear legs depicted. Length, 1.8 cm. Width, 0.7 cm. Height, 0.7 cm. One of quartz (complete), other of limestone. One found in fill Structure F5, other from surface.

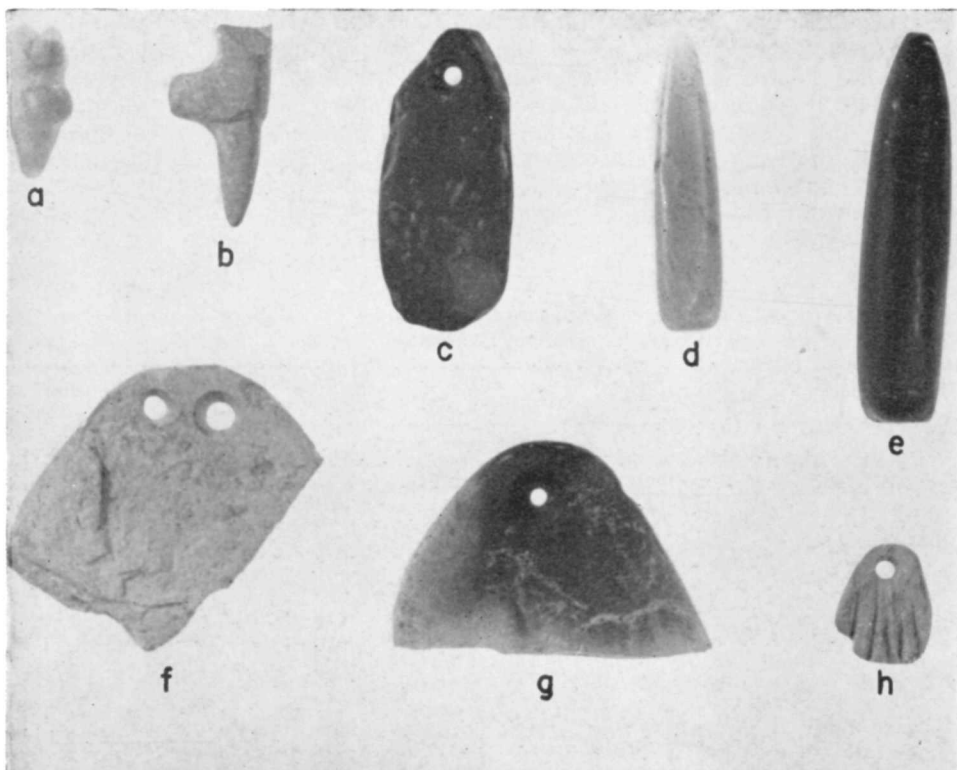


FIGURE 83.

a, b, Effigies.
c, f-h, Pendants.
d, e, Cone-shaped objects.

CONE-SHAPED OBJECTS (13) (Figure 83d-e).

Small cones of petrified wood carefully shaped and polished. All have flat or nearly flat bases, rounded sides and pointed tops. Round in cross section. Some show no wear facets, others not so carefully finished. Lengths, from 1.2 to 5.3 cm. Diameters, from 0.5 to 1.7 cm. Nine found in cache in fill of Structure F2, one from fill Structure F4, remainder from surface.

MOSAIC (?) OR UNFINISHED BEADS.

Among the contents of a small pottery bowl placed beside Burial 2 were 376 pieces of worked turquoise and 9 pieces of red sandstone or argillite (?). The majority of these fragments were rectangular in outline and carefully shaped. A few were nearly square. Average dimensions were 1 cm. long, 0.6 cm. wide, and 0.2 cm. thick. Their exact purpose has not been accurately determined. The presence of turquoise and red sandstone pieces together suggested a possible incomplete or disarranged mosaic; however, they may have been unfinished beads and pendants.

CHIPPED—PRESSURE

RANDOM FLAKES UNMODIFIED EXCEPT BY USE (358).

In this category are included the fortuitous flakes which were utilized without further modification. Minute flakes, removed during the process of using the tool, are visible along one or more edges. Above total does not represent more than representative sample of similar flakes on surface of site. Lengths, from 1.8 to 12.0 cm. Widths, from 1.0 to 8.3 cm. Thicknesses, from 0.2 to 3.7 cm. Sixty of chert, one quartzite,

remainder of petrified wood. Of total, one hundred and forty recovered from excavation, representing all houses and features. Remainder from surface.

PROJECTILE POINTS (82).

a. (Figure 84a-c) 20

Small, thin, triangular in outline. Unnotched. Made from selected flakes, trimmed around edges to give desired shape. Rarely flaked over entire surface. Lengths, from 2.2 to 4.3 cm. Widths, from 1.1 to 2.0 cm. Thicknesses, from 0.1 to 0.5 cm. One chert, remainder petrified wood.

b. (Figure 84d-g) 36

Similar to *a* above but with deep, narrow diagonal notches removed from both basal corners. Lengths from 1.8 to 3.4 cm. Widths, from 1.1 to 1.7 cm. Thicknesses, from 0.1 to 0.3 cm. One chert, three obsidian, remainder petrified wood. One each from

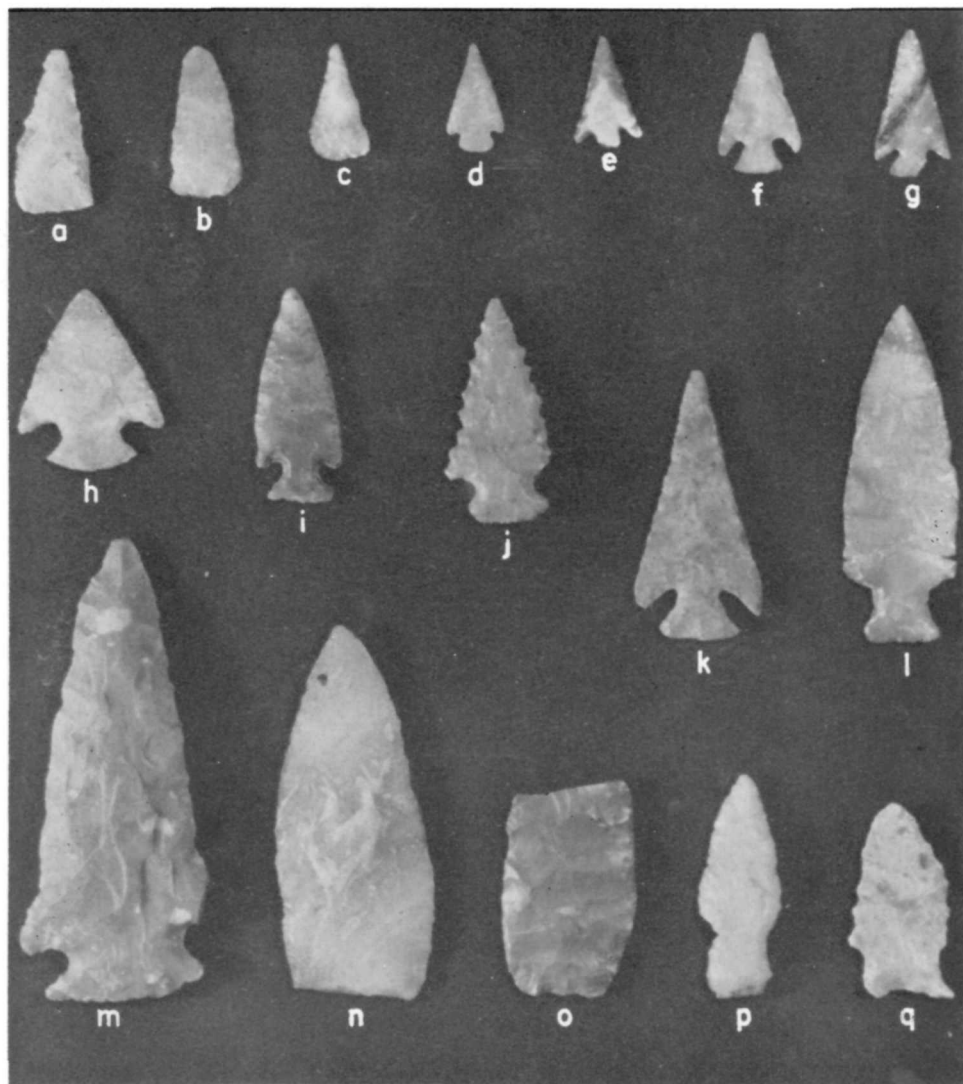


FIGURE 84. *Projectile points and blades.*

fill Structures A and F5, one from Test Trench II, one from level 8, Stratigraphic Test II, remainder from surface.

c. (Not illustrated) 1

Similar to *b* above but with two lateral notches removed approximately one-third distance from base to point. Incomplete. Chert. Surface.

d. (Figure 84h-l) 11

Large, thin, carefully worked points with deep, diagonal corner notches. One has serrated edges. Lengths, from 3.5 to 6.3 cm. Widths, from 1.6 to 2.7 cm. Thicknesses, from 0.3 to 0.5 cm. One of calcite, three of chert, remainder of petrified wood. Six from fill Structure F2, one (of calcite) (h) from fill Structure D1, remainder from surface.

e. (Figure 84p) 2

Similar to *d* above but with long, parallel sided stems. Only one complete. Length, 4.6 cm. Width, 1.5 cm. Thickness, 0.3 cm. Both petrified wood. One from fill Structure F2, other from surface.

f. (Figure 84q) 1

Stemmed, concave base, serrated edges. Base wider than shoulders. Length, 3.6 cm. Width, 1.9 cm. Thickness, 0.2 cm. Chert. Surface.

g. (Not illustrated) 11

Too incomplete to classify. Two obsidian, remainder petrified wood. One each from fill Structure A and G1, remainder from surface.

COMMENTS. The marked differences between the projectile points of the Flattop and Twin Butte Sites is of considerable interest. While the style of point from the Flattop Site survives throughout the period of the Twin Butte occupation, it is the introduction of the small, thin diagonally notched points of the later site that is significant here. In view of the recent discovery of both large and small sized points attached to both spear and arrow shafts (University of New Mexico excavations, 1948) it would perhaps be unwise to suggest that these small points are primarily designed for use on arrows while the larger points of the Flattop Site, as well as those of a similar size from the Twin Butte Site, were spear or dart points. Regardless of whether or not this segregation is ever proved correct the presence of the small points in the Twin Butte Site is one of the major distinctions between the lithic complex of that site and the earlier Flattop Site. Small points similar to these apparently are typical for Basket Maker III-Pueblo I sites. At Shabik'eschee (Roberts, 1929, Plate 28), White Mound (Gladwin, 1945, Plate XVII), Site 13 on Alkali Ridge (Brew, 1946, pp. 233-235) and in the La Plata District (Morris, 1939, Plate 126) small thin points with diagonal corner notches are reported for these periods. They do not, however, occur in Basket Maker II sites. During this period projectile points are similar if not identical to the large points found at the Flattop Site.

Among the Mogollon small, diagonally notched points occur in horizons probably antedating the appearance of this type among the Anasazi. At the San Simon Site they are reported from the earliest, or Peñasco Phase (Sayles, 1945, Plate XLII) while in the Point of Pines area they are found in the early Circle Prairie Phase (Wheat, 1950, p. 20). Both of these sites are considered by many to at least in part antedate the appearance of pottery among the Anasazi. Should this chronological placement be correct, then it is not unlikely that these points reached the Anasazi from the south and may have accompanied the diffusion of pottery, pit house architecture and the full-grooved maul to this northern group.

The single lateral notched point found is probably a late intrusion on the site. This style of point is often found associated with Pueblo II-III

ruins in this area (several ruins of this date are located within a few hundred yards of this site) and elsewhere in the Anasazi district (Brew, 1946, pp. 233-235).

BIFACIALLY WORKED BLADES (7).

a. (Figure 84m) 3

Large, irregularly chipped blades with deep diagonal notches removed from each basal corner. Blades asymmetrical. One complete. Length, 8.8 cm. Width, 3.5 cm. Thickness, 0.7 cm. One chert, remainder petrified wood. One from fill Structure F2, remainder from surface.

b. (Figure 84n-o) 4

Similar to *a* above but lacks corner notches. Only one complete. Length, 6.5 cm. Width, 2.9 cm. Thickness, 0.5 cm. All petrified wood. All surface.

DRILLS (20).

a. (Figure 85a-b) 7

Plain shafted. Chipped over both major faces. Rounded to oval cross-section. One example has a shallow lateral notch removed a short distance above base. Lengths,

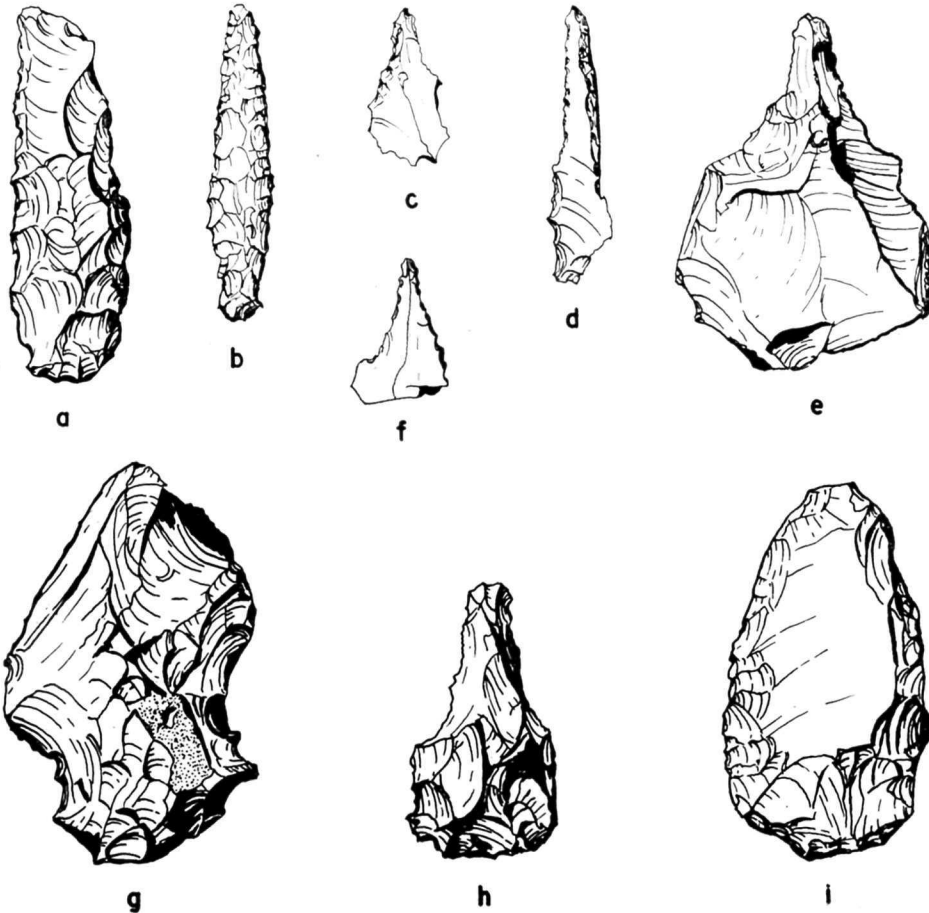


FIGURE 85. Drills and scrapers. Length of b, 4.2 cm.

from 3.8 to 6.7 cm. Widths, from 0.8 to 2.5 cm. Thicknesses, from 0.6 to 2.0 cm. One chert, remainder petrified wood. Two from Test Trench I, remainder from surface.

b. (Figure 85c-f, h) 13

Random flakes chipped for varying distances along two adjoining edges to form a working point. Worked edges tend to be beveled producing rounded cross section near point. Lengths, from 1.7 to 4.6 cm. Widths, from 0.5 to 3.4 cm. Thicknesses, from 0.2 to 1.0 cm. All petrified wood. One from fill Structure A, one from Test Trench I, remainder from surface.

GRAVER (1) (Figure 86).

Random flake trimmed from one face. Graver point shows considerable wear from use. Length, 3.7 cm. Width, 2.0 cm. Thickness, 1.7 cm. Petrified wood. Surface.

SCRAPERS (15).

a. (Figure 89b-c) 13

Plano-convex. Steeply chipped along one or more edges producing a sinuous scraping edge. Lengths, from 3.9 to 9.2 cm. Widths, from 2.5 to 7.3 cm. Thicknesses, from 1.2 to 2.8 cm. One quartzite, three chert, remainder petrified wood. One each from Structures F1, F4, F5, G1 and B, remainder from surface.

b. (Figure 85g) 2

Hollow edge or concave scraping edge. One has two opposed working edges. Lengths, 3.2 and 6.5 cm. Widths, 2.5 and 4.0 cm. Thicknesses, 1.5 and 2.0 cm. Petrified wood. One from fill Structure D1, other from surface.

SAWS (3) (Figure 87).

Random selected flakes carefully retouched along one edge producing a denticulate cutting edge. All incomplete. One chert, remainder petrified wood.

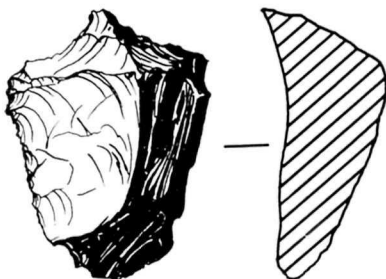


FIGURE 86. *Graver*.
Length, 3.7 cm.



FIGURE 87.
Saw.
Length,
3.3 cm.

PERCUSSION

CHOPPERS (6).

- a.* (Figure 89d) 3

Uniface. Large, selected flakes used with minimum of modification. Trim flakes removed from one side along working edge only. Lengths, from 10.0 to 15.2 cm. Widths, from 8.7 to 10.5 cm. Thicknesses, from 2.6 to 4.9 cm. All petrified wood. One each from Units F1 and D1, other from surface.

- b.* (Figure 89a, e) 2

Biface. Similar to *a* above but with trim flakes removed from both major faces. Note difference in materials. Lengths, 8.6 and 10.5 cm. Widths, 8.8 and 7.9 cm. Thicknesses, 2.2 and 2.4 cm. Quartzite and indurated sandstone. One from surface, other from fill Structure F3.

- c.* (Figure 88) 1

Large, possibly accidentally pointed. Triangular cross section of working end. All edges show battering from use. Length, 11.8 cm. Width, 4.9 cm. Thickness, 3.4 cm. Petrified wood. Surface.

OVATES (5) (Figure 85i).

Thick, bifacially worked. Possibly rejected blades or points. Lengths, from 4.8 to 7.4 cm. Widths, from 2.6 to 4.1 cm. Thicknesses, from 1.4 to 1.7 cm. One from fill Structure F2, remainder from surface.



FIGURE 88. *Pointed chopper or spike.* Length, 11.8 cm.

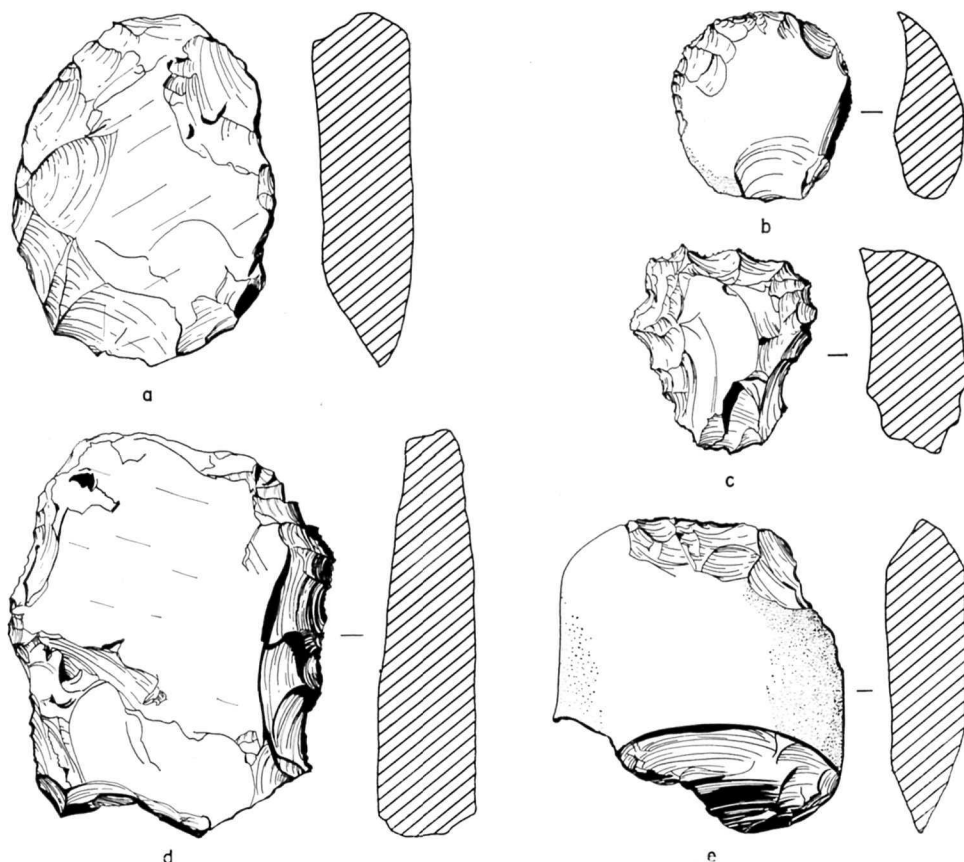


FIGURE 89. *Choppers and Scrapers*. Length of a, 10.5 cm.

PETROGLYPH SLAB (1) (Figure 90).

Roughly shaped sandstone slab with two designs, one an equal armed cross, the other a zig-zag line, pecked into one surface. The zig-zag line incomplete. Width of equal-armed cross, 9.0 cm. Height of slab, 47.5 cm. Thickness, 5.2 cm. Wall slab in Structure F3.

COMMENTS. The incompleteness of the zig-zag line indicates that the petroglyphs were already on the slab before it was removed and shaped for use in structure F3. Thus, the exact age of these motifs is not known, however, they are at least as old as Basket Maker III, and may be older. The equal-armed cross was identified by a Hopi informant as a star. The same informant considered the zig-zag line to represent a snake. Similar identifications have been offered for these motifs by other groups and it seems probable that they are a widespread representation of these features.

WORKED BONE AND ANTLER

ANTLER

a. (Figure 91a) 2

Unmodified antler cores. Possibly used as perforators. Antelope (*Antilocapra americana*). Lengths, 7.7 and 8.5 cm. In bowl on floor Structure A1.

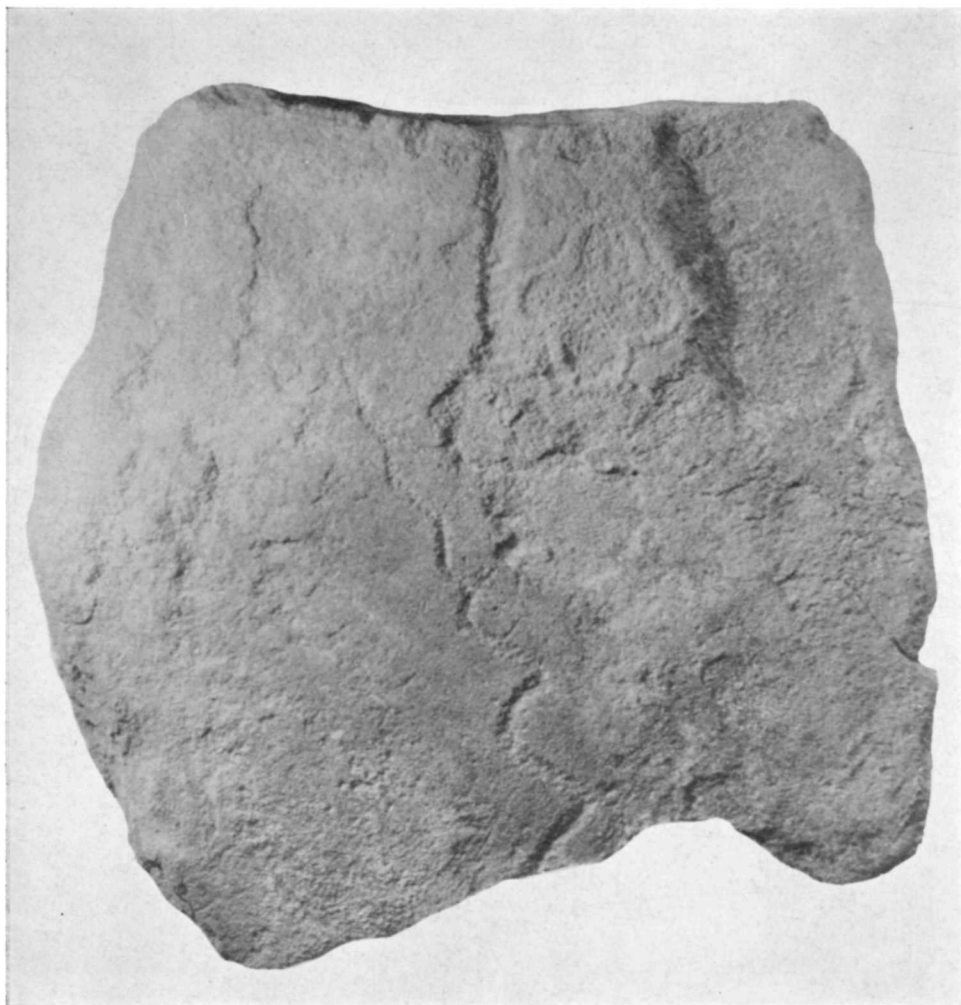


FIGURE 90. Petroglyph slab.

- b. (Not illustrated) 1
 Incomplete. Split antler tine worked to gradually tapering point.
- c. (Not illustrated) 2
 Too incomplete to classify.

BONE

AWLS (26)

- a. (Figure 91b, c) 2
 Articular end unmodified. One, distal end of antelope (*Antilocapra americana*) metatarsus; other, proximal end of antelope ulna. Points abruptly tapering; the ulna from one side only, the metatarsus from both sides and further thinned to a keen point. Lengths, 7.7 and 8.0 cm. Widths, 3.1 and 3.6 cm. One found in bowl on floor Structure A, other with Burial 3.
- b. (Figure 91d-f, h) 7
 Articular end unworked except for splitting. All distal ends of antelope (*Antilocapra americana*) metatarsus. All but two have points abruptly tapering from both

sides. Two exceptions have gradually tapering points. Lengths, from 6.9 to 10.5 cm. Widths, from 2.0 to 2.3 cm. One found in fill each Structures D1, D2 and F4, two found in fill Structures F2 and G1.

c. (Figure 91n-q) 4

Similar to *b* above except shaft reduced in size by splitting, leaving notch or shoulder short distance above articular end. Points all abruptly tapering from both

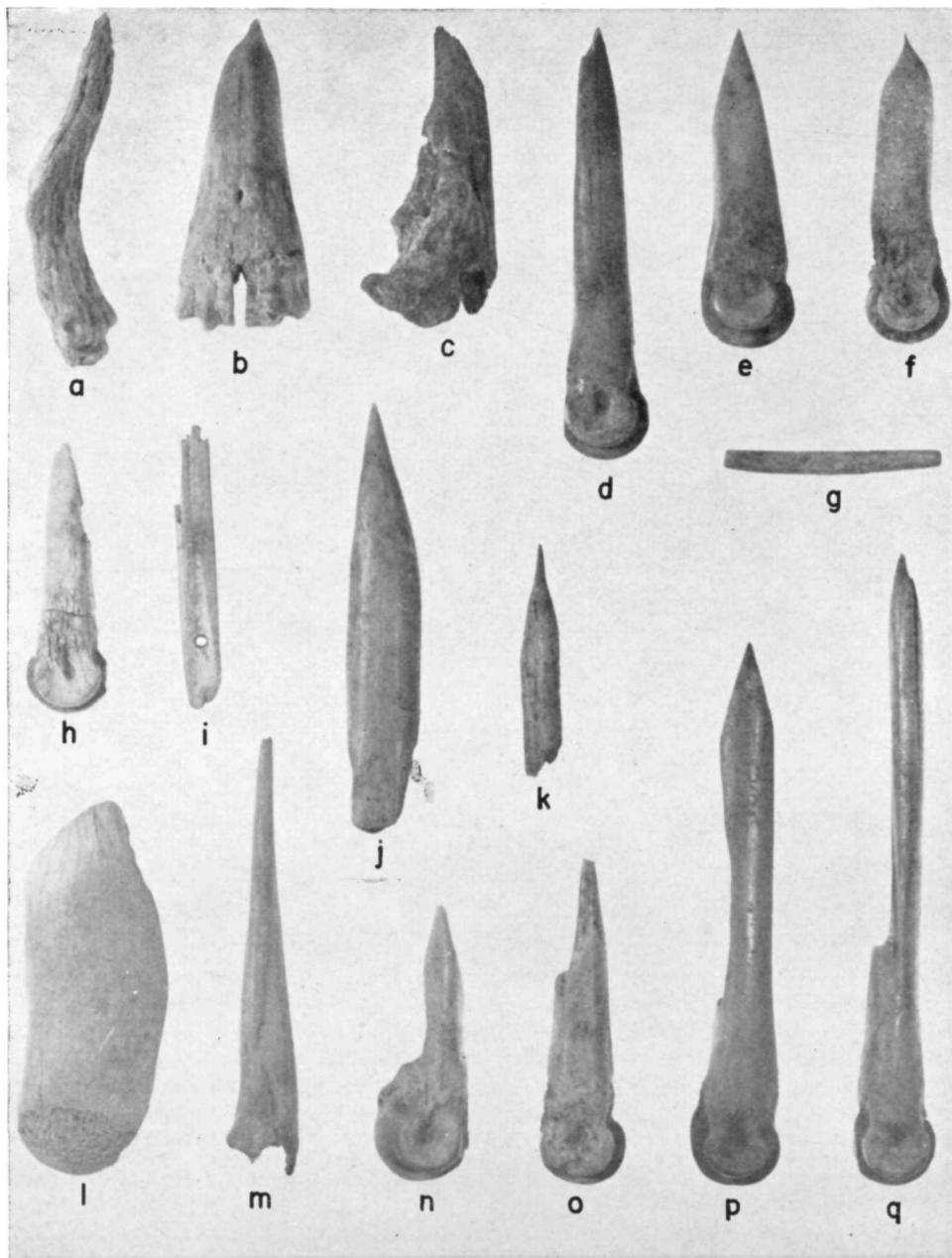


FIGURE 91. Artifacts of bone and antler.

sides. Lengths, from 6.6 to 15.2 cm. Widths, from 2.1 to 2.2 cm. One found on floor Structure D4, one on floor F4, one from Stratigraphic Test II, and one from fill Structure F2.

d. (Figure 91m) 3

Articular end modified. One made from proximal end of dog (*Canis domesticus*) ulna, others unidentifiable. Two complete. One has gradually tapering point, other abruptly tapering from both sides.

e. (Figure 91j-k) 6

Made from mammal long bone splinters. Five have points abruptly tapering from both sides, one has point tapering from one side only. Two found in Test Trench I, one each found in fill Structure D1, D4, F4 and F5.

f. (Not illustrated) 4

Too fragmentary to classify. Tips or midsection of awls. One found in fill Structure F2, one from surface, two from Stratigraphic Test II.

NEEDLES(?) (3) (Figure 91i).

All fragmentary. Characterized by hole drilled near one end. All holes drilled from two sides. One found in Stratigraphic Test II, one in fill Structure G1, one from surface.

SKEWER(?) (1) (Figure 91g).

Bone splinter rounded by abrasion with both ends cut square and worked smooth. Length, 5.2 cm. Diameter, 0.4 cm. Found in Test Trench 2.

SPOON (1) (Figure 91l).

Split mammal long bone. Working edge carefully thinned and polished. Length, 9.1 cm. Width, 3.5 cm. Found on floor Structure F4.

GAMING PIECE (1) (Not illustrated).

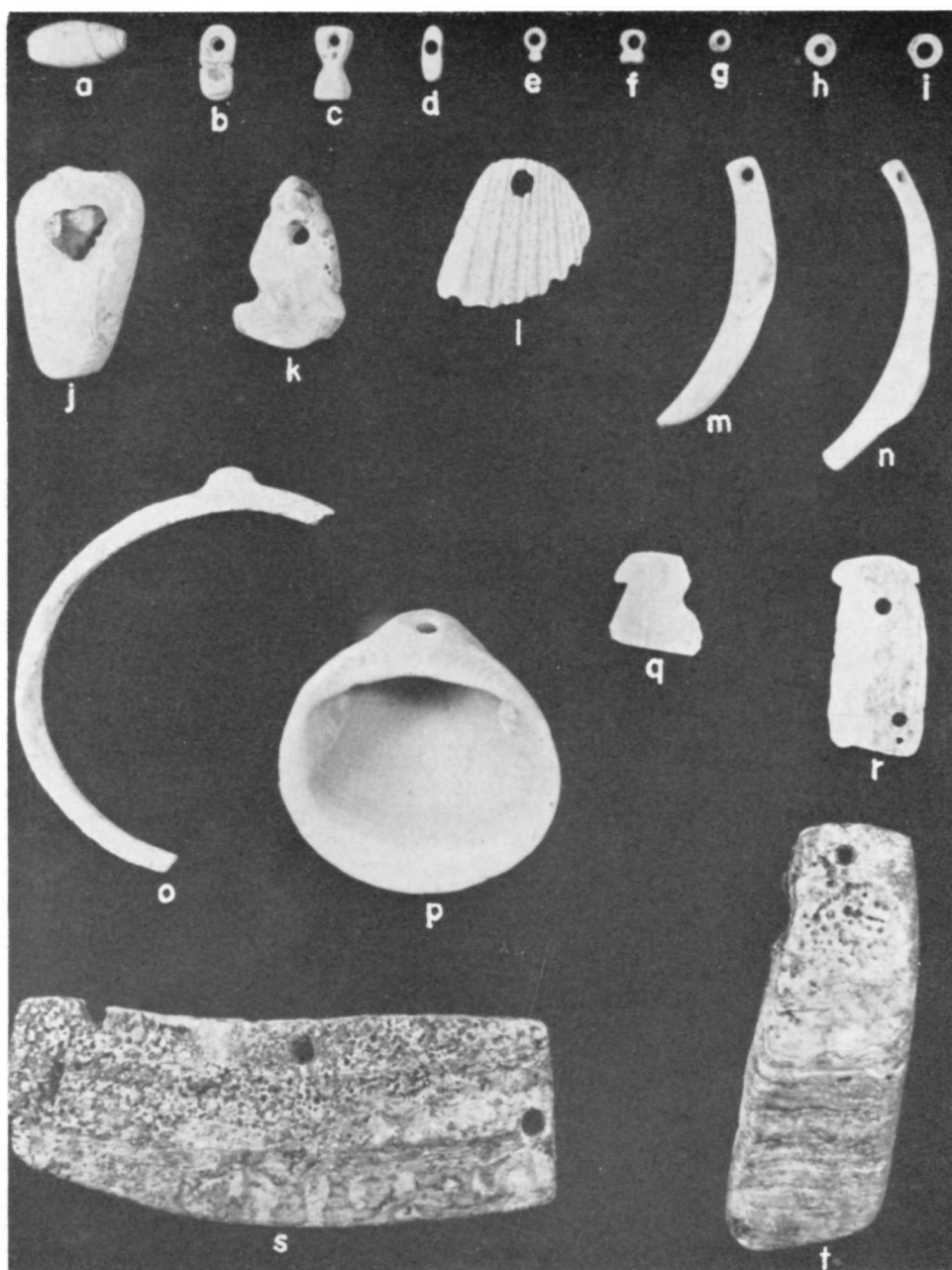
Small circular tablet. One surface flat, other convex, slightly flattened. Single, right angle. Cross decoration incised into flat surface. Diameter, 1 cm. Thickness, 0.4 cm. Found in fill Structure G1.

COMMENTS. It will be recalled that bone tools were absent from the Flatlop Site (see p. 76). The addition of bone to the list of materials utilized in the manufacture of tools is one of the significant characteristics of the artifact assemblage of the Twin Butte Site. In this respect the Twin Butte Site is paralleled by other Anasazi sites of comparable age. From Shabik'eschee (Roberts, 1929, pp. 128-132), White Mound (Gladwin, 1945, p. 26) and Site 13 on Alkali Ridge (Brew, 1946, pp. 242-245) similar bone artifacts are reported. Thus, tools of bone were well established among the Anasazi.

Of interest is the presence of the notched bone awl in significant numbers. Heretofore this specialized type of awl has been considered a diagnostic of the Mogollon (Haury, 1936, pp. 110-111). It is not an exclusive Mogollon trait, however, for in addition to the Twin Butte Site they were also found at least at one other Anasazi site: Shabik'eschee (Roberts, 1929, Plate 20h). Whether these can be attributed to contact between the Anasazi and the Mogollon is not clear. But the absence of the notched awl from the collection from the Bear Ruin (Haury, 1940, pp. 116-117), which is located in the area from which it is believed originated most of the intrusive Mogollon pottery found at the Twin Butte Site (see pp. 127-128) weakens any argument favoring trade.

ARTIFACTS OF SHELL

Identifications of the shells described below were made by the author by comparison with an identified collection available at the Museum of

FIGURE 92. *Artifacts of shell.*

Northern Arizona. The range of the identified types are taken from Howard R. Hill, Los Angeles Museum, as recorded by McGregor (1941, p. 215).

BEADS.

- a. (Figure 92g-i) 1155
Simple disc. Unidentified shell worked into circular form and perforated through the center by drilling from both sides. Diameters, from 0.2 to 0.8 cm. Thicknesses, from 0.1 to 0.3 cm. Found with Burials 2, 4, 5, 6 and 7.
- b. (Figure 92b-f) 800
Bilobate. Unidentified shell worked into figure "8" outline and perforated through the center of one of the lobes. Often wedge shaped in cross section. Lengths, from 0.3 to 1.0 cm. Thicknesses, from 0.1 to 0.2 cm. All found with Burial 2.
- c. (Figure 92a) 650
Olivella, spires removed. Found with Burials 2, 3, 4, 5, 6 and 7. In the latter case possibly sewn to garment. Scattered olivella beads also found in Structures A1, F1, F2, F3, F4, F5 and G1. Possible origin either Gulf of California or Pacific Coast.
- d. (Figure 92k) 8 only
Fragment of *Spina chama*, perforated near one end. Lengths, from 1.0 to 2.5 cm. All found with Burial 2. Origin: probably Gulf of California.
- e. (Figure 92j) 1
Conus. Spire removed by abrasion. Length, 2.9 cm. Diameter, 1.8 cm. Found on surface. Range: Gulf of California south to Panama.

PENDANTS (9).

- a. (Figure 92l) 1
Fragment of pecten, trimmed to desired sub-triangular shape and perforated near apex of triangle. Length, 2.0 cm. Width, 2.3 cm. Thickness, 0.1 cm. Surface. Range: Monterrey, California to Peru.
- b. (Figure 92 m, n) 4
Glycimeris. Possibly fragment of bracelet. Perforated end thinned from both sides to facilitate stringing. Lengths, from 3.5 to 4.2 cm. Found in fill Structure D1. Range: Gulf of California south to Panama.
- c. (Figure 92r-t) 3
Abalone (*Haliotis fulgens*) worked into roughly rectangular outline and with one or more holes drilled for suspension. No decoration. One incomplete. Dimensions of others: Lengths, 6.0 and 7.6 cm. Widths, 2.2 and 2.6 cm. Thicknesses, both 0.4 cm. One from fill Structure D1, others from Burials 2 and 7. Range: Farallon Islands to Gulf of California.
- d. (Figure 92p) 1
Glycimeris (*Glycimeris maculatus*). Whole shell. Hole for suspension formed by abrasion of spine. Diameter, 3.9 cm. Found on surface. Range: Gulf of California to Panama.

BRACELETS (42) (Figure 92o).

All Glycimeris. Fragmentary. Manufactured by removing the centers of the shells and grinding the edges smooth. Diameters, from 5.0 to 7.0 cm. (est.). Thirty-one found on surface, three from fill Structure F2, two from fill Structure F4, one from F5, one from Stratigraphic Test I, one from Stratigraphic Test II, one from Burial 4 (around left wrist) and one from Burial 3. Range: Gulf of California to Panama.

COMMENTS. The addition of shell as a material utilized for artifacts is, like bone, a notable difference between the collections from the Flatop and Twin Butte Sites. In contrast to the bone artifacts, which were primarily utilitarian in purpose, the shell artifacts are all designed for use as ornaments. Trade routes, which for some reason were not functioning when the Flatop Site was occupied, now supplied an abundance of shell. Many of the species represented could have originated from either the Pacific Coast or Gulf of California areas. Some, however, are found

exclusively in the Gulf of California, or farther south, although some were species which could only have originated on the Pacific Coast. The Gulf of California was, therefore, the more important source for the shells at this site. No fresh water forms were recovered.

The bilobate beads require further comment. These unusual beads have been reported from several late ruins scattered over a wide area of the Southwest. Among the Anasazi they are reported from the pueblo at Kiatuthlanna (Roberts, 1931, p. 161), from Chaco Canyon (Pepper, 1920, p. 125) and from a pueblo cache in the Marsh Pass district (Kidder and Guernsey, 1919, p. 150). Among the Mogollon they are late, although only two occurrences are reported, one from the Starkweather Ruin and the other from a Classic Mimbres site (Nesbitt, 1931 and 1938, p. 110). At Winona, a Sinagua-Hohokam site, similar beads occurred in all horizons (McGregor, 1941, p. 218) but the occupation at the site probably began after 1075 A.D. and therefore compares in age with the previous finds in other areas. At Snaketown this type of bead was also late, found only in the Santa Cruz and Sacaton Phases (Gladwin, et al., 1937, p. 140). Outside of the Southwest similar beads were also found at Culiacan in Sinaloa, Mexico (Kelley, 1945, p. 145) where they were associated with the Aztatlan Complex. The significance of this distribution is not yet apparent; however, these examples from the Twin Butte Site are among the earliest reported occurrences.

Most of the beads found with the burials apparently had been strung so that they hung from the neck or around the wrists of the individual. Associated with Burial 7, however, were numerous olivella beads massed over the thoracic area as if they had been fastened to a leather or woven garment. Unfortunately, our evidence for this possibility is very meager, and since, to my knowledge, it has not been reported elsewhere in the Southwest it would be wise to withhold final judgment in this case until more satisfactory data are available.

ARTIFACTS OF PERISHABLE MATERIALS

Because the site was open and unprotected from moisture, artifacts made from perishable materials had long since disintegrated unless accidentally preserved by partial burning or other means. The following two reports by Kate Peck Kent and Earl H. Morris describe the few artifacts of this nature that were recovered. The first report, by Kent, describes a small fragment of netting found on the surface of the site after a heavy rain. The second report, by Morris, describes three very poorly preserved examples recovered from Test Trench No. 1. The first specimen described by Morris was found in the upper portion of the trench and was not associated with any feature or structure. The last two specimens, however, were found with Burial 7 and were preserved because they lay under pottery vessels.

A CHARRED TEXTILE FRAGMENT

BY KATE PECK KENT

Site: Twin Butte, Surface.

Dimensions: 1" x $\frac{3}{4}$ ". Coils per $\frac{1}{2}$ "—3. Width of threads— $\frac{1}{32}$ " to $\frac{1}{16}$ ".

Materials: Unidentified vegetable fiber. 2-ply, S-spun, Z-twined.* Probably not cotton.

Usual prehistoric 2-ply cotton thread is Z-spun, S-twined, or spun and twisted in

* This means each thread, or ply, is composed of fibers twisted together so that they all follow the direction of the center line of the letter S. Two threads, or plies, have then been twisted together so as to lie in the same direction as the center line of the letter Z.

just the opposite direction of this. These fibers should be analyzed by an expert to determine their exact nature.

Technique: Plain coiled netting** (knotless netting). The charred fragment is illustrated in Figure 93.

** Also called "looping" by Amsden and K. Bartlett, p. 4 in Amsden; or "coil without foundation" by Mason, pp. 245-248. Designated "plain coiled netting" in Cosgrove, p. 71. I prefer this term because the technique is, in fact, a variety of netting and might as well be referred to as such.

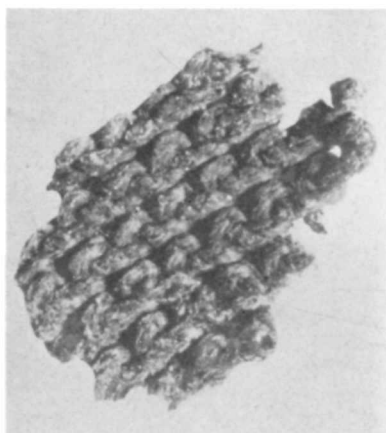


FIGURE 93. *Fragment of charred cloth.*

Photographs of plain coiled netting show the same distribution, or pattern, of threads (see Cosgrove, Figure 80). This thread pattern is the result of the technique illustrated in Figure 94. From this illustration one may see why the fragment appears to have rows of short "stitches" alternating with rows of long "stitches." Work would have proceeded from the top down, each succeeding row of loops being suspended from the row above. Thread was probably wound on a short, slender stick, while a second, flat stick was used to gauge the width of each loop, as in regular netting.

Distribution of plain coiled netting in the prehistoric Southwest, so far as I know it, is shown in the following chart.

<i>Site and Catalogue No.</i>	<i>Period</i>	<i>Material and Description</i>
Chavez Cave, near Las Cruces, New Mexico*	Basket Maker	Bag. Asclepias, or milkweed fiber.
Ruin 9, Marsh Pass**	P III	Fragment. 2-strand human hair.
Sagietososi**	P III	Fragment. 2-strand human hair.
Northern Arizona**	?	Bag. Human hair.
Canyon de Chelly**	P III	Shoe-sock upper. Human hair.
Ruin 2, Sayodneeche**	P III	Cap. Apocynum string.
Marsh Pass area**	P III	Yucca string sandal shoe, and sandal upper of cotton cord with animal hair twisted in it.
Ruins 2, 5, 9, Marsh Pass**	P III	Leggings or sandal uppers of yucca string wound with feathers, or of yucca string with animal hair twisted in it.

* Cosgrove, 1947, p. 71.

** Kidder and Guernsey, 1919, p. 117.

** *Ibid.*, p. 173.

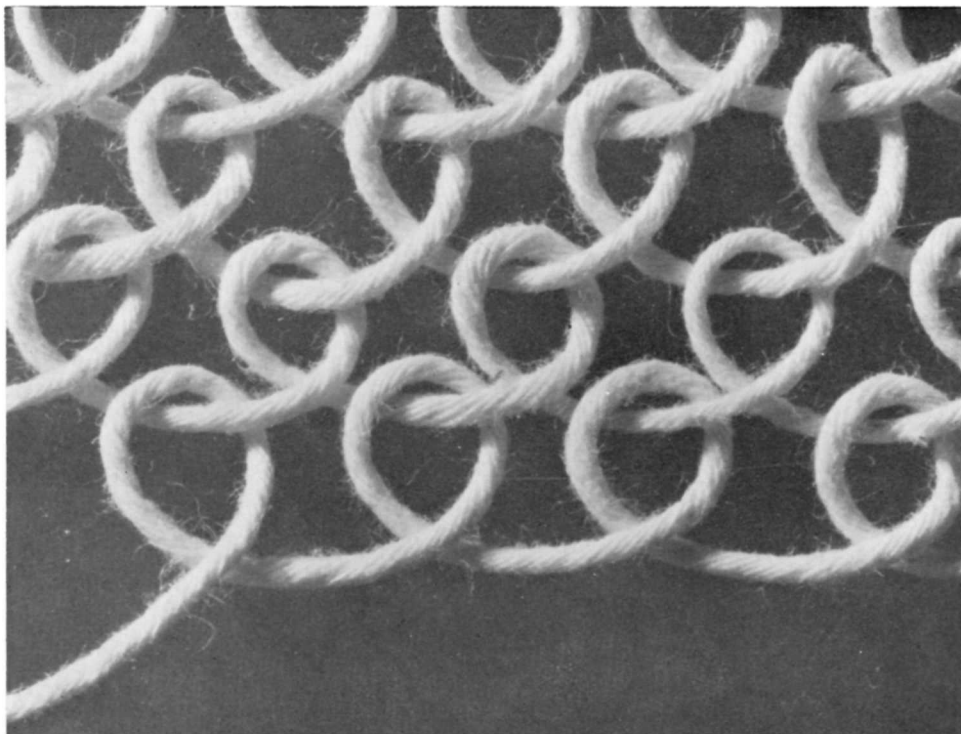


FIGURE 94. *Reconstruction of technique* (Courtesy of Irene Emery, Laboratory of Anthropology, Santa Fe, New Mexico).

<i>Site and Catalogue No.</i>	<i>Period</i>	<i>Material and Description</i>
Grand Gulch, Utah**	P III?	Shoe-socks. Yucca string wound with feathers.
Cist 3, Cave I, Kin-Boko Canyon**	Basket Maker	Fragment. Human hair.
Sayodnecchee**	Basket Maker	Fragment. Material unidentified.
White Dog Cave***	Basket Maker	Bag. Apocynum fiber.
Coahuila Cave†	Basket Maker	Fiber, not analyzed, but very coarse. Many large fragments in collections of Peabody Museum, Cambridge.
McKeuen Cave, near Globe, Arizona†	?	Bag. Human hair.
Two-Mummy Ruin, Chilchintaboko (Nitsie Canyon?). ASM 1026† ⁽¹⁾	P III	Shoe-sock upper. Cotton string with animal hair twisted in.
Gourd Cave, Nitsie Canyon (5 Specs.): ASM 1983†	P III	Bag. Cotton string.
ASM 2768†	P III	Shoe-sock upper. Cotton string with animal hair twisted in.
ASM 3017†	P III	Bag. Cotton string.
ASM 3447†	P III	Fragment, probably shoe-sock upper. Cotton string with animal hair twisted in.

** Kidder and Guernsey, 1919, p. 117.

*** Guernsey and Kidder, 1921, p. 77.

† Kent notes.

(1) ASM indicates "Arizona State Museum."

<i>Site and Catalogue No.</i>	<i>Period</i>	<i>Material and Description</i>
ASM 3448†	P III	Same as 3447, above.
White House, Canyon de Chelly, (2 Spec.): AMNH 29.1/7934† (2)	P III	Fragment, probably shoe-sock upper. Cotton string with animal hair twisted in.
AMNH 29.1/7992	P III	Fragment. 4-ply cotton string with feathers twisted in.
"Navaho National Monument." USNM 270.244† (3)	?P III	Bag. Cotton string.
Kiet Siel (2 Spec.): MNA 695/2519.M352† (4)	P III	Fragment. Cotton string.
MNA 695/2519.421 †	P III	Fragment. Cotton string.
Hidden House, Sycamore Canyon (2 Spec.): ASM 20492†	P III	Quiver tip. Cotton string.
ASM, no. not listed.	P III	2 large bags. Human hair.

† Kent notes.

(2) AMNH indicates "American Museum of Natural History."

(3) USNM indicates "United States National Museum."

(4) MNA indicates "Museum of Northern Arizona."

REMARKS. Among the Anasazi plain coiled netting seems to have been practiced from Basket Maker times through Pueblo III—probably until Spanish days, when it was replaced by knitting with needles, a European introduction. Knitted fabrics closely resemble plain coiled netting. Both Basket Maker and Pueblo used human hair or vegetable fiber. After the introduction of cotton (Pueblo I at the latest), string of that material was also employed for plain coiled netting. This string, containing from 2 to 6 plies, was coarser than that used in loom weaving. A sturdy, warm wool-like yarn was created for shoe-sock uppers by twisting animal hair or feathers between the plies of cotton string. Yucca string was similarly converted to "wool" yarn in Pueblo III for leggings or shoe-sock uppers.

Plain coiled netting is a technique well adapted to the production of seamless, circular objects, the looping being carried on with one continuous string, around and around, tubular fashion. In the case of the shoe-sock, the looping was started around the outer edge of a sandal, and continued, with variations to shape the sock to the foot and ankle, until a complete sock was produced. The articles made by plain coiled netting include, in addition to shoe-sock uppers: bags, leggings, a cap and a quiver tip. It is interesting to note that the tradition of leggings in plain coiled netting survives today in the knitted or crocheted footless socks of Pueblo men, which superficially resemble the prehistoric footgear.

Outside the Anasazi area, examples of plain coiled netting come from the Pueblo III site of Hidden House, Sycamore Canyon (a site containing many evidences of Anasazi influence); McKeuen Cave, date unknown; Chavez Cave, Basket Maker; and the Coahuila Caves, which I understand correlate with northern Basket Maker in time. According to Mason (1904, pp. 247-248), the Mound Builders knew the technique. The same author points out that at present plain coiled netting is used by the Pima in making their carrying baskets, and is found among Indian tribes from northern Mexico to the Straits of Magellan. The Athapaskan tribes of the Mackenzie Basin do it with rawhide.

There is little doubt that plain coiled netting, together with other types of more elaborate netting, was practically universal as a pre-loom technique in the Americas.

UTILIZED FIBER MATERIALS

BY EARL H. MORRIS

1) I can make nothing positive out of this charred wisp. At first glance it would seem to be a bit of woven fabric, but the component fibers are not twisted into cords and I find no proof of a warp-weft structure. My feeling is that the vestige is part of a hank of bast or separated plant-stem fiber which had not been elaborated into a finished product. An attempt to dissect would mean complete ruin of the specimen.

2) The coarse parallel ribs which are the most conspicuous feature of this specimen give it the semblance of basketry. However, the ribs are not close together as they should be, were they the coils of a basket, but are separated by distances equal to or slightly greater than their diameter. At no place is there evidence of woody sewing elements encircling and binding the cores together. These two points are enough to put an identification as basketry into sharp question.

On the convex surface of the specimen it can be discerned that the ribs were composed of twisted cords, the residue of which has the brown color proper for partly roasted, partly rotted plant tissue. In contrast, the crust that spreads between and across the opposite surface of the ribs has the fused appearance and black color of heavily roasted animal substance. About $1\frac{1}{4}$ inches from one end, a set of cords crosses at right angle to the ribs, enclosing one of them in each element of twining. Near the opposite end, $2\frac{1}{4}$ inches from the first, there appears to have been a second transverse twined lashing. Thus the specimen presents the essential structural characteristics of fur-string cloth—heavy cords wrapped with strips of animal skin, laid side by side and held in place by spaced lashings. In my opinion it is a fragment of fur-string blanket.

3) The advanced decay of the fragments in this entry make it impossible—at least for me—to be certain what they represent. Surface texture, where this feature survives, strongly resembles that of coiled basketry. But if so, I have seen no other archaeological specimen from the Southwest exhibiting such delicate workmanship—some 12 coils and 35 to 40 stitches to the inch.

On a few of the crumbs, the basket-like impression is present on both surfaces, with a considerable layer of impacted vegetable decay between. This would suggest a flexible container holding meal or the like, flattened down by the weight of whatever rested upon it, perhaps a twined bag of Basket Maker type, the impression of the ribs of which might easily be mistaken for those of a coiled basket.

BURIALS

A total of eight burials were found at the site; four in Test Trench I, three in Test Trench II and one intrusive into Structure F4. All, with the possible exception of the intrusive burial in Structure F4, were contemporary with the occupation of the site and through associated artifacts can be dated as late Basket Maker III.

BURIAL I.

Location: Test Trench II.

Position: Partly flexed, on back, head to southwest. Knees drawn up vertically and flexed.

Placement: In pit 1.25 m. deep, probably interred simultaneously with Burial II. Upper limits of burial pit visible to within 25 cm. of surface. Burial rests on sterile shale substratum.

Image of human burial
removed from the electronic edition.

FIGURE 95. *Burial 2.*

Condition: Very poor, only traces of lower long bones and skull remained.

Age and sex: Adult? Sex indeterminant.

Associated artifacts: One Forestdale Smudged bowl placed to right of pelvis. A lump of galena and a lump of kaolin clay inside the bowl. Trace of abalone pendant below mandible.

Remarks: Traces of red ocher scattered over burial.

BURIAL II (Figure 95).

Location: Test Trench II.

Position: Partly flexed, on back, head to southwest. Knees drawn up vertically and flexed.

Placement: In pit 1.25 m. deep, probably interred simultaneously with Burial I. Upper limits of burial pit visible to within 25 cm. of surface. Burial rests on sterile shale substratum.

Condition: Poor. No bones saved, although traces of long bone and skull remained.

Age and sex: Adult. Sex indeterminant.

Associated artifacts: One White Mound Black-on-White bowl, one Forestdale Black-on-Red bowl, one Lino Smudged bowl, three Forestdale Smudged bowls, two (one incomplete) Forestdale Plain jars, several hundred strung shell beads of the disk and bilobate types, one abalone pendant and numerous pieces of turquoise and argillite (the latter probably an unfinished mosaic of possibly bead blanks). Beads, pendants and mosaic pieces found inside a bowl placed to the left of burial. All other bowls were placed on either side of burial.

Remarks: Burial stratigraphically placed below stone alignment on surface and therefore is chronologically earlier.

BURIAL III.

Location: Test Trench II.

Position: Unknown.

Placement: Probably in shallow pit. Uppermost bones within 30 cm. of surface.
Burial entirely in trash.

Condition: Very poor. Only fragments remained.

Age and sex: Unknown. Probably an adult.

Associated artifacts: One Forestdale Smudged bowl, one incomplete bone awl, eight olivella shell beads.

BURIAL IV.

Location: Test Trench I.

Position: Partly flexed, on back, head to northeast.

Placement: In shallow pit 50 cm. deep.

Image of human burial
removed from the electronic edition.

FIGURE 96. *Burials 5 and 6.*

Condition: Poor. Traces of skull, pelvis and upper long bones remained.

Age and sex: Infant. Sex indeterminant.

Associated artifacts: Two Forestdale Smudged bowls, two shell bracelets (fragmentary) and fifteen olivella shell beads.

Remarks: Traces of red ocher around right side of burial.

BURIAL V (Figure 96).

Location: Test Trench I.

Position: Partially flexed, on back, head to west, knees drawn up vertically and flexed.

Placement: In pit, 1.22 m. below surface. Interred simultaneously with Burial VI. Burial entirely in trash. Stratigraphically placed over Structure D4.

Condition: Poor. No mandible present.

Age and sex: Adult. Sex possibly female.

Associated artifacts: See Burial VI.

BURIAL VI (Figure 96).

Location: Test Trench I.

Position: Partially flexed, on back, head to west, knees drawn up vertically and flexed.

Placement: In pit, 1.22 m. below surface. Interred simultaneously with Burial V. Burial entirely in trash. Stratigraphically placed over Structure D4.

Condition: Poor.

Age and sex: Adult. Sex probably male.

Associated artifacts: Four Forestdale Smudged bowls, two Forestdale Plain jars, one Forestdale Unslipped Red neckless jar. Olivella and disc shell beads were found near the necks of both Burials V and VI and near the right and left wrists of Burials V and VI. A turquoise pendant was found between the two skeletons.

BURIAL VII.

Location: Test Trench I.

Position: Partially flexed, on back, head to west, knees drawn up vertically and flexed.

Placement: In pit, 90 cm. below surface. Burial entirely in trash. Stratigraphically placed over Structure D4.

Condition: Poor.

Age and sex: Adult. Male.

Associated artifacts: Eight Forestdale Smudged bowls, one Forestdale Unslipped Red neckless jar and one Lino Gray jar. Traces of a fur-string blanket and a twined bag found under two of the pottery vessels. Numerous olivella and disc beads and one abalone pendant were massed in the upper thoracic area and over the lower jar. These beads were in such numbers and position that at the time of excavation it was felt that they possibly had once been affixed to a leather or cloth base and worn as a breast plate. No confirmatory data, however, were obtained.

BURIAL VIII.

Location: Structure F4.

Position: Partly flexed, on back, head to north. Knees drawn up vertically and flexed. Burial covered with several unshaped boulders.

Placement: In pit, 1.56 m. below surface. Interred in fill of Structure F4.

Condition: Poor.

Age and sex: Juvenile. Sex indeterminant.

Associated artifacts: None.

BURIALS: DISCUSSION

Of the total of eight burials found at the Twin Butte Site, five are closely similar in that each has numerous associated artifacts, all are semi-flexed with heads to the west or southwest, and are laid on their backs with their knees flexed and drawn up vertically. We may assume that these criteria mark the typical burial pattern for this Phase. Of the three aberrant burials, one was too fragmentary to determine its original position, one was an infant which, except for the orientation of the skull, otherwise conformed to the dominant pattern and the third may possibly date later than the major occupation of the site. It is possible, however, that a larger sample would show more variability in the burial customs.

No traces of cremation, bundle burial or other methods of disposing of the dead were noted.

Associated artifacts were placed around the skeleton, but generally near the head. Often the pottery was arranged with one bowl inverted over the top of another bowl or jar. Inside the lower vessel sometimes could be found traces of food, probably ground corn. In one instance, however, the vessel contained an unfinished mosaic (see p. 138) and several hundred strung shell beads. We may judge from Burial VII that clothing or blankets occasionally, if not generally, accompanied the bodies.

Of interest, is the great preponderance of brown ware vessels accompanying the burials. If we had only these burials from which to judge the cultural relationships of the site, we would undoubtedly consider the site as closely affiliated with the brown ware or Mogollon group. Since, however, architecture as well as the majority of the ceramics from the site as a whole indicate a much closer relationship with the Anasazi rather than the Mogollon tradition we must account for this situation by other interpretations. The simplest and perhaps the most logical explanation is to attribute the brown pottery to trade. Trade pottery would be highly prized and therefore likely to be included with the individual's more cherished possessions. From the other accompanying artifacts, such as abalone pendants, beads by the hundreds and turquoise mosaics, it would appear that the finer possessions were placed with the dead. The brown pottery was probably thus considered by this group.

Comparisons with other sites of the same relative age are significant but not conclusive. At the White Mound Site a slightly different burial pattern is reported (Gladwin, 1945, p. 27). There, although all were flexed with the knees drawn up similar to those from the Twin Butte Site, there was no fixed orientation and the majority lacked associated grave furniture. At Shabik'eschee (Roberts, 1929, pp. 143-144) burials again are similar in position to the Twin Butte burials, and, as in the latter site, orientation is predominately to the west. In contrast, however, there was no grave furniture. The burials found at Site 145 on the Mesa Verde (O'Bryan, 1950, p. 61) were more variable, with both extended and flexed positions represented. Accompanying offerings were few. South of the Petrified Forest, burials at the Bear Ruin (Haury, 1940, pp. 64-66) were placed on their backs with their heads generally to the northeast and their knees flexed. Like the Twin Butte burials most of those found at the Bear Ruin had accompanying artifacts. Returning to the Anasazi and at a slightly later date, Kiatuthlanna (Roberts, 1931, pp. 168-170) burials are identical in position and amount of burial accompaniments to these from the Twin Butte Site. They differ, however, in that no consistent orientation was observed.

Although sufficient data do not exist at present to allow us to make any satisfactory historical sequence of the burial pattern in this area in Basket Maker III-Pueblo I times, certain tendencies are suggested from the above survey. Elsewhere in this report it is suggested that the drift of the population after the abandonment of the Twin Butte Site was eastward, up the Puerco and into the juniper-piñon timbered uplands. The chronologically later burials which accompanied the pit houses at Kiatuthlanna (*Ibid.*) may possibly represent the following stage in this sequence. There we note a combination of the features from the White Mound and Twin Butte Sites. The absence of fixed orientation of the White Mound burials was retained and the use of burial offerings, which were rare at the White Mound Site but consistently present in the Twin Butte burials, was added to the complex. We should note, however, that offerings are a common feature in Basket Maker II burials (see Guernsey and Kidder, 1921) although during this early period they are of perishable materials which would not normally survive in the more open sites like White Mound and Shabik'eschee. It is possible, therefore, that absence of grave goods in these two sites may be the result of the deterioration of the offerings. In that event, a change in the kind, rather than the addition, of offerings is suggested.

TURKEY BURIALS

Three probable turkey burials were discovered. These consisted of approximately complete articulated skeletons. One was located along the west side of Structure E1 and at a depth of ca. 50 cm. The second was inside Structure D3 (no depth was recorded). The third was found intrusive into Structure D4. The latter was covered with several small boulders. No burial accompaniments were noted.

COMMENTS. The presence of turkey burials further confirms our earlier statements regarding the cultural affiliations of the Twin Butte Site. Reed (1951a) has recently reviewed the archaeological evidence pertaining to the domesticated turkey in the Southwest, and although he now doubts his conclusion that only the Anasazi possessed the domesticated turkey, in so far as is presently known the Anasazi were, until perhaps very late, the only group who gave special burial to these birds. The Mogollon, while they probably possessed domestic turkeys, used them as a source for food. Significantly, this feature serves to further contrast the Flattop and Twin Butte Sites. The absence of any evidence for domestic turkey in the Flattop Site is in keeping with other data from sites where paddle and anvil finished pottery is the dominant variety. With the single exception of the Cinder Park Site (de Laguna, 1942) where a turkey burial was discovered, the domestic turkey has not been reported from these sites and utilization of wild forms is not common. Apparently, for some unexplained reason this group (or groups) never accepted this otherwise widely spread Southwestern feature.

FLORAL REMAINS

Charred corncobs were found in Structures B, D1, D2, E1, F1a, F1b, F2, and from the lowest level in Stratigraphic Test II. These specimens have been submitted to Dr. Paul C. Mangelsdorf for identification; however, his report is not yet available.

IDENTIFIED FAUNAL REMAINS*

	Number of Occurrences
<i>Worked bone</i>	
<i>Antilocapra americana</i> (antelope)	14
<i>Canis domesticus</i> (dog)	1
<i>Aquila chrysaetos</i> (eagle)	1
<i>Unworked bone</i>	
<i>Sylvilagus auduboni</i> (cottontail)	21
<i>Lepus californicus</i> (jack rabbit)	15
<i>Meleagris gallopavo merriani</i> (turkey)	6 (3 burials)
<i>Antilocapra americana</i> (antelope)	12
<i>Canis domesticus</i> (dog, may include coyote)	13
<i>Taxidea taxus</i> (badger)	1
<i>Aquila chrysaetos</i> (eagle)	2
<i>Cynomys g. zuniensis</i> (prairie dog)	3
Hawk, species unidentified	1

* Identified by Milton A. Wetherill, Associate, Museum of Northern Arizona.

TWIN BUTTE SITE: SUMMARY AND AFFILIATIONS

The Twin Butte Site, a large Anasazi Basket Maker III village located in the Petrified Forest National Monument, has supplied us with considerable data regarding this horizon in the Puerco-Little Colorado drainage area. Following Gladwin (1945), this manifestation has been ascribed to the White Mound Phase (Aspect) and the Twin Butte Site has been seen as a major concentration of population for this area during this time interval. The settlement pattern of the White Mound Phase, at least in so far as the Petrified Forest is concerned, seems to have included a large number of small, scattered occupations and what was apparently one main population center, the Twin Butte Site.

The architecture of the White Mound Phase, as presented at the Twin Butte Site, consisted of groups of slab-lined storage units and one or more pit houses. This architectural pattern has been identified as a stage in the Anasazi developmental "pueblo-kiva" complex. The pit houses or "proto-kivas" of this Phase are rectangular in outline, have a four-post roof support system, fire pit, ash pit, and ventilator (possibly long, lateral entrance during the earlier part of the Phase). The storage units were of three main types: 1) isolated cists; 2) grouped cists; and 3) deep granaries.

The ceramics of the Twin Butte Site consisted of two main groups—gray wares and brown wares—both scrape-finished. Of the two, the gray wares were numerically slightly more important. The brown wares are believed to have been traded into the site from Mogollon centers farther south. If this be so, then trade, at least in ceramics, was more advanced than has hitherto been suspected. In addition to these two main ceramic groups, a few sherds of paddle and anvil finished Adamana Brown (major type found at the Flattop Site) were recovered from the lower levels of the stratigraphic tests. This stratigraphic position has further strengthened the suggestion of an early chronological date for the Flattop Site.

Eight burials were also excavated. The majority of these were flexed, oriented toward the west, and were accompanied by offerings.

In Table II is listed the artifact categories as represented at the Twin Butte Site and some other sites of comparable age in the Southwest. It is apparent that there were close resemblances in architecture, ceramics and other features between the Twin Butte Site and other "Anasazi" sites. Resemblances with the Bear Ruin, a Mogollon Site, particularly in lithic

materials, should also be noted. Other Mogollon sites have many parallels, but they are less striking.

Differences and similarities with the earlier Flattop Site are also apparent. Principally, we note a change in projectile points, the addition of axes, mauls, ornaments, and artifacts of bone and shell in the later site.

TABLE II

	Flattop Site	Twin Butte Site	White Mound	Bear Ruin	Shabikeshchee	Site 145, Mesa Verde	Site 13, Alkali Ridge
POTTERY							
Adamana Brown	X	X		X			
Lino Gray		X	X	X	X	X	X
Lino Black-on-Gray		X	X	X	X	X	X
White Mound Black-on-White		X	X	X	X		
Lino Smudged		X		X	X	X	
Lino Red		X	X				
Kana-a Gray		X	X	?			X
Forestdale Plain	X	X	?	X	?		
Forestdale Red		X	?	X	?		
Woodruff Red		X	?	X	?		
Alma Plain	X	X	?	X	?		
Woodruff Rough		X	?	?	?		
Worked Sherds							
Plain	X	X	?	X	X		X
Perforated		X	?	X	X		X
STONE: GROUND AND PECKED							
Metates							
Troughed, closed at one end	X	X	X	X	X	X	X
Troughed, with secondary grinding surface on platform	X	X		X			
Basin	X			X			
Manos							
For use with trough metate	X	X	X	X	X	X	X
One hand type variety	X	X		X		X	X
Hammerstones	X	X	X	X	X	X	X
Sandstone Discs	X	X				X	
Balls	X	X					
Bowls	X	X		X			
Pipes							
Short, tubular	X	X					
Long, tubular		X			X		
Lapstones	X						
Notched Stones	X						
Awl, stone	X						
Milling Stone		X		X			
Mortars		X					
Abraders		X					X
Rubbing Stones		X		X	X	X	X
Full-grooved Axes		X	X				X
Grooved Mauls		X	X	X	X		X
Notched Mauls		X					
Beads		X			X		
Cones		X					
Pendants	X	X	X	X	X	X	X
Effigies	X	X	X				

	Flattop Site	Twin Butte Site	White Mound	Bear Ruin	Shabikeshchee	Site 145, Mesa Verde	Site 13, Alkali Ridge
CHIPPED STONE: PRESSURE							
Projectile Points							
Large, lateral or diagonal corner notched	X	X	X	X	X	X	X
Small, thin, diagonal corner notched		X	X	X	X		X
Random Flakes Utilized	X	X	X	X	X	X	X
Unnotched Bifacially Worked Blades	X	X		X	X		X
Notched Bifacially Worked Blades		X		X	X		
Drills							
Plain shafted	X	X		X			
Flanged	X	X		X			X
Graver	X	X		X			
Scrapers							
Side	X	X	X	X	X	X	X
End	X	X	X	X	X	X	X
Hollow edge	X	X		X			
Plano-convex		X					
Saw		X		X			
STONE: PERCUSSION							
Choppers	X	X		X			
Spikes	X	X					
Ovates	X	X		X			
BONE							
Awls							
Articular end unmodified		X	X	X	X		X
Split		X	X	X	X	X	X
Notched		X			X		
Articular end modified		X	X	X	X		X
Splinter		X	X	X	X		X
Needles		X	X	X	X		X
Skewer		X			X		X
Spoon		X			X		X
Gaming Piece		X		X			X
Antler Artifacts		X					X
SHELL ARTIFACTS							
Beads							
Simple disc		X	X	X	X		
Bilobate		X					
<i>Olivella</i>		X	X	X	X		X
<i>Spina Chama</i>		X					
<i>Conus</i>		X					
Pendants							
<i>Pecten</i>		X					
<i>Glycimeris</i>							
Fragment		X				X	
Whole shell		X	X		X		
Abalone		X	X		X		
Bracelets		X	X	X	X		
MINERALS							
Turquoise		X	X	X	X		
Argillite		X					
Galena		X		X			
Hematite	X	X		X		X	X
Limonite	X	X		X			

CHAPTER IV

SYNTHESIS

In the preceding pages we have described the results of two seasons' excavations conducted at two prehistoric pit house villages located in the Petrified Forest National Monument. Through stratigraphic studies and typology these villages have been placed in a relative chronological order, and this chronology has been roughly correlated with developments in adjacent areas. The chronology and the suggested correlation may be summarized as follows:

<i>Anasazi Periods</i>	<i>Petrified Forest</i>	<i>Lupton Area</i>	<i>Forestdale Valley</i>	<i>Upper Gila</i>
Pueblo I	?	Roberts Site	—	San Francisco Phase
Basket Maker III	Twin Butte Site (White Mound Phase)	White Mound Vil- age (White Mound Phase)	Bear Ruin	Georgetown Phase
Basket Maker II (Pre- pottery)	Flattop Site (Flattop Phase)	?	Bluff Site	SU, Cave Creek

Two major pottery finishing traditions have been defined: 1) paddle and anvil, and 2) scraped. In the Petrified Forest paddle and anvil finishing was identified for the majority of the ceramics from the Flattop Site. Scrape-finished pottery was also present at this site, but was considered to be intrusive. In this area, therefore, paddle and anvil finished pottery was the earliest variety, although no earlier than scraped pottery in some areas to the south.

Both gray (Anasazi) and brown (Mogollon) scrape-finished pottery were found in the somewhat later Twin Butte Site. Because of the slight predominance of the gray pottery and the associated Anasazi developmental pueblo-kiva architecture, the gray pottery was believed to be the local product, while the brown was considered to be intrusive from Mogollon sites farther south.

The recognition of two methods or traditions for finishing pottery is not a recent development in Southwestern archaeology. These differences have been recognized for at least twenty-five years (Gifford, 1928) and probably longer. It must be admitted, however, that there has been little effort expended toward determining the historical background which led to these differences. This lack of interest seems hardly justified for these techniques are sufficiently distinctive and complex that diverse origins are indicated.

As we have previously pointed out the significance of these differences is between *paddle and anvil* and *scraping*; not, as is so often considered, between coiling and paddle and anvil. This latter comparison is invalid because one (coiling) is a *manufacturing* technique while the other is a *finishing* technique. This important distinction was clearly made by Gif-

ford (*Ibid.*), Roberts (1935, p. 20), Shepard (1936, p. 553), and Fewkes (1941). It is perhaps pertinent to quote Fewkes on this topic:

Coiling, or rather *building with fillets*, as applicable to pottery, connotes a constructional process which, by virtue of logic as well as of physical law, unconditionally requires manual manipulation. The potter's hands simply must be free for the handling, placement, adjustment, and bonding of the fillets. The use of the paddle and anvil leads to deliberate alteration of either a partially or a completely built, fully plastic, embryonic vessel. Such alterations may involve, inter alia: thinning of the wall; compacting of the paste; bonding of the tectonic segments; obliteration of junctions; smoothing of the surface; shaping of the final form. However, no matter what the ultimate effect may be, the paddle and anvil, either in their dual role or independently, cannot, again by virtue of logic and of physical law, be utilized as an aid to the constructional process proper. Yet it is conceivable that bonding and adjustment of fillets might, if desired, be accomplished with the use of a paddle, stick, anvil, etc., although such tasks are most commonly performed by the hands alone. In any event, the manipulation of the tectonic component, as it enters the building process, indispensably requires that the potter's hands be free. And once the component is incorporated in the growing vessel, its subsequent alteration, no matter how attained, no longer constitutes construction. It is, therefore, a gross methodological error either to compare or contrast "coiling" with the use of the "paddle and anvil," for the two are functionally different. Moreover, the differences involve fundamental principles of technology and lend themselves to objectively determined identification. Therefore, it is imperative to observe and to detail the pertinent technical phenomena and their criteria in a manner commensurate with their significance. (Fewkes, V. J., 1941, pp. 163-164.)

For purposes of classification we may define three stages in the making of pottery:

Manufacturing: the building of the vessel base and walls. There are at least four manufacturing techniques: direct shaping, coiling, molding, and wheel.

Finishing: the thinning of the vessel walls. This step is usually accomplished either by scraping with some edged tool or with the paddle and anvil; the latter either a specialized tool, an unshaped stone or the hands. In crude pottery this step is sometimes omitted.

Decorating: the alteration of the vessel surfaces either by manipulation such as polishing, incising, stamping, etc., and/or the addition of pigments to the surfaces in the form of slips or painted designs, the results being primarily for aesthetic purposes.

Not always are the three techniques clearly separated. For instance, it is sometimes extremely difficult to distinguish between the use of the paddle in decorating as against its use in finishing (thinning). In some instances the paddle may have served a dual purpose (*e.g.*, among the Cherokee; Harrington, 1922, pp. 195-204), but it is also possible that some pottery was finished by scraping while the exterior was decorated with a carved or cord wrapped paddle. Actually, there is no reason why both techniques (scraping and paddle and anvil) could not be utilized together.

Unfortunately, descriptions of pottery-making techniques are often inadequate for comparative purposes. This is true not only of many recent ethnographies, but also of the accounts of early travelers. In addition, identification of finishing techniques from archaeological material is not always entirely satisfactory. The potter often obliterated the distinctive features of the various techniques during the process of polishing and decorating. Secure identification depends on complete vessels or large sherds, preferably from jars. In the latter, in contrast to bowls, the interiors are usually not modified following the finishing process.

The significance of paddle and anvil finishing has never been clearly formulated. Gifford (1928) made the initial attempt in this direction; how-

ever, his conclusions were hampered by inadequate data, particularly for northeastern North America.

Tschopik (1941, p. 71) apparently misinterpreted Gifford and Roberts and failed to grasp the significance of their distinction, for he observed the following:

This tends to bear out the statements of Roberts and Gifford to the effect that the use or non-use of the paddle and anvil as a shaping device is, after all, not necessarily in itself of primary significance in a judgment of ceramic relationships.

In contrast to Tschopik, I believe a consideration of the distribution of these two techniques indicates that they do have value in judging ceramic relationships.

DISTRIBUTION OF PADDLE AND ANVIL TECHNIQUE. Gifford (1928, pp. 264-268) has pointed out that the paddle and anvil finishing technique has a scattered distribution from Fiji Island in eastern Melanesia to Yunnan Province in the Asiatic continent. He also noted that most of the ancient pottery of Paleo-Asiatics was finished by this method. In Northeastern Asia, Jochelson (1928, p. 73; 1933, p. 158) has reported this method for the Kamchadal, Yakut and Ainu. There is still but little information on the technique employed by the Neolithic potters of the Lake Baikal area and westward from there into northern Europe. It is likely, however, that the paddle was used throughout this "circumpolar" area and may have been used on some of the Neolithic ceramics of Europe.

It is interesting that in many areas in Asia the wheel and the paddle and anvil are both used on the same vessel. Gifford (1928, pp. 368-370) noted that both methods were used in India, China, Japan and Korea. In these areas the vessel is first roughly formed on the wheel and then finished with paddle and anvil. As a result, Gifford (*Ibid.*, p. 370) suggested that the absence of the paddle and anvil from other areas where the wheel was utilized in the making of pottery "and its (wheel and paddle and anvil used together) proximity to the area of paddle-and-anvil hand-made pottery suggests 1) that it is a process borrowed from the area of paddle-and-anvil hand-made pottery, or 2) that it is a survival from times before the introduction of the wheel."

In North America paddle and anvil finishing is confined to two major areas: 1) Northeastern North America (Woodland Pattern See Anonymous, 1943, p. 396) where the earliest pottery was manufactured by both coiling and direct shaping but finished with the paddle and anvil and often, but not always, decorated with a cord-wrapped paddle. 2) The second North American center of paddle and anvil pottery was in the Southwest-Great Basin area.

In the Southwest-Great Basin area paddle and anvil pottery has been reported for the Northern and Western Shoshoni (Steward, 1943), Southern Paiute (Steward, 1941, p. 295), the Yuman tribes living near the lower Colorado River (Rogers, 1936) and the mountains of northwestern Arizona (Spier, 1928), the Pima and Papago of southern Arizona (Drucker, 1941), and the southern California tribes (Kroeber, 1937). It is probable, but apparently unreported, that this technique was used by at least some of the Sonoran groups. According to Barber (1876, p. 452) the Utes of southwestern Colorado also finished their pottery with the paddle and anvil. These occurrences indicate a continuous distribution from Idaho in the north to Baja California in the south.

Farther south, in Mexico, the scrape-finishing technique seems to be almost universally employed. The known exceptions to this statement is in western Mexico (Jalisco) where Taylor (1933) described the use of a paddle in molding (not finishing) pottery. Foster (1948, p. 367) also reports (but does not describe) the use of a paddle in pottery making at neighboring Manzanillo, Colima.

In South America paddle and anvil pottery has been reported from northern Peru by Linné (1925, p. 75) and Tello (1938, fig. 7). The remainder of that area apparently was characterized by scrape-finished pottery; however, further data from the Parana, Pampas and Patagonian areas may modify this distribution. According to Willey (personal communication), pottery in this area closely resembles that of the early periods from the southeastern United States and may be paddle and anvil finished.

DISTRIBUTION OF SCRAPE-FINISHED POTTERY. Scrape-finished pottery has three main distribution centers: Negro Africa, Malaysia-Indonesia and the Americas.

Gifford (1928, p. 359) noted that Negro Africa seemed to be

... an area in which the non-paddle technique of coiling prevails, employing such Pueblo-like accessories as the calabash-shell smoother (scraper) and an old pot for a base. The method appears in Sierra Leone in the west, in Uganda in the east, and in Rhodesia in the south.

More recent information (Hambly, 1937, p. 364) has disclosed that paddle and anvil techniques were also used in Nigeria, although otherwise Gifford seems to be correct in considering Africa an area essentially characterized by scraping.

In Malaysia and Indonesia scrape-finishing seemed to be marginal to paddle and anvil finishing for Gifford (1928, p. 360) noted that scrape-finishing was used in the Andamans, Nicobars, and Formosa. In Melanesia both paddle and anvil and scraping were used.

In the Americas the

... non-paddle method of manufacturing coiled pottery will probably be found to be distributed generally from the Pueblo area in North America to the southern limit of pottery-making in South America, except where molding takes its place or is a companion process. (*Ibid.*, p. 359.)

The Southwestern scrape-finished pottery of the Pueblo area is closely related, not only in the finishing technique, but also in vessel forms and decorations to that of northern Mexico.

East of the Pueblo area, scrape-finishing may have appeared during the transitional Woodland-Mississippi times when many other southern traits were also introduced. By the time of the early French explorers, scrape-finishing was to be found from the Gulf area to Southern Canada.

Some pottery, for instance that of the modern western Eskimo (Nelson, 1899, p. 201), is apparently neither scraped nor paddled. Although the modern Eskimo have apparently abandoned the paddle and anvil, archaeological studies indicate that this method was employed in the past (Collins, 1937, p. 168).

SIGNIFICANCE OF THE DISTRIBUTION OF SCRAPE AND PADDLE AND ANVIL FINISHED POTTERY. The methods and the sources from which pottery was first introduced into North America has not been agreed upon. At the present time there are four general theories on this subject: 1) that pottery was independently invented several times—at last once in the Southwest (Morris, 1929) and perhaps again in the Southeast (Phillips, Ford

and Griffin, 1951, p. 435); 2) that the idea for pottery making was diffused into northern North America from Mexico and Central America, possibly accompanied by corn (Ford and Willey, 1941); 3) that the earliest pottery in northern North America (Woodland Pattern) was introduced from northeastern Asia and that influences from Mexico and Central America were later (McKern, 1937; Griffin, 1946, pp. 44-45); 4) "that Woodland paddle-stamped wares probably came from Asia. . . , but that the predominantly smoothed wares . . . came from an old pottery base that was shared with Mesoamerica." (Phillips, Ford and Griffin, 1951, p. 435.) The evidence supporting any one of these theories is not conclusive.

The problem of independent invention versus diffusion must be considered. The extreme independent inventionist view that anything, regardless of how specialized or how complex, can be invented any number of times seems as unreasonable as the equally extreme diffusion hypothesis that similar culture traits, no matter how simple, must have a common origin. A compromise position seems necessary and each situation must be judged on the merits of the available testimony.

The prevalence of the paddle and anvil technique in northern and eastern Eurasia and in northern North America suggests a possible connection between these two areas. On the other hand, the scattered occurrences of this technique in western Mexico and South America may indicate other explanations: 1) that this method was technically simple and independently invented several times, or 2) that paddle and anvil was an old influence throughout the Americas which will eventually show up in ancient and as yet unrecognized or undiscovered horizons in Middle America underlying later scrape techniques. Present evidence is not sufficient to conclusively confirm any of these possibilities.

It should be noted, however, that the paddle and anvil technique is a specialized, and, to me, a not too obvious, method for finishing pottery. In view of its mechanical complexity (when compared with scraping) it is difficult to account for the peripheral geographical position of paddle and anvil pottery in North America, particularly should this imply that the earliest "independently invented" pottery in the New World was finished by this method. On the other hand, this complexity together with the proximity of the North American paddle and anvil pottery to similarly finished pottery of Eurasia, strongly supports the possibility of Eurasian origin for the paddle and anvil technique. Such an explanation would not rule out the possibility that paddle and anvil pottery at one time had a wider distribution in Central and South America than is presently indicated.

Returning to the Southwest, the almost continuous distribution of paddle and anvil pottery from the "Woodland" sites on the western Plains, through the Great Basin area to Baja California, tempts one to suggest that the paddle and anvil tradition reached the Southwest by way of this route. To do so, however, it would be necessary to ignore other evidence, particularly the absence of "Woodland" vessel forms and the prevalence of "Mexican" forms in these early Southwestern sites thus far reported which have paddle and anvil pottery.

One of the most characteristic vessel forms of Woodland pottery is the pointed bottom or conical jar. In addition to this characteristic form there are also round bottom jars, both simple and everted rim bowls, flat bottomed or barrel shapes, and a few tetrapodial vessel supports, the latter mainly in the southern portion of the Woodland area. In contrast to this simple but specialized series of Woodland shapes, we find the earliest known Southwestern paddle and anvil pottery made into an elaborate and

complex group of forms such as tall, narrow neck jars, ladles, and "duck" effigies, among others (see p. 49). The ladle and "duck" forms are perhaps the most devastating to the idea of a northern or northeastern origin for the paddle and anvil pottery in the Southwest. These two forms are undoubtedly southern in their ultimate origin since they do not, in so far as present evidence indicates, occur in Early or Middle Woodland or northeastern Asiatic ceramics, but are a frequent feature in the Formative (pre-Classic) and later horizons of Mexico and Central America. Perhaps equally significant is the apparent absence of the conical jar in the early Southwestern paddle and anvil pottery.

Related to this problem is the absence of conclusive data on the techniques utilized in finishing the early ceramics reported from the Great Basin area. Although Steward termed the early ceramic occupation as "Puebloan," he also indicated that the pottery may have been paddle and anvil finished (1936, p. 6). A better understanding of these early ceramic cultures and their chronological position relative to the early Southwestern materials is an essential prerequisite to a correct evaluation of this problem.

Of more immediate interest to our discussion is the probability that the early Southwestern groups practicing paddle and anvil finishing all had historically related backgrounds. The learned motor habits of childhood, handed down from parent to child, as a basic and long established tradition for creating one of the major household needs of the family, was undoubtedly one of the most resistant elements in that culture. No other explanation could better account for its survival in an area almost completely surrounded by another tradition. This does not imply that all of the groups who finished pottery by this method should have a common origin. Once the paddle and anvil technique had been introduced into the area, perhaps by a small group, it is reasonable that other groups living nearby, but previously lacking in pottery, would adopt this method once they began to make pottery. Should this happen, considerable diversity might result. Not only would the introducers of the paddle and anvil tradition differ from the original inhabitants of the area but these original groups might also differ among themselves. Varying influences from other sources, particularly the scrape-finished tradition, would also cause differences within the paddle and anvil tradition. The unity of the associated "cultures" is possible, but it is not necessary, and at the present time is not demonstrable.

THE CLASSIFICATION SCHEME

An attempt to organize the foregoing data into an overall picture of Southwestern culture history may be premature at this time and undoubtedly additional data, when available, will modify any such reconstruction. With this thought in mind, however, it is nevertheless helpful to pause and regroup our thinking, if for no other reason than to check our prior hypotheses in the light of more recent data.

As a classificatory hypothesis all Southwestern ceramics finished with the paddle and anvil may be grouped into a single ceramic tradition, a tradition of finishing. A second tradition of finishing also may be defined for the scrape-finished pottery in this area.

This classificatory scheme is viewed as a device not only for handling the complex data, but also as a means of emphasizing the dual origin of some of the more advanced elements in Southwestern culture.

It should be emphasized that these traditions are not viewed as "cultures," for they are but fractions of the total culture. The archaeologist,

however, because of the nature of the materials with which he works, must always deal in culture fractions. This is apparent first, in that the artifacts, houses and other materials used in these studies are but material manifestations of culture (Rouse, 1939, pp. 15-18), and, second, the selective forces of nature have in most cases destroyed a large portion of the material manifestations of that culture.

Rather than "culture," these traditions are considered as aids in determining the historic events and cultural processes which led to the apparent differences in cultural manifestations in various geographical areas and in the continuing of these differences, or other differences, through time. Thus, in function traditions are similar to the "culture areas" of the ethnologist. Kroeber (1939, p. 1) commented on the theoretical role of the culture areas as follows:

"The concept of a culture area is a means to an end. The end may be the understanding of culture processes as such, or of the historic events of culture."

The archaeologist, however, must select from these materials available to him those features which seem to indicate that historical or cultural differences may have existed. It is just such a selection that is suggested by the ceramic traditions used herein.

It is also apparent that pottery techniques can be diffused from one group to another independently of the other aspects of the culture. This might result in two groups with ceramic similarities, but otherwise with radically different general cultural contents.

On the other hand, this typological concept, while admittedly weak due to its emphasis on one feature of the culture, at the same time avoids the unproven assumption of cultural, or even worse, "genetic" relationships between the bearers of the various archaeological sub-groups that is either explicitly stated or implied in the "tree-type" classificatory schemes. I am not suggesting, however, that these other schemes be entirely abandoned, but rather that the emphasis shift from taxonomy for taxonomy's sake to one of primary concern for the prehistoric events and forces that shaped Southwestern culture.

ARCHAEOLOGICAL OCCURRENCES OF PADDLE AND ANVIL POTTERY IN THE SOUTHWEST

Throughout much of western Arizona, from below the Gila in the south and the Petrified Forest in the north to beyond Colorado River into southern California in the west, sites have been found which contained only plain brown-colored pottery finished with the paddle and anvil (Gladwin, 1930, 1930b, and surveys by the Museum of Northern Arizona). The chronological age of these sites relative to other ceramic sites north and east of this area of paddle and anvil pottery is not known; however, from the evidence at Snaketown (Gladwin, et al., 1937), Cinder Park (de Laguna, 1942) and the Flattop Sites, we may suggest that this tradition of undecorated paddle and anvil pottery has an antiquity comparable to that of scrape-finished pottery in the Southwest.

Within this general area several sub-groups have been defined (Colton, 1939). Heretofore these sub-groups have been assigned to two major groups or "roots," the Hohokam and the Patayan; however, a different classification, wherein all of those sub-groups utilizing paddle and anvil finishing may be considered together, seems indicated.

PIONEER (DESERT) HOHOKAM. Since the excavation of Snaketown and definition of the Pioneer Period (Gladwin, et al., 1937) sites of this

horizon have been located in the Verde Valley (Schroeder, personal communication), near Tucson (Hodges Site; Kelley, I., unpublished manuscript), and in Papagueria (Ventana Cave; Haury, 1950a, p. 16). The decorated ceramics of the Pioneer Period are paddle and anvil finished but the design motifs closely resemble the early decorated types (but scrape-finished?) of northern Sonora (Gladwin, et al., 1937, p. 218) and southeastern Arizona (Sayles, 1945, p. 46). Because of the absence of work in northern Mexico, it cannot be demonstrated whether the Pioneer Hohokam received this stimulus from northern Mexico and then transferred the idea to the Mogollon or if the influences moved from Mogollon to the Pioneer Hohokam. The evidence indicates, however, that in southeastern Arizona there was a closely related series of decorated ceramic types among both paddle and anvil and scrape-finished traditions. Furthermore, in both traditions in this area earlier phases have been defined which have only undecorated ceramics (Peñasco and Pinelawn Phases in Mogollon; Vahki Phase in Pioneer Hohokam). Influences from the early Mogollon to the Vahki Phase are indicated by the presence of a few pieces of locally made (?) red slipped paddle and anvil finished pottery (Gladwin, et al., 1937, pp. 204-205).

The following list of traits in addition to pottery might be offered for the Pioneer Hohokam.

- Shallow pit house
- No information on disposal of dead, possibly cremation (?)
- Trough metate (may be open at both ends)
- Mano
- Abrading stone
- Hammerstone
- Stone vessels
- Bone tubes
- Disc beads of shell
- Olivella beads
- Shell bracelets
- Small, stemmed projectile points with triangular blades (shape of stem unknown)
- Turquoise (pendants, mosaics)
- Figurines with pinched features (*Ibid.*, pp. 253-254)

In the final Phase of the Pioneer Hohokam as defined at Snaketown several new features made their initial appearance: three-quarter grooved axes, bordered palettes, reamers, whetstones, polishing stones, carved bracelets, lateral notched projectile points, and in ceramics, several new designs were introduced (*Ibid.*, p. 255).

In the Gila and Verde Valleys the Pioneer Period was terminated by the introduction of many new traits, most of which can be demonstrated to have a southern origin. These new traits enter the Gila area apparently simultaneously and as a complex.¹ While they profoundly modified many aspects of the culture, paddle and anvil finishing continued to be employed on the ceramics.

Away from the Gila and Verde Rivers, but particularly in Papagueria, these new influences penetrated only weakly. Haury (1950a) has recognized the differences in the histories of the two areas and has suggested that two "Branches" of the Hohokam be defined; one, a River Branch, the other a Desert Branch. It has been suggested that the Desert Branch were the survivors of the Pioneer Hohokam (Reed, 1951b) strongly influenced by the Mogollon (inhumations, red slipped pottery). Haury, (1950a, p. 547) summarized the important differences between the two "Branches" as follows:

1. Schroeder, A. H., 1940. "A Stratigraphic Survey of Pre-Spanish Trash Mounds of the Salt River Valley, Arizona." Master's Thesis, University of Arizona (manuscript).

River Branch

Cremation
 Red-on-buff pottery, not polished
 Red ware, black interiors
 Full troughed metate, well shaped
 Great array of projectile points, delicate workmanship
 Well developed carved stone
 Few chopping, scraping, and cutting tools
 Slate palette
 Stone and shell jewelry abundant and elaborate
 Figurine complex strong
 Large-scale irrigation systems, drawing water from streams
 Subsistence primarily agriculture
 Heavy Salado intrusion after 1300

Desert Branch

Earth burial
 Red-on-brown pottery, polish
 Red ware, red interiors
 Block metate, some shaping not, troughed as a rule
 Limited projectile point types, few in number, workmanship inferior
 Carved stone weakly represented
 Abundance of roughly chipped chopping, scraping and cutting tools
 Slate palette little used
 Stone and shell jewelry, rare and simple
 Figurines, rare
 Limited irrigation canals, designed to catch surface runoff
 Subsistence primarily collecting
 Little affected by Salado

RIVER HOHOKAM (Colonial and Later). In the Gila Valley, and northward from there up the Verde, the Pioneer Period was terminated by the influx of such features as ball courts, rubbish mounds, developed figurines, pit cremations, decorated palettes, mosaic plaques, design motifs of small repeated life forms, formed spindle whorls, copper bells and canal irrigation. Not all of this list can be demonstrated to have entered the Hohokam area simultaneously. For instance, copper bells and canal irrigation may have reached the area somewhat later. There remains, however, ample proof for a considerable amount of change which marks the beginning of the Colonial Hohokam. Apparently the majority of these new features entered the Southwest from Mexico. It is probable that the final phase of the Pioneer Period and the initial Phase of the Colonial were times of adjustment for in many respects the two defined Phases are transitional between the Pioneer and Colonial Hohokam (Gladwin, et al., 1937, p. 256). How long a time is represented by this adjustment is not known, but it need not have been long.

Following the appearance of the new features, the Gila Valley was the scene of the development of the highly advanced River Hohokam. Influences from this area undoubtedly affected much of the Southwest and small colonies were established as far north as Flagstaff (McGregor, 1941).

According to Gladwin (et al., 1937, pp. 266-267) and Haury (1945, pp. 204-213) the Hohokam in the Classic Period (ca. 1300) received strong influences from a Puebloan group, called the Salado, from the northeast. They have suggested that the Salado brought inhumation burials, Salado pottery (scrape-finished), and multi-storied great houses. Schroeder (1947) has questioned the importance of the Salado in bringing about these changes and has pointed out that the Sinagua of the Verde Valley possessed most of the features (but not the scrape-finished pottery) which have been attributed to the Salado and that they might just as logically have been responsible for the pueblo-like traits in late Hohokam sites (with Salado scraped pottery being intrusive trade ware). Both interpretations, however, explained the presence of the Puebloan traits as due to the actual migration of a group of people to the Gila Valley from either the Verde (*Ibid.*) or east-central Arizona (Gladwin and Haury), and who lived among the Hohokam for several generations but retained their own customs and traditions. Significantly the Salado (Sinagua), like the Colonial Hohokam, never penetrated Papagueria. Around 1400 A.D. apparently the Sinagua (Salado) left the Gila and disappeared—according

to Gladwin (in Sayles, 1936, p. 99), moving to Chihuahua. This explanation, however, has not been universally accepted (Kidder and Cosgrove, 1949).

It has been suggested (Gladwin, et al., 1937, p. 18) that when the Salado (or Sinagua) abandoned the Gila the Hohokam remained behind to become the historic Pima. Similarly, Haury (1950) has offered evidence that the Desert Branch developed into the modern Papago.

At the beginning of historic times, however, the Pima and Papago closely resembled each other (Drucker, 1941, p. 233; Underhill, 1936, pp. 1-2) and an examination of their modern culture offers few differences which might be considered to have resulted from the differing historical contacts that are indicated by the archaeological evidence. It would seem that if the River Hohokam are the ancestors of the Pima then the intrusion of the Colonial Hohokam and the Salado-Sinagua left little or no permanent imprint on the basic features of the culture. It might be worthwhile, therefore, to reconsider the arguments supporting a Hohokam-Pima continuum. The possibility should be examined to determine if it is not more probable that the Hohokam abandoned the Gila with the Salado-Sinagua and that this area was reoccupied by groups of the Desert Branch.

PATAYAN. Colton (1939) recognized the close cultural relationship of the Yuman speaking tribes of the Lower Colorado River area to the archaeological materials which had been found in the mountainous areas of northwestern Arizona. He suggested that these resemblances were sufficient to warrant definition of a separate "Root" which he termed Patayan. Colton believed that future work would confirm that Patayan was prehistoric Yuman. As yet sufficient excavation has not been done in this area to substantiate Colton's theory and the known resemblances are only of a general ceramic nature.

Colton defined three sub-groups of the Patayan. These were Cerbat, Cohonina and Prescott. Tentatively a fourth, the Sinagua, was considered as a possible sub-group. The Cerbat, defined on the basis of surface surveys only, has a geographical center in west-central Arizona between the Colorado River and the Aubrey Cliffs.² Associated architecture is unknown; however, surface indications are similar to that indicating surface structures among the Cohonina. Pottery is brown in color and, at least in some sites, has no painted decorations, red slips or smudged interiors.

Cohonina sites are concentrated in northwestern Arizona and south of the Colorado River and contain ceramics which are gray-colored and rarely decorated. Pottery may be comparatively late in this area since the earliest ceramics thus far reported show marked Anasazi influence in surface color and finishing techniques. Both paddle and anvil and scraping seem to have been used (Colton and Hargrave, 1937, p. 25; McGregor, 1951, p. 136). Their ceramics, therefore, may reflect their intermediate position between groups that finished their pottery by scraping (in this case the Anasazi) and others who thin their vessels with the paddle and anvil.

Associated features include rectangular surface structures, trough metates, triangular projectile points, probably cremation burial.

Sites of the Prescott sub-group are found in west-central Arizona from the Big Sandy to the Chino Valley. Pottery was paddle and anvil finished, usually brown in color, and rarely decorated. Pit houses are re-

2. Albert Schroeder, in a forthcoming report on his excavations at Willow Beach below Hoover Dam, has defined a fourth sub-group (Branch) for those groups living and farming in the valley of the Colorado River. This group he has named Laquish.

ported for the earlier sites; however, by 1100 or shortly afterwards pueblo architecture was introduced, possibly accompanied by inhumation burial.

Surface surveys indicate the presence of sites in this area with only plain brown pottery. As yet none of these localities have been excavated.

From the area around Flagstaff and south from there to the edge of the Verde Valley have been reported pit house sites with plain brown, undecorated, unsmudged and unslipped, paddle and anvil finished pottery. Collectively these sites have been grouped together and called the Sinagua (Colton, 1946). The affiliations of the Sinagua have never been satisfactorily determined. Colton (1938), who has published much of the work on the Sinagua, at one time reluctantly assigned the Sinagua to the Mogollon "Root," but by 1946 (p. 310) he no longer felt that the evidence warranted this assignment and suggested that perhaps they should be affiliated with the Patayan. Reed (1948), however, continued to view the Sinagua as Mogollon despite the non-Mogollon character of the ceramics, i.e., paddle and anvil finishing and the absence of red and smudged wares until late in the Sinagua history when inhumation burials and pueblo architecture was also introduced.

Very little information is available on the other features of early Sinagua sites. Only one (de Laguna, 1942) has been excavated and the findings at that site have not been published. In the later horizons, however, there is evidence of increasing Anasazi, Mogollon and River Hohokam influence in this area (Colton, 1946).

ARCHAEOLOGICAL OCCURRENCES OF SCRAPE-FINISHED POTTERY IN THE SOUTHWEST

At least two major sub-groups may be defined: 1) Mogollon and 2) Anasazi. These two sub-groups have been distinguished primarily on the basis of surface color and finish. This is proposed in spite of an awareness of the role played by locally available clays in determining ultimate surface color. It is suggested, nevertheless, that there was a culturally determined and conscious effort on the part of the Anasazi to produce a gray rather than a brown or buff-colored pottery. That they could, should they desire, produce such brown or orange pottery is evident, since in some areas (i.e., Kayenta-Alkali Ridge) they did manufacture orange pottery in their decorated wares. Therefore, that the Anasazi *did not* choose to follow their southern neighbors in their culinary pottery is sufficient evidence to warrant separate consideration.

That surface color was not altogether environmentally determined is further indicated by evidence from the areas where Mogollon and Anasazi ceramics share a common "boundary." In these areas, such as the Petrified Forest, often sites of one time interval are found in which the utility ceramics are preponderantly brown-colored and polished while in the same area sites occupied during another time interval may be found in which the majority of the utility pottery is gray and unpolished. Several possibilities might be offered to explain this situation, but to me the most logical explanation is that two different groups, one preferring brown colored pottery, the other gray, occupied the same area at different times. If this be so, then in these cases culture, rather than environment, must have played the significant role in determining the character of their ceramics.

On the other hand, the Mogollon and Anasazi may be grouped together because of the obvious resemblances in basic techniques between the two

groups. It is suggested that the Anasazi received their stimulus for ceramics from the Mogollon who in turn were stimulated by more highly developed ceramic centers farther south where similar techniques are also found. The Anasazi, although borrowing the basic methods of Mogollon ceramics, reinterpreted the character of their ceramics into a distinctive Anasazi trait. It is suggested that the cultural basis for this reinterpretation was already laid in the preceramic horizons when local differences, perhaps developing through isolation, had already appeared.

ANASAZI. In addition to the scrape-finished, gray-colored ceramics, this group is characterized by the "pueblo-kiva" architectural complex. Their geographical center lies near the "Four Corners" area where Arizona, New Mexico, Colorado, and Utah share a common boundary. Their southern limits were only slightly beyond the Little Colorado River. The earliest known Anasazi ceramics are sometimes decorated, occasionally have a red slip and may have smudged interiors. Burial was by inhumation.

MOGOLLON. Sites of this sub-group are found in the mountain and plateau area in western (and southeastern) New Mexico and eastern Arizona south of the Little Colorado River to, and presumably beyond, the international boundary. In the early sites the associated pottery is brown in color, is sometimes decorated, and may have a red slip or a smudged interior. Pit house villages are reported for these sites until approximately 1000 A.D. or later (in some areas 1200 A.D.) when pueblo architecture was introduced, presumably from the Anasazi. Burial was by inhumation.

In spite of the dearth of specific data for much of the area characterized by paddle and anvil pottery several facts stand out as features distinguishing that area from the scrape-finished. With the exception of Snaketown, red slips and painted decorations are chronologically very late on paddle and anvil finished pottery. A similar observation may be made for smudging. The significance of these differences is not clearly apparent; however, it suggests that differences other than finishing distinguish the two traditions.

ETHNOGRAPHIC DATA

Kroeber (1939, pp. 32-33) has previously suggested "that the known Southwest appears to comprise two related but consistently distinctive culture types: one characterized by the Pueblo culmination, and one which might be named the Sonora-Gila-Yuma. The common elements such as agriculture, cotton, pottery are obvious. The Pueblo culture shows masonry, clustered houses, stories; the kiva ceremonial chamber, altars and sand or meal paintings, masks and ancestor impersonation, priestly offices, elaborate ritual, much visual and verbal symbolism with special reference to colors, directions, fertility, and emergence; matrilinear descent; pacific inclinations; pottery with a whitish ground, polychrome or glazed painting, and texture decoration by corrugating. The Sonora-Gila-Yuma culture possesses adobe, wattled, or brush houses, village instead of town type of settlement; no kivas and few altars, little visibly expressed symbolism; simple rituals with few masks; shamans rather than priests; patrilinear institutions; warlikeness; a pottery reddish, monochrome or with one design color, uncorrugated; canal or river overflow irrigation." Kroeber (*Ibid.*, pp. 33-34) also noted that the "fact that the environment of one of the two Southwestern sub-areas runs far outside the cultural Southwest strengthens the probability that the two subcultures are fairly distinct, because it suggests that the history of one of them contains influences

lacking in the other." Significantly, Kroeber's Sonora-Gila-Yuma groups, with but one or two exceptions (Seri, Southeastern Yavapai (?), no information is available on Sonoran techniques), finish their pottery with the paddle and anvil. Their geographical area also closely correlates with the past distribution of paddle and anvil pottery in the Southwest. This suggests that the paddle and anvil technique was but one of a group of traits introduced into this area. Only further excavation, however, can substantiate this supposition.

* * * *

An evaluation of the material which we recovered from the excavations in the Petrified Forest in the light of the above discussion is only partially satisfactory. Primarily we are handicapped by a lack of comparative data from contemporary sites with paddle and anvil pottery. Only with such data available will it be possible to answer many of the questions raised below.

THE FLATTOP SITE

Assuming that the majority of the ceramics recovered at the Flattop Site were products of the occupants of that site and not trade goods from other areas, the assignment of that site to the Paddle and Anvil Tradition seems justified. Taxonomically the site, therefore, may be affiliated with the Hohokam, particularly the Desert or Pioneer group, the Cohonina, Cerbat and Prescott groups in western Arizona and the Sinagua of the Flagstaff area. Other than ceramics, however, there are apparently few parallels between the Flattop Site and sites of these other groups. In architecture (to a limited extent) and lithic materials the closest resemblances are to be found with the adjacent Anasazi Basket Maker II and the Mogollon as represented at the Bluff Site. In part this situation may be the result of the scanty data available on the early horizons in the other groups of the Paddle and Anvil Tradition but it may also indicate that closely related non-ceramic groups may have adopted different ceramic techniques, depending upon the influences to which they were subjected.

THE TWIN BUTTE SITE

With the exception of a few sherds of Adamana Brown, all of the pottery at the Twin Butte Site, both indigenous and intrusive, was finished by scraping. The site may be affiliated with the Anasazi because 1) the majority of the culinary pottery was unpolished gray ware, and 2) the close resemblances of the architectural pattern to that reported from other Anasazi sites.

Our work in the Twin Butte Site has provided us with significant data pertaining to the Mogollon-Anasazi "frontier." The assignment of that site to the Anasazi indicates that, at least in this area, Mogollon and Anasazi did not blend. Although trade was active between the two groups, they both retained their own distinctive features. It remains to be determined whether this cohesiveness is characteristic of other time horizons and in other "frontier" areas.

* * * *

The suggested hypothesis of a dual origin of Southwestern ceramics, if accepted, will indicate several interesting lines for further investigation. The most obvious, but not necessarily the most important, is the origin and route through which the paddle and anvil technique was introduced to the Southwest. A second problem is concerned with the dis-

semination of these techniques to adjacent groups. The determination of additional traits introduced or consistently associated with groups of either one or the other ceramic tradition will also provide much needed information and will aid in the eventual evaluation of the ceramic tradition in cultural terms.

The significance of this taxonomic approach should be clearly evident—it challenges the traditional belief in a southern origin for all “advanced” southwestern culture and proposes a possible explanation for at least some of the differences between the desert or mountain tribes of western Arizona and the pueblo groups of the more eastern portion of this area. It suggests that the study of Southwestern prehistory may profitably be approached from a historical viewpoint whereby the histories of certain cultural traits are traced through their development and diffusion.

APPENDIX I

NOTES ON COLOR AND PASTE COMPOSITION

BY ANNA O. SHEPARD

Color has been accepted as a reliable means of distinguishing Mogollon from Anasazi pottery. The color of pottery is determined by two independent factors, composition of the clay and firing conditions. The effect of each must be weighed when we consider the significance of color differences. In order to define the paste color of the two classes of pottery found at Twin Butte Site and to study evidences of firing method, tests were made on a sample of eighty-six sherds. Before summarizing these tests and their results, it may be well to review briefly the basic facts regarding firing atmosphere and the effect of impurities on the color of clay.

Through the studies of Dr. Harold Colton, archaeologists have become familiar with the fact that some gases produced in firing rob constituents of the clay of oxygen, a process described as reduction; whereas oxygen, if it is present in excess of the amount required for combustion and if temperatures are favorable, will unite with constituents of clay in the process of oxidation. It is further recognized that clays that are fully oxidized usually have a clear color within the range of cream to red, whereas clays that are reduced are gray. Consequently, it has become customary to describe wares that have a clear color as being "fired in oxidizing atmosphere" and those that are grayish as being "fired in reducing atmosphere." These terms should not be understood as meaning that a uniform atmosphere was maintained throughout firing. Furthermore, it is important to remember that gray can be produced in other ways than by reduction and that clays differ greatly in their requirements for oxidation. These points will be clarified by a consideration of the reactions taking place in combustion.

THE NATURE OF COMBUSTION

The combustion of fuel is a complex chemical process involving oxidation. The end products, if the process is complete, are carbon dioxide and water, but the intermediate products include reducing gases. When wood is burned, volatile matter is first driven off and decomposed to two so-called elementary fuels (hydrocarbons and a mixture of hydrogen and carbon monoxide), leaving a third elementary fuel (solid carbon), the charcoal. The volatile elementary fuels are reducing gases. Under certain conditions colloidal carbon is also present with the gases and appears as black smoke.

The intermediate products of combustion and the way they are formed differ for each of the three elementary fuels and also for the members of each class depending on such factors as temperature, the relative amount of oxygen in the atmosphere, surface of the fuel exposed, and the presence or absence of catalysts. For example, when there is sufficient oxygen, hydrocarbons can be burned with a smokeless flame forming in rapid succession

intermediate compounds which break down into hydrogen and carbon monoxide or water and either carbon monoxide or carbon dioxide depending on the amount of oxygen present. Under certain other conditions the hydrocarbons, particularly the higher ones, break down into carbon and hydrogen, and the carbon appears as black smoke. Temperature, as well as the proportion of oxygen in the atmosphere, influences the decomposition of the hydrocarbons. Although both types of decomposition can take place simultaneously, conditions usually favor one over the other. Charcoal affords another example of the variable intermediate products of combustion. Hot charcoal unites with oxygen from air passing over it to form carbon dioxide, carbon monoxide, and an intermediate physico-chemical complex that breaks down into these two. At low temperatures, carbon monoxide may be the principal product of combustion. At higher temperatures, carbon dioxide will be formed, but it may be reduced wholly or in part to carbon monoxide depending on the relative amounts of carbon and oxygen, and the time of contact between carbon dioxide and carbon. These examples will suggest the complexity of the mechanics of combustion and the wide variability in the process. Added to this basic variability are the differences in woods, differences in composition and volume of volatile products and in form of charcoal and ash.

In view of these facts, the impossibility of maintaining a uniform atmosphere with a direct, open fire and little or no control of draft can readily be understood. During the early stages of firing when volatile products are given off from the fuel, reducing gases are present, but air bearing oxygen is constantly being drawn in and it mingles with the products of combustion. Whenever fresh fuel is added to the fire, the composition of the gases surrounding the pottery changes. When the fuel has burned to coals (solid carbon) and there is good draft, oxidation will take place, provided the temperature is still high enough. Without draft the atmosphere will be reducing.

Since reducing gases will always be present when volatile products are released, and oxygen, which is essential to burn the fuel, cannot be fully and effectively excluded from the firing atmosphere with primitive methods, a definite, constant atmosphere cannot be maintained. Consequently, the expressions "fired in reducing atmosphere" and "fired in oxidizing atmosphere" do not describe uniform conditions of firing, but rather refer to the overall effects or the end results of firing. To avoid confusion, it is important that we distinguish inferences regarding the effects of firing from inferences regarding method of firing.

One other fact needs emphasis. Neither a reducing nor an oxidizing atmosphere in primitive firing is quantitatively defined. The effective gas or gases, whether reducing or oxidizing, may be present in large or small amounts. Not only can an atmosphere be either strongly, moderately or weakly oxidizing or reducing, but its effect can also be nearly neutral. It will necessarily be neutral in effect, regardless of the gases present, when the temperature is below the range required for reaction.

The process of combustion must be considered in relation to the changes that take place in the firing of clay if we are to understand the meaning of the color of pottery. These changes are classified in the order of their occurrence as dehydration, decomposition and oxidation, and vitrification. The temperature ranges of these reactions overlap, and their limits vary depending on the characteristics of the clay. The period of decomposition and oxidation, with which we are concerned, may start at 400° or 450° C

although reactions at this low temperature are slow. The upper limit, which is sometimes placed between 850° and 900° C, is set mainly by the temperature at which incipient vitrification occurs, since the increased density of the paste impedes the circulation of gases.

THE OXIDIZABLE IMPURITIES OF CLAY

The clay substance itself is neither oxidized nor reduced in firing. These processes effect only the impurities in clay. The common clay minerals when free from impurities fire white whether the atmosphere is oxidizing, neutral, or reducing. The principal oxidizable impurities are carbonaceous matter and iron compounds in their lower state of oxidation. Although there are others, it will be sufficient for our purpose to consider these two because they are by far the most important and they are nearly ubiquitous in clays.

The amount and form of carbonaceous matter in clays varies greatly. Some clays contain considerable amounts and require long and careful oxidation; others are practically free from it. Furthermore, carbonaceous matter occurs in many forms, as vegetable matter, lignite, bituminous or asphaltic matter, hard or coaly carbon, etc. The temperature at which it begins to burn (oxidize) depends partly on its state or density. The rate of combustion is effected by temperature and also by the relative porosity of the paste, which controls the rate of circulation of gases. Oxidation of carbon may commence at 450° or 500° C, but the process will be much more rapid at 750° or 800° C. The rate is slowed down when incipient vitrification occurs.

Reducing gases have no effect on carbonaceous matter. If the amount of oxygen is limited, carbon monoxide instead of carbon dioxide may be formed by the burning of the carbon and this will have a reducing effect on the iron oxides. In commercial ceramic practice, the firing schedule is carefully adjusted to the requirements of the clay in order to burn out carbonaceous matter completely and efficiently before vitrification commences. Since pre-wheel pottery is seldom vitrified, the primitive potter did not find it necessary to oxidize fully, and gray or blackish cores often attest to the incomplete oxidation of a carbonaceous clay.

Iron compounds in the lower state of oxidation do not unite with oxygen until carbonaceous matter has been burned out. The amount, distribution, particle size and state of oxidation of the iron oxides have an important effect on the color of pottery. When the iron is fully oxidized, the clay will be cream, yellow or red depending primarily on the percentage, particle size, and degree of dissemination of the oxide. The relation between the color of clay and the amount of ferric oxide can be stated only roughly because of these variables and the fact that certain substances sometimes mask the color of iron oxide. In the absence of these substances, a rough approximation is that clays with less than 1 per cent of ferric oxide generally fire whitish, those with 1 to 4 per cent, yellow or buff, those over 4 per cent, red. When ferric oxide is reduced it gives a grayish color if present in sufficient quantity. In raw clay, iron oxide often occurs in its highest state of oxidation as a ferric oxide or hydroxide (hematite, goethite, and limonite). Iron may be present in a lower state however, as for example, in magnetite, pyrite, siderite and some silicates. When there is sufficient oxygen and proper temperature, these minerals will be converted to ferric oxide after carbonaceous matter is burned out. When there is insufficient oxygen, the carbonate will be decomposed and converted to lower oxides

comparable in composition to magnetite, the magnetite will be unchanged, and the color effects will be comparable to those obtained when ferric oxide is reduced in firing.

The variability of clays with respect to the amount and form of carbonaceous material and iron compounds they contain is such that a clay may be nearly oxidized in its original state or it may contain so much oxidizable material that it requires a long firing period with good draft, particularly if it is dense. It follows from this variability that a firing atmosphere that will oxidize one clay will be entirely inadequate for another, or an atmosphere that will prevent the oxidation of one clay will have no effect on another. In consequence of the different requirements of clays it is possible to obtain a gray ware and a brown ware with the same firing if the firing atmosphere is nearly neutral, although this would not ordinarily happen.

Perhaps this discussion of the complexity of clays and of firing conditions suggests a maze to which the ceramic technologist can conveniently retreat in his cautious moods, or when he is not prepared to give a definite answer. The intricacies of any process in which many factors enter are discouraging when they block the solution of a problem, and they seem unnecessary when the hypotheses we formulate without them appear workable. The fact remains, however, that a hypothesis often seems workable only because it has not been tested, and we do not avoid but merely postpone difficulties by neglecting basic factors. The diverse firing behavior of clays and the variability of firing atmosphere are basic facts we must recognize if we are to reach sound conclusions. These facts are not too involved to prevent us from making some inferences even from simple inspection, as a summary will show.

THE SIGNIFICANCE OF THE COLOR OF POTTERY

A number of inferences regarding the state of oxidation of a paste can be drawn from its color. Clear colors in the range of cream to red indicate oxidation because these colors are due to iron oxide in its highest state of oxidation. It must be remembered, however, that in consequence of the differences in clays, similar colors do not necessarily indicate comparable firing conditions. Black shows smudging, that is deposition of carbon from the smoke formed when fuel is burned with insufficient oxygen. In some instances tarry products from the distillation of wood are deposited with the carbon. When black smoke is formed, reducing gases are usually present, but sometimes the temperature is too low for these gases to have effect. A white paste speaks less clearly of its firing history because a clay that is free from ferric oxide and carbonaceous matter will fire white in oxidizing, neutral, or reducing gases. Often, however, a paste that appears practically white is actually a pale gray. Refiring it will bring out a cream color, showing that it was not fully oxidized.

Grays are most difficult to explain. They can result from: 1) unburned carbonaceous material that occurred originally in the clay; 2) carbon deposited on the pottery from a smokey fire; 3) iron compounds not fully oxidized which occurred originally in the clay or were formed by reduction during firing. Carbon from either source and the lower oxide of iron can occur alone or in any combination with each other. Furthermore, these grays can result from firing that was too short, too low, and had too poor draft for full oxidation, or they can result from the presence of reducing gases in sufficient amount, at effective temperatures, and for a long enough time to bring about reduction of the ferric oxide. Since we

know that reducing gases are always formed when volatile products are released from the fuel, the question is, were the other conditions favorable for reduction. Primitive, direct firing represents an ever changing sequence of conditions, and we see only the end results of a pot's varied firing history. To explain a gray color, we should be able to distinguish carbon deposited in firing from carbonaceous matter originally present in the clay. The color caused by carbon should in turn be distinguished from that of the lower oxides of iron. This cannot be done by visual inspection. We must resort to various tests to find the answer. Finally the state of iron compounds in the raw clay should be known. When we have this information, we can say whether or not the firing atmosphere had a reducing effect.

We can draw conclusions regarding the effect of firing with considerable assurance if we have samples of the potter's clay because we can then determine its state and the conditions under which it fires to the color of the pottery. Clay from potter's caches is invaluable in such studies, but it is all too rare. Regardless of what the spade yields, we can always make a survey of the ceramic resources of the locality of a site. Collection of clays is the simplest part of this task. To compare fully a clay with a particular paste requires lengthy and exacting tests, and after making these tests, we come out at best with strong circumstantial evidence rather than proof of derivation. This fact does not detract from the importance of surveys of ceramic resources because often the general characteristics of the clays of a locality are more significant when considered in relation to the properties of pottery than the fact that clay from a particular deposit was used.

Surveys of ceramic resources have been made in several localities in the Pueblo area. For example, in the investigation of the sources of Pecos pottery, the hypothesis of extensive trade, a hypothesis suggested by various foreign tempering materials occurring in common pottery types, was strengthened by determining the distribution of buff-firing Cretaceous clays and of bentonitic clays and by showing their correlation with particular classes of temper. Again, in work on La Plata pottery, an extensive survey was made to learn the frequency of occurrence of red-firing clays and of clays that retain organic paint and to test the firing properties of the carbonaceous clays of the Cretaceous Formations of the La Plata Valley. In experiments conducted at Awatovi, the thermal behavior of buff- and red-firing clays in various strata of the mesa on which this site is located was tested. The significant facts brought out by these tests were that the colors of black-on-white ware can be obtained with buff-firing clays which, when fully oxidized, match the color of Jeddito Yellow and Sikyatki Polychrome. The red-firing clays give colors within the range of Jeddito Orange when oxidized, but when unoxidized are too dark for black-on-white ware.

The importance of testing potter's materials found in excavation and of investigating the ceramic resources of a site cannot be over emphasized, but there are times when samples of clay are not available. We are then thrown back on the study of sherds alone. Under this circumstance, something can be learned by refiring chips and studying color changes. An electric resistance furnace is most convenient for this purpose. Temperature control is important, and temperature measurements should be made with a thermoelectric pyrometer. If a clear color within the cream to red range appears when a gray paste is refired at 500° C, easily oxidizable

carbon has been removed revealing the ferric oxide color which it masked. Carbon deposited from a smoky fire is lightly held in the pores of the paste and it is easily oxidized. The ferric oxide color that it masks can represent the original state of the iron in the clay. If this low firing leaves the pottery gray, and a higher temperature (650° to 700° C) lightens it without developing the warm colors imparted by ferric oxide, it is apparent that a more dense form of carbon or carbon more intimately enmeshed in the clay than soot from smoke has been burned out. The probability is that the clay was originally carbonaceous. Further evidence may be found in sherds with black cores which generally indicate a carbonaceous clay. Partial reoxidation of a completely smudged paste will also leave a dark core, but this condition is not common. If still higher temperatures are required to bring out warm colors after masking carbonaceous material has been removed (*i.e.*, the clay is a very light gray), it is probable that iron compounds in their lower state of oxidation are present.

Simple firing tests demonstrate significant differences in the state of oxidation of a paste, and the inferences suggested have a high degree of probability, but these tests do not afford proof of the causes of gray color. Chemical analyses can be made to determine ferrous iron and carbon. A caution to observe in testing for ferrous iron is to first establish by petrographic analysis the absence of iron-bearing minerals in the temper or to secure a sample free of such minerals. Although chemical analysis will prove the presence of ferrous iron, it will not show whether it was originally present in the clay or was formed during firing. For evidence on this important point, we have to turn to the study of unfired clays or draw inferences from other lines of evidence. The inferences will be considered after summarizing the characteristics of Twin Butte sherds.

THE TWIN BUTTE SAMPLE OF ANASAZI AND MOGOLLON SHERDS

The sample of sherds from the Twin Butte Site shows considerable color variation. The surface of Lino sherds range from light through medium to dark gray. A few sherds show a tinge of drab. Light and medium gray predominate. The Mogollon sherds include browns, black, some reds and some grays, a color range that might lead to type assignments of Forestdale Plain, Forestdale Smudged, and Forestdale Red. In this discussion they will be treated as a Mogollon group. The relative frequency of surface colors in the sample submitted for test is shown in the following tabulation. This does not necessarily represent the relative frequencies in the material as a whole.

ORIGINAL SURFACE COLOR OF THE TWIN BUTTE SHERDS

Class	Brown	Brown and Gray	Light Brown Gray	Brown and Black	Light Gray	Medium Gray	Gray and Black	Black
Lino	—	—	5	—	13	16	6	8
Mogollon	10	2	1	9	4	4	5	3
State	Partially or fully oxidized (some ferric oxide present)			Partially oxidized- smudged	Unoxidized		Unoxidized and smudged	Smudged

Where two colors are recorded, they occur on opposite surfaces of the sherds. Since the sherds are small, each surface is generally uniform. The exceptional sherds that are uneven in color have been grouped by their principal color. A classification by state of oxidation is given at the bottom of the table. This anticipates in some measure the results of refiring sherds. The term unoxidized has been used for the classes that would ordinarily be described as reduced because I believe we should have evidence that reduction actually took place in firing before we use this term. Unoxidized is a broader term than reduced as it is understood by Southwestern archaeologists. If carbonaceous matter is not burned out, the clay is unoxidized, but this does not mean that it was reduced. Furthermore, as has been explained, the presence of the lower oxides of iron does not prove that reduction took place in firing, although there may be a high probability that it did. The attempt to designate the state represented by these colors brings out the importance of recognizing that simple, absolute states are not represented but rather degrees or stages of oxidation and reduction. Pottery is oxidized when a deposition of carbon is burned from it, when carbonaceous matter in the clay is burned out, and when compounds containing ferrous iron are converted to ferric oxide. These processes take place in a sequence at any point in which we can say that the paste is partially oxidized.

The occurrence of fully smudged sherds in both groups, and the fact that the few light grays among the Mogollon sherds are close matches with some of the Lino shows that color is not always a reliable criterion of classification. Parenthetically it may be noted that the paste of Lino Smudged sherds is generally less uniformly and fully blackened than those of smudged Mogollon owing, perhaps, to the greater density of Lino paste. Surface finish is a second criterion of classification which is useful but not absolute because there are a few well-polished sherds in both groups, and Mogollon sherds do not invariably show the marks of a hard, smooth finishing tool. Alma Plain is usually described as polished with a stone or tool. To anyone unfamiliar with Mogollon pottery, this description suggests evenness, smoothness, and distinct luster. A lustrous surface is not characteristic of Mogollon Brown Ware, but a compact surface texture and tool streaks do indicate the use of a hard, smooth tool in the finishing process. Such a tool could not have been used for the typical Lino surface since it is distinguished by the protrusion of coarse grains of temper. The difference in paste texture between Mogollon and Lino is constant and easily recognized in this group of sherds. Mogollon paste is sandy and porous. The sand grains range in size from fine to medium with a sprinkling of coarse grains. Lino paste is dense, and the grains of sand temper are coarse to medium with a conspicuous absence of fine grains (textural terms are taken from Wentworth's grade scale: coarse—1-1/2 mm.; medium—1/2-1/4 mm.; fine—1/4-1/8 mm.). Rapid judgments of texture are made by comparison with prepared standards. It is the grading of temper as much as absolute grain size that distinguishes Mogollon and Lino pastes.

The first question considered in testing the sample of Twin Butte sherds was how the paste colors of the two groups compare when fully oxidized under the same conditions. A temperature of 750° C held 10 minutes was sufficient in most cases to bring out clear colors, although raising the temperature to 850° C usually developed more strongly the iron oxide colors of the Lino paste, and in a few cases it was necessary to oxidize fully the Mogollon paste. The color difference in the refired sherds distinguishes the two wares clearly. Lino pastes are mainly buff (Munsell reading: 10YR 7/4

to 1Y 8/4). A few are white (10YR 8/1.5). Mogollon paste is red (2.5YR 4/6 to 2.5YR 6/7). In commercial ceramic nomenclature, Lino would be described as buff-firing and considered a higher grade clay than the red-firing Mogollon. Buff-firing clays generally stand higher temperatures than the red, but this is a property that did not concern the ancient potters because their temperatures were not high enough to cause vitrification.

A peculiarity of the Mogollon sherds is that the color of the paste is almost invariably deeper and clearer than that of the surface. I have not attempted to determine the cause of this difference although scumming is a possibility. This is an effect that occurs when soluble salts, principally sulphates, originally present in the clay migrate to the surface with the evaporation of water during the drying of the ware. Until the cause of the lighter surface color of Mogollon sherds is determined, comparison of surface colors has little meaning, and only paste colors from fresh breaks will be reported here.

The relative ease of oxidation of the paste was studied by refiring chips in air in an electric resistance furnace to successive temperatures. Chips were held 5 minutes at each temperature, cooled for color reading, returned to the furnace and held 10 minutes longer at temperature. Longer firing would have produced further change in those pastes that were lightened by partial combustion of carbon, but the rate could be judged by the effect of the two firings. It is important to bear in mind the difference between the kiln atmosphere and that of the original firing. Aside from being constant in composition, the kiln atmosphere has a higher percentage of oxygen than would occur in direct firing. Air contains 21 per cent oxygen by volume. Values ranging from a fraction of a per cent to 11.7 per cent were obtained in the analysis of gas samples taken from direct firings when there was no smoke (Shepard in Morris, 1939, p. 265). In consequence of this difference in atmosphere, experimental firings do not show directly the combination of time and temperature required for complete oxidation in primitive firing, but they give evidence of the presence of different classes of carbonaceous material and show when the color due to ferric oxide first appears.

The results of the tests are summarized in tabular form in Munsell color notations. A word of explanation of this notation will aid in interpreting the results. Three color variables are recorded by the symbol. The first numbers, together with letters designate the hue (position in the spectrum), the numerator of the fraction designates the value (lightness or darkness) and the denominator, the chroma (saturation or purity) of the color. Hues of unglazed pottery extend from R (red) through YR (yellow red) to Y (yellow). The numbers indicate the position of the hues in each range; for example, 2.5YR is toward the red end of the yellow-red range, and 10YR is at the yellow end. In the Munsell standard, four hues, numbered 2.5, 5, 7.5 and 10, are given in each range. The value scale runs from 0 for black to 10 for white, 5 being a medium gray. Neutral gray is 0 in chroma and the purest colors of the standard are 8 (colors purer than 6 are not common among Southwestern pottery types). This system of notation permits interpolation for all three color variables, and the accurate visual spacing of the standards throughout the scale greatly facilitates the comparison of colors. Experience demonstrates the distinct advantage of these features.

COLOR CHANGES IN REFIRED PASTES

Temperature Degrees C	MOGOLLON			
	<i>Brown</i>	<i>Dark Gray</i>	<i>Black</i>	<i>Light Gray</i>
<i>Original</i>	2.5YR 4/6	2.5YR 3/0.5	2.5YR 2/1	10YR 5/1
500	"	10YR 5/3	5YR 4/4	"
600	"	8YR 5/4	2.5YR 4/6	"
750	2.5YR 5/6	5YR 5/6	2.5YR 4.5/6	10YR 4.5/3—4YR 5/4
850	"	—	—	3.5YR 4/6

Temperature Degrees C	LINO			
	<i>Light Gray</i>	<i>Medium Gray</i>	<i>Brown Gray</i>	<i>Dark Gray</i>
<i>Original</i>	10YR 7/0.5—1	N 3—10YR 5/3	10YR 7/1.5	5YR 2/1
500	"	"	10YR 6.5/1	N 8
600	"	10YR 6/1	—	—
750	10YR 7/4	10YR 7/4	10YR 7/4	10YR 8/1
850	7.5YR 7.5/5	7.5YR 8/5	7.5YR 7.5/5	"

There is a certain variability in the firing behavior of both Mogollon and Lino pastes, but beyond the variation there are distinct and significant uniformities. The hue of all fully oxidized Mogollon pastes, regardless of their original color, is near the red end of the yellow-red scale. A few take on a more yellow hue when they are only partially oxidized and hence grayed by unburned carbon. The values are medium (4 to 5) and the chroma fairly high (5 to 6). The original brown paste differs from the fully oxidized paste mainly in chroma. Some of the browns darken on short refiring at 500° C owing probably to the presence of secondary carbonaceous material. A general characteristic of the group is the relative ease with which the color of full oxidation is brought out. In some instances, five minutes at 500° C is sufficient to clear a dark gray paste. At 600° C the chroma of these pastes is between 4 and 6. Fifteen minutes at 650° C is sufficient for full oxidation of most pastes, and there is no further change in color as the temperature is increased to 850° C. The ease of oxidation and the fact that the change is from dark gray to red suggests that lightly held carbon is burned out revealing the color imparted by ferric oxide which occurred originally in this state and was only masked by carbon. The few light gray pastes of the Mogollon group are an exception to this generalization. Their firing behavior is more like that of the Lino pastes. They are unchanged at 600° C, and their chroma is still low at 750° C, but they develop the characteristic red color at 850° C. The firing behavior of these sherds suggests the presence of the lower oxide of iron which may possibly have been formed through accidental reduction in firing.

It is characteristic of typical light gray Lino paste that the color remains unchanged on refiring to 500° and 600° C. A warmer tone appears at 650° C on heating for 15 minutes if not after 5 minutes, and the chroma continues to become clearer with each successive rise in temperature, but even at 850° C, the paste does not attain as high a chroma as the Mogollon paste. There is little change in value of light gray Lino paste on refiring but the hue becomes somewhat redder between 750° and 850° C although it is still toward the yellow end of the yellow-red range. This warm color is undoubtedly due to the formation of some ferric oxide, a process which, judging by color changes, continues through the temperature range employed.

Either ferric oxide was reduced in the original firing or the clay was not fully oxidized in its raw state. It is noteworthy that there are a few Lino pastes that have the warm color obtained on refiring to 650° C and also that this color appears when some smudge sherds are given a short firing at 600° C. Again the question may be asked whether firing atmosphere or the original condition of the clay is the cause. An exceptional Lino paste, of which only a few examples were found, is white firing. A smudged sherd of this paste changed from a value of 1 to 8 on refiring to 500° C showing the presence of lightly held carbon. At 750° C the paste becomes slightly warmer in chroma but is distinct in color from the buff sherds and shows no further change when the temperature is raised another hundred degrees.

Gray cores are very rare in the Lino sherds. This may mean that the clay was not highly carbonaceous or that carbonaceous matter was burned out in firing. One sherd with a core was refired to compare the rate of oxidation with that of carbon deposited in smudging. The change was imperceptible at 500°; at 600° after 15 minutes firing the value became a step and a half lighter. Further change took place at 650° C, but a distinct core still remained after 5 minutes at 750° C. In contrast, black smudged sherds are distinctly lighter when refired to 500° C and are cleared at 600 or 650° C.

The question of primary interest that the Twin Butte sherds raise is what the color difference indicates regarding firing technique. Conclusions must be drawn with caution because we are dealing with two distinct classes of clay, one red-firing, the other buff-firing, and we have no direct evidence of their state of oxidation before firing. Moreover, I have not attempted to estimate the original firing temperature and have only considered the color of the fully oxidized paste in the lower range of temperatures obtainable with simple, direct firing methods. The presence of unaltered muscovite in occasional Mogollon sherds indicates that they were fired below 900° to 950° C. It is doubtful that a study of the thermal behavior of these sherds at lower temperatures would give further indication of original firing temperatures because of the unoxidized condition of the Lino pastes and the slight color change of the Mogollon pastes.

It is reasonably clear, however, that the ferric oxide of the distinctly ferruginous Mogollon pastes was not generally reduced in firing and there is a high probability that it was already in the ferric state in the raw clay. It is equally clear that potters did not exercise care to bring out the full color of the paste. Potters of Chinautla, Guatemala have remarked that their vessels would have gray clouds unless they were left in the fire until the fuel heaped around them had burned white (to ash). The potters who made the Twin Butte Mogollon ware could have produced much clearer colors had they followed this simple practice, but they appear to have been indifferent to color. This generalization does not hold for all Mogollon pottery for San Francisco Red produced to the south is a fine clear color. It is not improbable that a number of the blacks in the sample were caused by accidental smudging, particularly those on roughly finished exteriors. If the rare light gray Mogollon paste is an example of accidental reduction in firing, this is another expression of careless technique.

The fact that Lino Gray paste has a high value and a very low chroma when refired to temperatures which burn out carbon deposited in firing points to the presence of the lower iron oxide. The Twin Butte sample does not answer directly the question whether ferric oxide was reduced in firing or iron compounds in the raw clay were unoxidized. Inferences will have to be drawn from the general characteristics of Lino pottery, nevertheless the relative uniformity of color of this class of pottery is significant of firing technique. Warm buffs are developed by refiring to 750° C showing that

Lino potters could easily have produced a well oxidized ware from this clay had they so desired. The rarity of sherds that show tinges of color indicative of ferric oxide is noteworthy. It is clear that the production of gray ware was a well established tradition, and firing methods that prevented oxidation were standardized. It is well known that this standardization is characteristic of Anasazi pottery in general. A brief review will serve to place the Twin Butte sample in the general picture.

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN LINO AND MOGOLLON POTTERY

When Mogollon and Anasazi wares are compared, it is important to consider them in relation to the natural resources of their respective areas and also in the light of what is known of the ceramic tradition of each.

The basic difference between the buff- or white-firing clays of Lino pottery and the red-firing clays of Mogollon pottery from Twin Butte site holds generally for these two classes of pottery. There can be little doubt that the difference was determined primarily by the ceramic resources of the areas in which the two classes of pottery occur. A large part of the region occupied by Anasazi potters is characterized by extensive Cretaceous formations that abound in buff-firing clays. Many of these clays are highly carbonaceous and require a longer firing period for oxidation than alluvial and primary clays. The iron content of the buff-firing clays is sufficiently low to have little color effect when they are reduced and in this condition they make a light gray or whitish ware. Some true white-firing clays also occur in the area. Red-firing clays are not absent, but they are far less common than the buff-firing ones and in some localities they are rare.

Although a systematic survey of ceramic resources in the Mogollon area has not been made, we know that the Cretaceous formations that supply the buff-firing clay of the north are absent from most parts of the area. The principal formations over much of the area are volcanic with alluvial sediments in the valleys. Potters used low-grade, red-firing clay probably from necessity. Clays of this type that are low in carbonaceous matter require only short oxidation in firing. They fire gray in a smoky atmosphere or with prolonged reduction, but they generally contain sufficient iron oxide to form a distinctly darker gray when reduced than the buff-firing clay. The firing characteristics of the red clay, therefore, offered the potters no incentive to reduce.

There is a constant relation in the Southwest between composition of paint and class of ware. Black iron oxide occurs only on gray ware; red iron oxide and black manganese or iron manganese paint on red ware. Carbon paint, derived presumably from a plant extract, occurs on clays having special physical properties that are independent of color.

The subject of paint introduces one of the most striking facts of Anasazi ceramic history, the very early appearance of painted design. It seems the more remarkable when compared with the course of ceramic history in other areas. Plain ware was made over a long period in the Mogollon area before the appearance of painting that was simple in technique and in design concept. Even this development was not general, for the rarity or absence of painted pottery in the northern part of the area suggests that only plain ware was made locally. In Mesoamerica, well finished ware in specialized shapes preceded painted pottery. In contrast, the Anasazi seem to have begun to paint soon after they learned to make pottery and before they had adopted such refinements as stone polishing and slipping. Even more remarkable are the three distinct classes of paint they used: black iron oxide, carbon derived, presumably, from a vegetable extract, and a

lead glaze applied as a paint in an organic medium. In our theorizing, it is simple to introduce the idea of pottery making to the Anasazi from Mexico, perhaps through Mogollon people, but how are we to explain these painting techniques? To suggest that the idea of painting pottery might occur to a people dyeing plant fibers and weaving intricate patterns in basketry may seem to suggest the old problem of the transfer of learning, although its setting differs from the usual pedagogical one when we are concerned with the development of a craft that was plied, not only by the average artisan, but also by those exceptional individuals of any group who possess what the psychologist might call superior closure. The point is that in explaining Anasazi painted pottery, we must consider, not only the source of the idea of painting, but also the source of the techniques of preparing and firing the particular kinds of paint they used. It is the paints in particular that show specialization.

Perhaps the most surprising technical accomplishment is the production of the lead-glaze paint which is best known from sites in the region about Durango and which strongly suggests that these potters were experimenting with new materials. The technique was limited and shortlived, however, and is less interesting in relation to firing method than the black paints. The practicability of producing a carbon paint on pottery might seem to depend on firing in a reducing atmosphere. With laboratory control, carbon paint could be obtained in this way, but in primitive firing, oxygen cannot be completely excluded; if there is enough to burn the fuel, then there will be the slight excess required to burn a film of carbon paint. Extensive experiments have shown that certain classes of clay having high adsorption will hold an organic paint under conditions that will burn it from an ordinary clay. Given a clay with the required properties, the production of a good black would be favored by a firing atmosphere that is reducing or not strongly oxidizing. The use of dyes in weaving might lead to experiments with dyes on pottery, but when particular clays are needed for success, the discovery of this form of decoration seems the more remarkable. The only comparable paint in the New World that has come to my attention was used by the Maya of Yucatan. The black of so-called resist decoration, a wide spread and specialized technique, is also organic but can be burned out at low temperatures indicating that it was a post-firing application.

The black iron oxide paint gives more direct evidence than carbon paint of the nature of the firing atmosphere. The question is whether the paint was a black iron oxide that was unchanged in firing or a ferric oxide that was reduced. Iron ore from many sources must have been used. Spectrographic analyses have shown that the impurities in the paint are variable. There is also considerable range in the properties of the paint. At its best it is black, hard and adherent, but it is often soft and brown or sometimes red. The cause of the adherence and hardness of this paint is one of the most interesting technical problems that Southwestern pottery poses. Pure powdered iron oxides fired in air in a laboratory kiln remains soft and powdery, but when ferric oxide is reduced it becomes more permanent. Several observations indicate that Anasazi blacks were reduced in firing. Microscopic examination shows that some paints of La Plata Black-on-white have a firm, black, crusty coat overlying soft, brown material. The change occurring in firing was incomplete. Reduction together with sintering, that is the tendency for grains to adhere as they change state in firing, appear to have affected permanence. Impurities also had an effect in some instances. Spectrographic analyses of exceptional paints that have a vitreous luster indicate that an iron-silica glass was formed. This would occur only

if the iron had been reduced to the ferrous state in which it acts as a strong flux. Incipient vitrification of an impure silica-bearing iron oxide may well have contributed to the hardness of many of the matte paints.

The black iron oxide paint of Anasazi pottery therefore gives more direct evidence of reducing conditions in firing than does the color of the pottery. That the intensity of reduction varied is shown by the soft, brown paints. Even when the paint is reddish and powdery, however, the pottery is still gray. Was the paste more easily reduced than the paint or was the clay originally unoxidized and the firing atmosphere so nearly neutral at effective temperatures that the paste was not oxidized? This question has not yet been answered directly, but the significant fact is the comparative rarity of accidentally oxidized Anasazi pottery. This can only have resulted from conscious effort to avoid complete oxidation.

The relationship between the firing properties of available clays, well established techniques of painting and method of firing is direct. When rapid, short firing failed to oxidize a carbonaceous clay fully, the pottery was still a satisfactory color and reduction improved the quality of pigments that offered strong color contrast. Only a minor part of the gray wares were decorated with paint that called for reduction, but it is probable that all Anasazi gray pottery was fired by a similar method. Had the common clays of the San Juan region been red-firing, Anasazi ceramic history would have been quite different.

This brings us to the final question of the difference in firing method required to obtain the degrees of oxidation and reduction represented by Mogollon and Anasazi wares. There is need for more experimentation, but the work that has been done so far has shown that a radical difference in technique, such as the use of a pit in place of open, surface firing, is not necessary to prevent the oxidation or reduce carbonaceous clays. Neither is a particular class of fuel required. In the experiments at Awatovi, clays were fired either white or buff with either juniper wood or coal by varying the draft and the length of time the pottery remained in the fire after volatile matter burned out. Coal, however, has a distinct advantage over wood for oxidation because it maintains temperature longer after it is burned to solid carbon, and it is certainly highly probable that the use of this fuel influenced the development of the fully oxidized Pueblo IV wares of this region.

In pure theorizing, there is a tendency to overlook what potters inevitably learn by practice and by accident. It is hardly conceivable that practical potters would fail to note the effect of draft, of frequency of fueling and of the length of time the pottery remained in the fire, and these are primary factors in determining whether or not a ware will be fully oxidized. It is clear that Anasazi technique was firmly established, likewise the influence on this technique of the type of clays they used is unquestionable. The bearing of these facts on the cultural difference between the Mogollon and Anasazi is beyond the scope of this note, which is intended only to clarify the problem of interpreting the evidence of firing method. When comparisons are made, however, the effect of natural resources and the entire complex of techniques should be given due weight.

PROBLEMS CONCERNING THE PASTE COMPOSITION OF PETRIFIED FOREST BROWN WARE

The following observations are offered primarily to suggest the possibilities of and requirements for investigating the sources of Petrified Forest brown ware. A detailed petrographic analysis of the pottery has not been

made, and these notes and comments are based on studies with the binocular microscope and preliminary examination of thirty-one thin sections. Sections of sherds from Bear Ruin and Bluff sites were used for comparison, and reference was also made to an extensive collection of sections from other Mogollon sites distributed throughout the area.

The brown ware of the Petrified Forest offers an excellent example of the possible usefulness of paste composition in establishing chronological seriation. There are four classes of brown paste in the Petrified Forest area: micaceous, sand-, sherd- and rock-tempered. The first three mark a chronological sequence; the rock occurs in minor amounts and undoubtedly stamps trade pottery. The micaceous paste is readily recognized megascopically. Furthermore, sand grains and sherd fragments are easily differentiated; a hand lens is often sufficient, and the coarser pastes can be recognized megascopically when one has become familiar with their characteristics. Consequently, in the Petrified Forest collection, paste composition affords an extremely useful criterion of classification and marker of time in a ware which lacks distinctive surface features.

Since the sherd-tempered brown ware follows the occupation of Twin Butte Site, it does not concern us here. Nevertheless its characteristics merit a few parenthetical remarks. The fragments of sherd temper are principally light gray or whitish and are derived, unquestionably, from Anasazi gray ware. The light color contrasts strongly with dark paste and thus facilitates identification. From a technological standpoint, this association of light gray temper and brown paste is interesting because it shows that the conditions under which brown ware was fired did not oxidize the gray paste. Of even greater interest is the reason for the use of white paste. I will bypass the question of the origin of the technique, which is foreign to earlier Mogollon tradition. On first thought, the gray sherd temper suggests that Mogollon people had moved into Anasazi territory where only light paste sherds were available. But this is not the condition in the Petrified Forest where both Mogollon and Lino sherds are abundant in some sites. It is quite possible that Mogollon potters preferred the dense gray paste to the friable brown. This question is raised because it may have a bearing on the problem of the source of brown ware in the Petrified Forest sites. Dr. Wendorf has postulated that Forestdale Plain of the Twin Butte Site was intrusive and Lino Gray indigenous. In testing this theory it will be important to determine whether or not buff-firing clays occur locally, and it may be helpful to consider the problem of source in the light of the later ceramic history represented by the sherd-tempered brown ware.

ADAMANA BROWN

The temper of Adamana Brown has three major constituents, a pearly white mineral of micaceous habit, quartz grains and microcrystalline fragments. The angular to subangular form of the grains distinguishes the material from waterworn sand. The micaceous mineral occurs in plates and "books" of plates, the coarser of which approach a millimeter in diameter, and in aggregates of twisted and interlocked vermicules composed of much smaller plates. The proportion of the micaceous mineral varies considerably from paste to paste and the vermicular form is not invariably present, but optical properties and associated minerals are constant. Optically the mineral has a low interference color which distinguishes it from true micas. The plates are brittle which is unusual for a mineral of micaceous habit. The plates of most micaceous minerals, including chlorites, pyrophyllites and talc, in addition to the true micas, are flexible. One group of comparatively rare minerals, the Clintonites, have brittle plates, but these minerals

are usually colored green by iron. It is probable that the Adamana mineral owes some of its peculiarities to alteration in firing. Many micaceous minerals alter with loss of water on heating, but these thermal effects have not yet been fully investigated.

Mica in pottery may represent various techniques; it may be a constituent of tempering material (stream sand and various classes of rock, particularly certain metamorphics) or it may occur in a primary clay as a remnant of rock weathering. Some of the most highly micaceous pastes are untempered primary clays, therefore the expression "mica tempered" should be used with circumspection. While working in the Petrified Forest, Wendorf searched for local sources of Adamana temper. The only material he found with a conspicuous platy mineral was a distinctly micaceous sandstone. Unfortunately, I dismissed the sample he sent me after hasty examination because the optical properties of the micaceous mineral did not correspond to those of the Adamana mineral. To fail to consider the possible effect of heat on the sandstone was a careless oversight on my part. When there is opportunity for further work on Adamana, it will be important to test the thermal behavior of the micaceous sandstone. We will then be in a better position to consider whether or not Adamana was made in the Petrified Forest. In the meantime the type stands as an extremely useful "index fossil" because of its unusual paste.

THE NON-ADAMANA SHERDS FROM FLATTOP SITE

As none of these sherds were thin sectioned, they are described in general terms only from examination with the binocular microscope (48x). Two major classes of paste are easily recognized. One is marked by clear quartz alone, the other contains conspicuous grains of opaque feldspar and rock fragments, together with quartz. There are also differences in paste color and texture which not only aid in separating these two pastes but also add to the indications that they are from different sources. The paste with feldspathic temper is very dark brown to near black. Coarse opaque grains are usually conspicuous. The texture is variable, however, and although it is generally coarser than that of the quartz sand, pastes with a preponderance of medium-sized grains occur. The quartz sand tempered paste is also generally dark gray, but it is distinctly more neutral, and it includes a group of red to brown pastes. The texture is predominantly medium and grains grade to fine and the lower range of coarse. There are some mineralogical variations in both groups. The quartz sand appears to be homogeneous in composition although other minerals may be masked by the dark paste. Occasionally a grain of rosy quartz is seen; ferruginous particles and lumps of brown shaley material are noticeable in the few sherds that were oxidized by refiring. The quartz in the brown pastes of this class are stained by a deposit of ferruginous material. This stain was not detected in the quartz of the gray pastes; although it may be masked, it does not show in the refired samples. It may be the remnants of the ferruginous cement of a red sandstone. The fact that the grading of grains in the oxidized pastes is uniform lends support to the hypothesis that they are derived from a sandstone, however, no fragments of sandstone were noted. The texture is finer than that of the majority of the gray pastes. There are seventeen sherds with hematite stained grains in a total of sixty-one. In addition, there are a few distinctive pastes. One contains irregular particles of an opaque, white material which may be the cement of a sandstone, as patches of it adhere to some of the quartz grains. Another sherd has a few grains of quartzite in addition to the quartz. A third is distinguished by hard, translucent gray grains, possibly chalcedony. Four sherds show large flakes of

biotite. The color of their paste is nearer that of the feldspar group than that of the quartz sand-tempered one. The single sherd of Gila plain with which these were compared has a mica schist temper in which the principal mica is muscovite occurring in masses of fine scales intergrown with quartz. Finally, two light gray pastes show incipient vitrification, and one of them contains numerous minute pores that were formed by trapped gas. The vitrification is undoubtedly accidental, but the paste may differ from that of the typical sand tempered variety. The texture is fine to medium, and distinct minerals in this range do not show up with the binocular microscope. These variations in temper have been mentioned because they show the possibility that the sherds are from more than one source.

The pastes distinguished by large crystals of opaque feldspar, quartz, and rock fragments vary mainly in ratio of constituents. Nevertheless the feldspar and quartz grains are always conspicuous, and in none is the rock the major constituent. The feldspar grains show crystal faces and some are pinkish. The rock fragments which are often subangular are opaque white or gray and occasionally they show specks of dark minerals. Some free, dark minerals are present but they do not show plainly in the dark paste.

Adamana Brown occurs as an intrusive in Bluff Site, and there may well have been trade in both directions. The paste of sherds from Flattop Site characterized by crystals of feldspar has a superficial resemblance to Alma Plain, Bluff variety, the distinctive type of the Bluff Site. Haury and Sayles (1947) have given the following description of the inclusions of the Bluff variety: "Some rounded quartz grains, but conspicuously an abundance of soft opaque white angular particles." The angular white particles are fragments of diabase. Had we asked these Bluff potters to use a rock differing from that of other rock tempers of Alma Plain, they could hardly have found anything better than this diabase. In the typical paste, quartz is absent, and the rock fragments show the fresh angular fractures characteristic of ground rock temper. Included in the sample of Bluff variety which I examined are a few other tempers confused with it because of the presence of large, opaque grains, and also there are some in which grains of quartz sand are prominent but fragments of diabase occur. It would seem therefore that sand from a drainage near the diabase outcrop was used as well as crushed rock. It is inadvisable to base comparisons of Alma Plain, Bluff variety and the Flattop opaque temper on examination in incident light alone, however, I found no paste in the Flattop sample which compared in freshness of fracture and absence of quartz with the crushed rock of the Bluff variety. If Flattop people had obtained any quantity of pottery from the Bluff Site, it seems unlikely that the typical paste would be unrepresented in a sample the size of that examined. We should therefore be on the alert for coarse, opaque temper in brown ware of other localities.

FORESTDALE PLAIN FROM TWIN BUTTE SITE

The composition of this type is of interest primarily in relation to Wendorf's theory that the brown ware of Twin Butte Site is intrusive. Sand temper does not give an easy answer to this question because it could have been obtained almost anywhere; moreover, to distinguish varieties of sand is often a time-consuming task. Nevertheless, there are a number of lines of evidence that can be followed. The mineralogical composition of local sand should be studied. If it differs from the temper, the evidence, though inconclusive, would have added weight because sand is not an unusual material that would be sought at a distance. A sizable sample of the type should be analyzed to learn whether or not it is uniform.

If the ware is intrusive, it is not unlikely that it was obtained from more than one place. Variation in composition might reflect diverse origin, whereas uniformity would be expected if the ware were indigenous or if trade were limited to a single source. Finally, the paste should be compared with that of the sand-tempered brown ware of sites within trading distance.

In the small sample that has been examined (nine sections), the sand is composed largely of subangular quartz with a minor proportion of clear and cloudy grains of cryptocrystalline quartz. Crystals of microcline are rare, and a single grain of quartzite was noted in one section. Whisps of muscovite and small crystals of tourmaline are also rare. Three pastes, otherwise typical, are distinguished by stray crystals of clear calcite. There is a noticeable difference in texture of sherds, but no corresponding difference in mineralogical composition was observed. If it were not for the calcite, the sample would be homogeneous.

The few sherds of Forestdale Plain from Bear Ruin that have been sectioned differ from the Twin Butte sample in rarity of cryptocrystalline quartz and prominence of quartzite. Although this difference is important, a more extensive sample should be studied before Bear Ruin is dismissed as a possible source of Twin Butte sand-tempered brown ware.

If all preconceived concepts of the independence and self-sufficiency of pueblo villages were laid aside, we would consider four possible explanations of the association of Mogollon and Lino pottery in Twin Butte Site: 1) both were made locally; 2) Lino was made locally, Forestdale Plain is intrusive; 3) the reverse relations hold; 4) both were obtained in trade. The possibilities of source would have to be considered in relation to the question of population; either Mogollon or Lino people occupied the site or both lived there together.

These possibilities are mentioned, not to argue the pros and cons, but rather to acknowledge the importance of learning, if possible, the sources of the pottery in order to understand the history of the site. The proportions in which the two wares occur at Twin Butte Site make the question of origin troublesome. A different kind of pottery is readily accepted as intrusive when it occurs only in small amount, and if it is known to occur in abundance elsewhere, we are well satisfied that it is trade ware. On the contrary, the suggestion that a large amount of pottery was obtained in trade does not square with our idea of the economic relations of prehistoric Southwestern villages. Nevertheless, when Pecos pottery was studied, very strong evidence of wholesale trade in specialized types was afforded by paste analysis and ceramic surveys. The evidence threw open to question the idea that intrusive pottery is limited in amount to that obtained by exchange of gifts and occasional barter motivated more by curiosity than need. The pottery of the Petrified Forest differs from that of Pecos in that it is less specialized in technique and style and less diverse in composition; consequently, its record is not as plain. Yet the story of what was happening in the borderland between Anasazi and Mogollon territory is sufficiently interesting to justify further technological work, and such work should be unhampered by fixed ideas of limits of volume of trade. There is nothing inherently impossible in the hypothesis that Anasazi people moving into territory where they could not find the kind of clay they were accustomed to using, ceased making pottery and obtained some in trade from their homeland and some from Mogollon people. Such speculation is, in itself, worthless, but it has value in so far as it serves to highlight the importance of investigating the ceramic resources of the region and of studying the pottery in its geological and broader archaeological setting.

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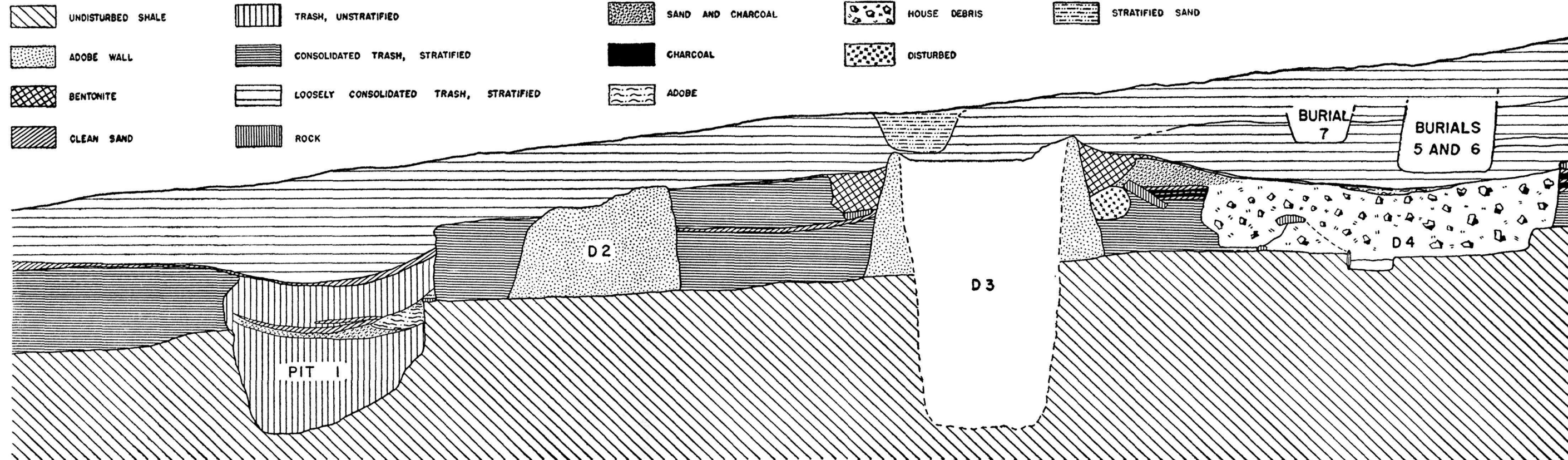
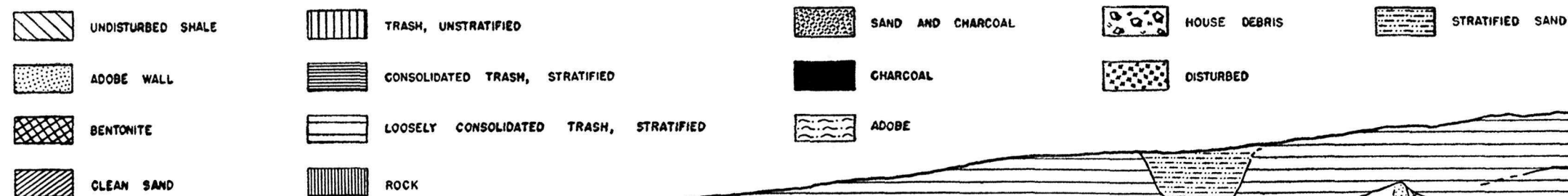
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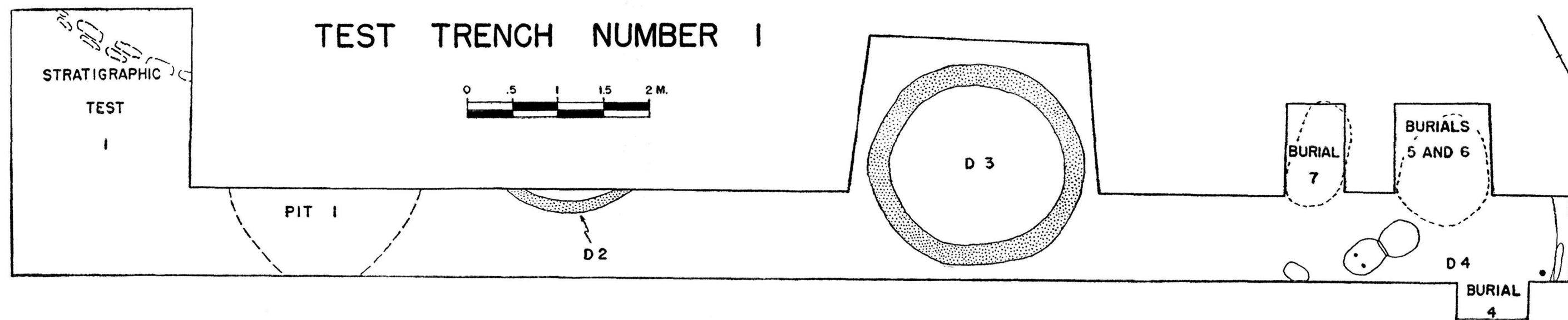
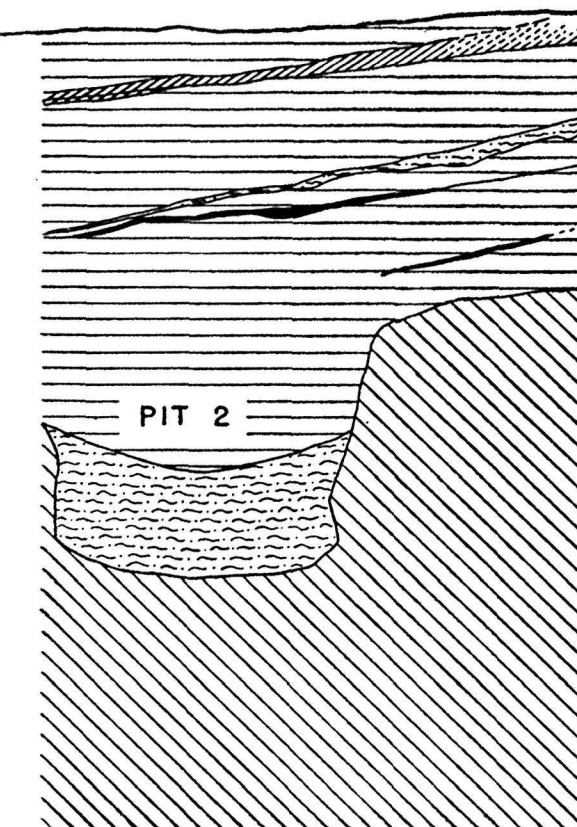
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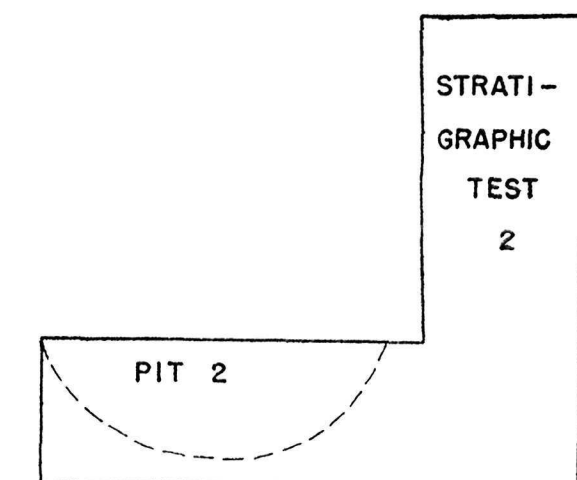
FIGURE 47.
*Outline map and profile of Test
Trench I.*



UNEXCAVATED



UNEXCAVATED



STRATI-
GRAPHIC
TEST
2

