Collected Papers
IN HONOR OF
John W. Runyan

James G. Bain
Joseph L. Chartkoff
Alan Ferg
Gerald X. Fitzgerald
Mark Ganas
John A. Hedrick
Jon Nathan Young

Karl J. Reinhard
Julia Runyan
Howard N. Smith, Jr.
Marilyn Swift
Reggie N. Wiseman
Fred York

Edited by Gerald X. Fitzgerald

Papers of the Archaeological Society of New Mexico: 7
ALBUQUERQUE ARCHAEOLOGICAL SOCIETY PRESS
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NEWSLETTER

Distributed to members only
PREFACE

This seventh release in the series of Papers of the Archaeological Society of New Mexico is in honor of John W. Runyan who was a long time member of the society and one of its most dedicated amateur archaeologists. He was a professional geologist, and as such he made many valuable contributions to the understanding of the ecology of the Southwest. He will be sorely missed by his many friends.

Many thanks are due those friends of John who contributed papers in his honor. Ceramics was one of John's special interests and some of the papers in this issue were written on this subject.

Special thanks go to the Albuquerque Archaeological Society Press and to Richard Bice for handling the graphics and many other details of getting out this volume. The typing was done by Kathie Morrison. Cover design by Joyce Fox. Drawing of El Paso Polychrome vessel by Stewart Peckham.

Gerald X. Fitzgerald

November 1981
JOHN W. RUNYAN
1928-1980
JOHN W. RUNYAN
A BRIEF BIOGRAPHY
BY
JULIA RUNYAN AND G.X. FITZGERALD

John Runyan was born in Coahoma, Texas on January 29, 1928. He died of a massive heart attack October 12, 1980 at his home in Hobbs, New Mexico. He had suffered a heart attack several years ago and lived with a heart pacer since that time, but he refused to let this slow him down. He remained active and continued his work as District Geologist for the New Mexico Energy and Minerals Department's Oil Conservation Division where he had worked for 25 years. He continued his work as a dedicated amateur archaeologist as well as keeping up his work with both Boy Scouts and Girl Scouts.

John gave unsparingly of his time to young people. He was advisor to Boy and Girl Scouts and helped many of them attain their merit badges. He taught and gave programs on archaeology and geology to school children. He was an avid stamp collector and shared this interest with young and old alike. At the time of his death he was president of the Road Runners Stamp Club.

Despite all of his other activities, he devoted a great deal of time to archaeology. He attended the first two field schools of the Archaeological Society of New Mexico at the Stirling Site near Farmington where he taught site surveying and mapping as well as teaching a seminar on pottery. In 1970 he attended the Texas Archaeological Society field school when they conducted a survey in the Guadalupe Mountains. There he served as pottery analyser.

In addition to his field school experiences, John helped excavate a number of sites with the Lea County Archaeological Society under Antiquities permits for mitigation. He also worked with Jack Hedrick on several surveys in the El Paso area. He was also active in the Southwestern Federation of Archaeological Societies. He was instrumental in the founding of that society.

Study of the temper of Jornada pottery types in the entire area where they are found was of special interest to John. He studied temper distribu-
tion with the ultimate aim of publishing his findings. Some years ago he was joined by Jack Hedrick in a series of experiments on Mogollon ceramics to determine differences in the paste and temper of sherds collected from sites in the area, and to correlate their findings with the sources of the clays and temper used. John's knowledge of geology was invaluable in helping to find the sources.

By using microscopic analyses of the paste and temper used, they set up a classification system through which they could determine whether the ceramics were locally made or imported. In time they hoped to be able to learn where the intrusives were from by tracing the source of the raw materials used. This system would be invaluable in determining the origin of sherds lacking design or other distinctive characteristics. John's data was turned over to Jack Hedrick who is continuing with the research.

The feeling of those who knew John was summed up in the eulogy given by Gil Hinshaw, editor of the Hobbs Daily News, at his funeral services.

He never hesitated to help anyone with any kind of endeavor, no matter what it was, from house building to motors, from pottery to archaeology. If he ever said anything bad or vicious about anyone, it is unknown to me. Also he was one of the highly talented people of this world, making it his domain to know everything. He was never petty, mean or small. I consider him one of the really "good" people I've ever known.

John is survived by his widow, Julia, a daughter, Pamela, a son, Emerson and a grandson, Robert.
MEMBERSHIPS AND HONORS

Degree in geology, University of Houston, 1956.
District Geologist, New Mexico Energy and Minerals Department's Oil
Conservation Division for 25 years.
Member of Archaeological Society of New Mexico.
Served on the Board of Trustees of ASNM for eight years. Vice-president
for four years, President for four years.
Received the Amateur Archaeologist Award in 1975.
Helped found the Southwestern Federation of Archaeological Societies.
Member of Texas Archaeological Society.
Charter member of Lea County Archaeological Society.
Charter member of Southwest New Mexico Museum.
Member of the Southwest Museum Association.
Member of Roadrunners Stamp Club.
Member of New Mexico Philatelic Association.
Charter member of Hobbs Geological Society.
Member of American Petroleum Institute.
Advisor to Boy Scouts and Girl Scouts.
Received the District Award of Merit, highest award a district can give
from the Scouts.
Received the Silver Beaver Award for Scout activities.
AN EXPERIMENT IN THE REPLICATION
OF EL PASO BROWN POTTERY

JOHN A. HEDRICK

INTRODUCTION

In recent years, examinations of ceramics from the El Paso region has led to technological changes in the type descriptions as originally proposed by Lehmer (1948) for El Paso Brown and Stallings (1939) for El Paso Polychrome. Microscopic examination of study sherds from the El Paso area by Runyan and Hedrick (1973) revealed interesting distinctions relating to tempering materials and clays used in the manufacture of these two pottery types. This study implied that by matching materials with the geologic sources of the area, a more precise method for understanding the relationships of ceramics within the cultural area might be determined. The study also implied that since the proper proportionment of clays and tempers within sherds could be determined, El Paso Brown and El Paso Polychrome pottery types could be replicated. This paper reports on an experiment in replicating El Paso Brown pottery based on the findings of that study.

MATERIAL SOURCES

Clays

Numerous clay sources have been reported in the El Paso region, specifically around the base of the Franklin Mountains and along the terraces of the Rio Grande Valley. One source on a valley terrace was reported to have been used by the Tigua Indians of Ysleta del Sur, Texas, prior to 1900 (Hedrick, 1971). Other clay sources lie along the terraces and slopes of the Diablo Plateau (Strain, 1959) which extends from just east of El Paso along the river basin to just east of McNary, Texas. One of these
deposits near Tommy's Town on Interstate 10 is extremely large and at one time was commercially mined (Olivo, 1978). Samples of this clay were used in the replication experiment. Another clay source was from deposits in a road cut and adjacent arroyos along US 62-180 in the Hueco Mountains. Neither clay sources used contained to any extent the carbonaceous material or silts characteristic of playa clay deposits. It should be noted that several clay deposits in the El Paso region contain large quantities of calcium carbonate. Runyan and Hedrick's study indicated that clays containing calcium carbonate were not used.

**Temper**

Since microscopic examination had already established the principal mineral content of El Paso Brown to be feldspar and quartz, the source areas for these combinations were located. The principal areas were in the Hueco Tanks State Park area where weathered, coarse-grained synite was deposited in arroyos, and the Fusselman Canyon-Trans-Mountain Road area of the Franklin Mountains. Samples used in the experiment were from the Franklin Mountains and are the result of weathering and deterioration of granitic rock along with natural feldspar inclusions in the form of crystals. These samples were reduced by grinding with a mano and metate to produce angular and subangular particles similar to the study sherds.

Gypsum also showed up in small quantities in some of the study samples. Gypsum samples similar to those which make up the White Sands National Monument were collected and later proved to be a valuable tool in the replication experiment.

Although some 2000 square miles of fine rolled quartz sand exists in the El Paso area desert and along the Rio Grande, only small quantities were found in the El Paso Brown study sherds.

**VESSEL MANUFACTURE**

**Paste Preparation**

The clay and temper materials used in the replication experiment were ground to a fine consistency using a mano and metate. The ground
clays were mixed with water and allowed to set for a day. The excess water was removed and the clays allowed to set for another day. At this point, the clay was sticky but in a usable state. Tempering materials from the Franklin Mountains source were added to the clays in proportions corresponding to the ratio in El Paso Brown study sherds. These proportions were 40 to 45 percent temper, 5 percent gypsum, and 50 to 55 percent clay. The clays and temper mixed very well with the addition of only a small amount of water needed to produce a usable paste ready for vessel manufacture.

No attempts were made to make artistically shaped vessels. Small bowls averaging 8 cm. in diameter and 5 cm. in height were made. Three were made using the clay from Tommy's Town and four were made from Hueco Mountains clay. The vessels were wet-smoothed using a small polishing stone and the fingers. On one of the Hueco Mountains clay vessels, a very thin wash was added with good success. On another Hueco Mountains clay vessel, a slip was attempted which slightly cracked on drying. Two small test bricks were also made with 40 to 50 percent gypsum added as the primary tempering material to test firing temperatures.

When heated, gypsum shrinks, losing water until a temperature of 600 degrees C is reached. At that temperature it disintegrates leaving a powder. If heating to a temperature of 950 degrees C occurs, it is converted to permanent lime. When used in ceramics, it will shrink during firing until a maximum temperature of just under 600 degrees C is reached. On cooling from this temperature, it will absorb water, expand and fracture the walls of the vessel. Coarse gypsum used in El Paso Brown and El Paso Polychrome study sherds showed some definable degree of radial fracturing, blow holes, and swelling indicating a firing temperature at or near 600 degrees C. With this information, it is possible to use gypsum as a test for firing temperature.

Painting

Samples of limonite (yellow ochre) and hematite (red ochre) collected from the Hueco and Jarilla Mountains were ground with a mano and metate
to a fine powder and filtered through a paper coffee filter to remove sand particles. Water was used as a binding agent and mixed with the ochres to produce a spreadable pigment. Three of the Hueco Mountain clay vessels were painted with the limonite paint and one was decorated with the hematite mixture. A yucca brush was used to apply the pigments.

Curing

The manufactured vessels were completed and left on an indoor storage shelf for two weeks. After that period, they were examined for drying problems. The Tommy's Town clay source vessels had begun to leach out a white powdery substance which was probably due to sulfates of calcium magnesium, potassium, or sodium in the clay (Sheppard, 1968). The Hueco Mountains source vessels remained in excellent condition.

Firing

The experimental vessels were fired during April, 1973, when the author and others from area archaeological societies were assisting S. Alan Skinner on the Milehigh Project near Sierra Blanca, Texas. Since the area was being developed and graded, numerous dead mesquite bushes were available. The sudden onset of a "blue norther" had already necessitated the building of a large campfire in a circular pit, so no steps were taken to prepare a special kiln for firing the vessels. The mesquite fire was allowed to burn down to coals and a metal grill was placed over the coals. The experimental vessels were inverted on the grill and more mesquite branches were added bringing the fire back to a blaze. The fire was kept blazing for 25 to 30 minutes by the addition of more mesquite and the help of a stout northeasterly wind. The fire was then allowed to die down for 30 minutes. During this time, the vessels glowed red-orange. Another 30 minutes were needed to remove the vessels from the fire in stages as it was not known what effects there would be if they were quickly removed into the cold air. All of the vessels and test bricks were in excellent condition when removed. Due to the strong winds and openness of the fire, the firing would be classified as oxidizing and partially uncontrolled.
OBSERVATIONS

Test Bricks

The test bricks were intentionally broken and examined under a microscope for effects of firing. The gypsum in both samples showed that the grains had begun to swell but none had blown out or powdered indicating that the firing temperature was below 600 degrees C. On both bricks, the interior carbon streak was light grey indicating very small amounts of carbonaceous material. The carbon streak was off center, possibly indicating that the strong winds created a stronger heat on one side of the bricks. Both bricks were dense and hard to break, not friable.

The sample made from clay from the Hueco Mountain source fired light brick red approximately the same color as the raw clay. The Tommy's Town clay source sample fired to a tan-brown indicating a slight color change from the reddish-tan raw clay. The sample still had slight amounts of white powdered scum on the exterior surface. Both samples had black to grey firing clouds on the exterior surface.

Vessels

The vessels made from the Hueco Mountains clay source produced the best results. They survived the firing process without cracking and with only minor grey to black firing clouds. The color remained approximately the same as that of the raw source material. The vessels appear to be very hard, well fired, and have a ring when struck.

The vessels from the Tommy's Town clay source did not come out as well as expected, although they fired well and also have a ring when struck. They appeared to have suffered more severe heat and numerous firing clouds were present. The color changes were more apparent and showed a defined deviation from the raw clay. The white powdery scum is quite apparent on the exterior and may have caused the color changes during firing.

Temper inclusions appeared unchanged or altered from their original states. Examination under a microscope showed no alteration in shape or density of the feldspars or quartz minerals. As with the test bricks, the gypsum showed swelling but the absence of fractured, blown out, or powdered particles indicated the same basic firing temperature of below 600 degrees C.
The results of the painting experiment were quite interesting. The three vessels painted with limonite fired to a bright red color while the single vessel painted with hematite fired to a dull pink color just a few shades darker than the clay. This was just the reverse of what had been expected. It is possible that too much water was used in preparation of the hematite, thinning the color.

CONCLUSIONS

The experimental vessels and bricks from both clay sources resulted in colors well within the ranges observed in the study sherds. Impurities which caused the white powdery scum on the Tommy's Town source vessels may have been responsible for the color changes and the denser firing clouds.

The firing effects on the gypsum crystals indicated that the experimental vessels were fired at a slightly lower temperature than the study sherds. This did not seem to make a significant difference in the physical characteristics which would affect the utility of the experimental vessel. If anything, the experimental vessels were less friable than the study sherds. The uncontrolled firing atmosphere may have caused an uneven distribution of heat as suggested by the off center carbon core in the test bricks. If this was the case, it was not significant enough to cause major variations within the small samples fired, but it could be a problem with large vessels.

Though experiments of this type are certainly not a recent innovation, they deserve consideration, if for no other reason than to make us look more closely at the physical attributes of pottery types. It is possible that such examinations whether subjected to testing or not, can eventually help to define geographical varieties and establish evolution of specific pottery types.
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1931    El Paso Polychrome, Laboratory of Anthropology Bulletin No. 2, Santa Fe.

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1966    Blancan Mammalian Fauna and Pleistocene Formations, Hudspeth County, Texas, Bulletin No. 10 of the Texas Memorial Museum, University of Texas, Austin.
14TH CENTURY KACHINA DEPICTIONS ON CERAMICS

ALAN FERG

INTRODUCTION

In New Mexico the Schaafsmas (1972, 1974, 1980) have been able to demonstrate that (among other things) the extent and strength of the prehistoric kachina cult can be gauged with some degree of accuracy using rock art. Here it will be shown that similar work can be carried out for the Western Pueblo and Salado areas in Arizona, using pottery. Some specific examples will be described, and some of the distinctive mask features which show both the continuity of the cult throughout its range in the Southwest as well as its somewhat varied evolution within smaller geographic areas will be discussed.

SALADO EXAMPLE

Besh-ba-gowah is a large Salado pueblo located in Globe, Arizona which was occupied from about A.D. 1225-1400. Excavated in the 1930's by Irene Vickrey, only a brief preliminary report has been published on the some 220 rooms and over 350 burials that were excavated (Vickrey 1939). While organizing Vickrey's field notes and photographs the author "discovered" what is apparently the first known instance of a kachina depiction on a Salado polychrome vessel.

Figure 1a is the best of three photographs which were taken of Burial 173, which was placed below the floor of room 117 at Besh-ba-gowah. This was an aged adult female, buried in an extended, supine position with her head to the northwest. Visible in Figure 1a are a large San Carlos Red-on-brown bowl to the left of the left ankle, a small Pinto Black-on-red bowl, a small Tonto Corrugated jar and the Gila Polychrome bowl with the kachina design which is under discussion here. At the head of the burial was another Gila Polychrome bowl, another small Tonto Corrugated jar and two turquoise ear bobs, one at either ear.

The bowl appears hemispherical, possibly with a slightly incurving rim. The design layout is typical of Gila Polychrome in having a heavy
framing line immediately below the rim, with the main design below this. On the vast majority of Gila Polychrome bowls, this line will be a "lifeline" with a line-break in it, and while very probably present on this bowl, it is not visible in the photograph and has not been included in the artist's reconstruction of the design (Fig. 1b). Likewise, the crescent at the bottom of the design probably extends symmetrically across the bowl, but this is not certain.

The mask has several distinctive features. It is unbounded, being open at the bottom, and has a toothed rectangular mouth with a long tongue or neck below. The eyes have lines extending out from their corners and pupils are indicated by a dot in one case and a wavy line in the other. Above the face is a rainbow-like motif of at least eight parallel arcs, and outward from the sides project horizontal design bands. From the small portion of the left band visible, it would appear to have a design different from the right one.

It is worth noting that sometime between 1937, when it was excavated, and the present this bowl was removed from the remainder of the Besh-ba-gowah materials which are now curated at the Clara T. Woody Museum in Globe. If someone reading this article has seen this bowl, the author would appreciate any information concerning its present whereabouts, in order to get more complete data on it. For the moment, the photograph in Figure 1a is the only record of its existence.

WESTERN PUEBLO EXAMPLES

Strikingly similar to the Gila Polychrome kachina bowl is a Four Mile Polychrome bowl (Fig. 1c) belonging to Bruce Bradley of Cortez, Colorado. It was obtained from a store in Show Low, Arizona and has no provenience information. Like the Gila Polychrome depiction, this Four Mile design has a rainbow-like arc motif above the face, horizontal extensions projecting out from the face, and a design-filled neck or tongue. Unlike the Gila Polychrome example the facial area is enclosed, no mouth is actually depicted and what are interpreted as the eyes are shown as two slanting rectangles with four dots in each (multiple pupils are known for Jornada rock art depictions--see Discussion below).
Figure 1. Kachina depictions with semicircular faces: (a, b) Gila Polychrome bowl from Besh-ba-gowah; (c) Four Mile Polychrome bowl, provenience unknown; (d) Cieneguilla Glaze-on-yellow bowl sherd from LA 70, Pueblo del Encierro.
Figure 2. Kachina depictions on Western Pueblo bowls: (a,d) Four Mile Polychrome; (c) Cedar Creek Polychrome; (b,e) Pinedale Black-on-white. Bowl e has two masks pendant upside down from the interior rim.
While there are a number of other 14th century bowls with kachina depictions in them (and some will be noted below), to this author, these two bowls stand apart in their common use of semicircular heads with horizontal extensions and rainbow-like motifs above the head. The potters of both bowls seem to have had the same basic mask in mind, even though the faces they actually painted on pottery differ in certain particulars.

With that statement I do not intend to imply that I believe the Salado were active practitioners of the kachina cult. Data pertinent to a discussion of Salado religious beliefs are still meager, with none, so far as I know, suggesting that they were engaged with a religious kachina pantheon. What does seem probable is that Salado potters had relatively close contact with Western Pueblo potters (in the form of trade pieces), and on occasion copied designs seen on White Mountain Redware vessels. To judge from the relatively numerous depictions of kachinas to be found in various White Mountain Redware polychrome types, the Western Pueblos were engaged in the kachina cult. It should be reiterated that in Salado polychrome pottery, the Gila Polychrome bowl reported here is, as far as is known, unique in its depiction of a kachina. For that matter, while Tonto Polychrome human (or supernaturals?) effigy vessels are not uncommon, only one other anthropomorphic representation on a Salado polychrome pot is known to the author, and this appears to be a human figure rather than a kachina [Hawley (Ellis), 1932:235]. Life forms of any sort are relatively rare. At any rate, it is proposed that this Gila Polychrome bowl represents an example of a Salado potter copying (probably with great care) a design not in her repertoire, seen on a White Mountain Redware bowl, one probably very like that shown in Figure 1c. Hence it suggests an acquaintance with, but probably not a practice of, the cult in the Salado area.

A second example of the "same" design occurring on bowls of two different pottery types is not so clear in its cultural implications. Martin and Willis (1940:Plate 1) illustrate a Four Mile Polychrome bowl with a full-length kachina figure (reproduced here in Fig. 2a). It has a round head halved by a horizontal line, almond-shaped eyes, a toothed rectangle mouth, fingers, a rectangular body and an arms-up-legs-down stance. Geometric designs fill in the space between the arms and legs.
The exact same description fits the kachina in what was identified as a Roosevelt Black-on-white bowl (first published in Hammack 1974:35, reproduced here in Fig. 2b). The cultural contact inferences to be made here are not so simple because it is unclear whether Roosevelt Black-on-white is a valid type, and who made the pots that have been so classified in the past. Roosevelt Black-on-white was originally thought to be a type made by Salado potters, but inspired by Western Pueblo black-on-whites (Gladwin and Gladwin 1931:46-49). In fact, many of the vessels previously typed as Roosevelt appear to actually be Western Pueblo types, presumably traded to the Salado, such as Pinedale Black-on-white and Tularosa Black-on-white. The bowl described above (Fig. 2b), and another bowl once classified as Roosevelt (Pomeroy 1974:Fig. 6c; reproduced here in Fig. 2e) both appear to be Pinedale Black-on-white (Patricia Crown, pers. comm.). A bird effigy with a toothed rectangular mouthed face painted on its breast (Hammack 1974:32), also typed as Roosevelt, again appears to be either Tularosa or Reserve Black-on-white. The more common occurrence of kachina figures on "Roosevelt Black-on-white" than on Salado polychromes would itself suggest that the former is not of Salado manufacture.

Regardless, materials called Roosevelt Black-on-white have been assigned dates of A.D. 1250-1350 as a minimum range of years (Breternitz 1966:92; Doyel 1978:198), and the bowls in Figures 2a and 2b nicely illustrate what would appear to be a standardized manner of presenting full-length kachina figures, irrespective of pottery type.

Other examples of kachina mask depictions on vessels from the Western Pueblo area can be cited for Pinedale Polychrome (American Indian Art 1979:99; The Aspen Center for the Visual Arts 1979:Fig. 78), Cedar Creek Polychrome (Arizona State Museum Cat. No. 74-13-287 - Fig. 2), Four Mile Polychrome (The Aspen Center for the Visual Arts 1979:Fig. 77; Martin and Willis 1940:Plate 105-Fig. 2; Martin, Rinaldo and Longacre 1961:123; Arizona State Museum Cat. No. A-29,532 - Fig. 2), an unidentified polychrome (?) from Four-mile Ruin (Fewkes 1904:Figure 90), and Jeddito Black-on-yellow (?) and Sikyatki Polychrome (?) from Homolovi (Fewkes 1904:Plate 27). These last two bowls may date later than the 1300's. Almost all of these depictions show faces with toothed rectangular mouths. Over
half have almond-shaped eyes, often with "tails" at their outer edge (like those on the Gila Polychrome bowl in Figures 1a, b). All except three have circular faces. These three exceptions are all semicircular with the flat side down, in a single bowl of Four Mile Polychrome from Hooper Ranch Pueblo, Arizona (Martin, Rinaldo and Longacre 1961:123). This particular mask shape appears to be absent in Jornada and Rio Grande rock art (see Discussion below). However, a similar kachina is to be found on a Cieneguilla Glaze-on-yellow bowl sherd (Figure 1d) from LA 70, Pueblo del Encierro, which is presently under Cochiti Lake in New Mexico. LA 70 is a Rio Grande Classic Period site of over 200 ground floor rooms, completely excavated by the Museum of New Mexico and reported on by Snow (1976). This sherd has already been illustrated in Snow's report. Apparently, while this mask shape was known (and perhaps originated?) in the Rio Grande, it was more popular in the Western Pueblo area and diffused into the Salado area from there.

DISCUSSION

Turning now to the entry of the kachina cult into the Southwest, let us review some arguments set forth by Polly and Curtis Schaafsma in recent years (Schaafsma 1972:95-122, 129-163; Schaafsma 1980:199-289; Schaafsma and Schaafsma 1974). The abstract of their 1974 article reads:

Rock art studies have indicated that the katchina cult and associated religious sodalities arrived in the Pueblo Southwest in the early 14th century from the Jornada region of the Mogollon. Recent studies of prehistoric Pueblo social organization suggest that population aggregation after A.D. 1150 led to the need for means of intravillage social integration. It is proposed that the arrival of the katchina cult and its widespread acceptance occurred in response to this need for intravillage integrative mechanisms. (Schaafsma and Schaafsma 1974:535.)

The rock art studies referred to indicate that Jornada style rock art was present in the Mogollon area possibly as early as A.D. 1000 and lasted to about A.D. 1375 or 1400 (Schaafsma and Schaafsma 1974:538). This style is
characterized by a host of complex mask depictions and a wide variety of life forms in both naturalized and formalized renditions. Prior to the advent of this style in the Mogollon area and before about A.D. 1300 in the Anasazi area, these sorts of motifs are unknown, with anthropomorphs and zoomorphs being fairly simply depicted. After A.D. 1300 the presence of Jornada influence and presumably ideologies is evident among the Rio Grande Anasazi in the form of Rio Grande style rock art and in the kiva murals of Pueblo IV sites. In content, it is basically the same as the Jornada style to the south, from which it is presumed to be derived.

Of interest here are the features of the masks (kachinas) present in both the Jornada and Rio Grande rock art styles. Looking at Jornada style masks, Schaafsma (1980) notes the presence of toothed mouths (p. 203), protruding tongues which may be divided and design-filled (pp. 217, 241), horizontal facial division, and says of the eyes (p.211):

The eyes are typically almond shaped, although square and round eyes are also depicted. A central dot or vertical line designates the pupil in most instances, but at San Diego Mountain two dots were used...Eyebrows are common.

Examples of these features can be seen in Schaafsma 1980 (Figs. 154, 166, 167-170,172,174; Plates 19-23).

While no examples were seen of masks with rainbows above them, rainbows or rainbow-like motifs are also an integral part of Jornada style rock art (Schaafsma 1980:203,235, Figs. 188 and 189).

Rio Grande style masks also possess toothed mouths (Schaafsma 1972: Figure 121; 1980:Figures 209,210,225), occasionally exhibit horizontal facial division, rarely depict tongues, but still depict eyes and pupils in a variety of ways including dots, double dots and vertical lines (Schaafsma 1980:260). Rainbows are apparently a minor element, or completely lacking in Rio Grande style rock art.

Though the kachina cult never flourished on the northern fringe of the Pueblo provinces, a bowl sherd with a Jornada/Rio Grande style mask in it from Pot Creek Pueblo attests to at least a limited knowledge of the cult (Wetherington 1968:56-57; Schaafsma and Schaafsma 1974:538). This sherd of Talpa Black-on-white, which type dates between about A.D. 1250-1400, shows
a circular mask with a toothed rectangular mouth, at least one horn, and what may be either a tongue or neck.

In the Western Pueblo area of Arizona very little recording of Pueblo IV rock art has been accomplished, however Pilles (1974) has recorded some sites on the Little Colorado River between Holbrook and Winslow. Kachina masks in a Jornada/Rio Grande style occur here too, with circular faces and toothed rectangular mouths (Pilles 1974:Fig. 20,22).

Other than the Jornada, Rio Grande, Western Pueblo and Salado areas, one presumed kachina depiction with a toothed diamond-shaped mouth is known for Mimbres Black-on-white (Tamarin and Clubok 1975:42). From Casas Grandes, faces and full-length figures with toothed rectangular mouths can be found on Ramos and Escondida Polychromes (DiPeso 1974:Fig. 5-3). At this time the niceties of the temporal and geographic relationships at work in the diffusion of various religious motifs in general, and the kachina cult in particular have yet to be worked out. How these Mimbres and Casas Grandes depictions relate to the Schaafsma's proposed Jornada area to Rio Grande area diffusion scheme is unclear. That Mesoamerican, and prehistoric and historic Southwestern religious/mythological iconography are all closely related is clear though. The explication of these relationships still presents challenging areas for work (for recent studies, see the discussion in DiPeso 1974:546-569, 768-773; Brody 1977:200-210; Carlson 1980).

One additional ceramic depiction is important to note here. Fewkes (1904:Fig. 105) illustrates what is almost certainly a Four Mile Polychrome bowl from Four-mile Ruin. It shows a central figure made up of a tall rectangle filled with geometric designs, with a smaller trapezoid or rectangle atop it. For a base it has a serrated figure with the "teeth" pointed town. Above it is a horseshoe-shaped arc with scalloping. Fewkes (1904:157) interpreted the serrate base and the arc as a rain symbol and a rainbow representation, respectively. I would agree with these interpretations and add that this figure is probably closely akin to those which Schaafsma has identified in Jornada style rock art as being the Southwestern equivalent of the Mesoamerican Tlaloc or Rain God. Schaafsma (1980:203, 208) describes the "classic" Tlaloc to be found in Jornada rock art as
...abstracted anthropomorphic designs consisting of a trapezoidal or rectangular head above a similarly shaped, larger block representing the body...Their outstanding feature, in addition to their shape, is the large round or square eyes that occupy the top half of the head. The lower half may be solid or filled with vertical hachuring or geometric designs. The appendageless torso is commonly covered with decorative geometric motifs incorporating opposed stepped elements and angular blanket motifs characteristic of the style.

Though the diagnostic goggle eyes are lacking, the overall appearance of Fewkes' Four Mile bowl figure compares well with Jornada Tlaloc figures illustrated by Schaafsma (1972:Fig. 63 and 94; 1980:Fig. 163).

A fringed "rain kilt" is also an integral part of many Jornada Tlaloc motifs (Schaafsma 1980:208, 236, Fig. 165) and the serrated base of Fewkes' Four Mile example is probably such a kilt symbol - a rain symbol, just as Fewkes said.

Tlaloc figures are curiously absent in Rio Grande style rock art (Schaafsma 1980:254-255), or rare to the point that none have yet been recorded. Nevertheless, based on the bowl described above, it is proposed that the Tlaloc symbol and its rain-associations were known to the Western Pueblos, even if its full significance and exact identity may not have survived intact its diffusion to that area. Similarly, Tlaloc representations on Mimbres Black-on-white are virtually unknown, but what may be one such figure (Cosgrove and Cosgrove 1932:Plate 229f, Brody 1977:Fig. 172) suggests the symbolism may also have been introduced from the Jornada area into the Mimbres area at an earlier date, but also failed to become established in this area. See Schaafsma (1980:235-237) for a fuller discussion of Jornada/Mesoamerican Tlaloc parallels.

While it may not be possible to differentiate between individual kachinas in these ceramic depictions, it may be significant that most are simply circular, the shape which Ellis and Hammack (1968:35) state is the usual form used by the historic Pueblos to depict the important supernatural, Sun, or Sun Father. They illustrate (1968:Fig. 3) a pictograph in Arrow Grotto which is rounded and has a toothed rectangular mouth, which they identify as Sun.
On the other hand, variability in kachina depictions does occur. As noted earlier, prehistoric kachina-related paraphernalia are rare, but several painted stone slabs with kachina representations have been found, at Kinishba (Cummings 1953:226, Plate 29) and at AZ W:10:47 and AZ W:10:50 at Point of Pines (DiPeso 1950), all Western Pueblo sites dating in the 1300's. These four slabs show kachinas in a variety of colors and distinctive mask shapes. All have horizontally divided faces and two from Point of Pines have toothed rectangular mouths.

DiPeso (1974:768, Figs. 4-3 and 5-3, footnote 20 on 966) definitely identifies various rectangular toothed mouth depictions as the Pueblo So'yok woman kachina and cites Smith's (1952:296,298, Figs. 27d and 51b) work on the Awatovi kiva murals. (Smith (1952:296,298), however, is actually more cautious about the identification of specific personnages, and he suggests that a combination of features (only one of which is the toothed mouth) points to Soyo'kwuqt for one of the figures in the murals.

In a similar conservative vein, this author suspects that even though many of the depictions discussed share similar, generalized features (toothed mouth, horizontally divided face, etc.), this is probably indicative of their relatedness in an artistic tradition, more than it is of their unity of identification with a single kachina. Differences in such things as nose, mouth and face shape, eye treatment, and the colors used, and various combinations of these attributes could all be subtle indicators of differences of identity among these two-dimensional depictions.

By now the similarities of kachinas in Jornada and Rio Grande style rock art with the various mask depictions on pottery described above should be evident. The above data are background for three points. (1) The numerous mask depictions on pottery in the Western Pueblo area of Arizona and New Mexico do provide evidence for the presence of the kachina cult in the Western Pueblo area (which is presently sparse in terms of recorded rock art or preserved prehistoric kachina paraphernalia). (2) These depictions support the 14th century dating of the proliferation of the cult in the Rio Grande and Western Pueblo area. (3) These depictions do not provide a further basis for evaluating why or how the kachina cult spread.
within the Southwest, or the validity of the socio-cultural inferences which are presented by Schaafsma and Schaafsma (1974:543-544), only evidence that it did indeed spread.

As the cult moved north out of the Jornada area and into the Rio Grande area, the face shape in mask depictions was often more rounded than flat on top as in the Jornada area, and though the masks became somewhat less varied and complex overall, they still retained the toothed mouth and occasionally the elaborate eye/pupil features of the Jornada style. This is presented graphically in Schaafsma (1980:Fig. 199). With ceramics (and possibly with rock art in the future) we can now expand this chart with the observations that as the cult moved west from the Rio Grande into the Western Pueblo area, mask depictions are predominantly circular, occasionally semicircular with the flat side down, and continue to retain the toothed (often rectangular) mouths, almond-shaped eyes and varied eye/pupil treatments to be found in the Jornada style from which they are descended. Though the cult is presumed here never to have reached the Salado area, some of its associated motifs did. The sole example presently known retains the omnipresent toothed rectangular mouth, but set in the semicircular mask shape which gained popularity in the adjoining Western Pueblo area.

Arizona State Museum
Tucson, Arizona

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Figure 1a was probably taken by Irene Vickrey and is reproduced courtesy of the Clara T. Woody Museum and the Arizona State Museum. Figure 1b was drafted by Ronald J. Beckwith, University of Arizona. Figure 1d was taken by Nancy Hunter Warren and is reproduced courtesy of David Snow and the Laboratory of Anthropology, Museum of New Mexico. Figure 2a is reproduced courtesy of the Field Museum of Natural History, Chicago. Figure 2b was taken by, and is reproduced courtesy of, Jerry D. Jacka. Figures 1c, 2c,
2c, 2d and 2e were all taken by Helga Teiwes, and are reproduced courtesy of the Arizona State Museum. R. Gwinn Vivian kindly took the time to read an earlier version of this paper. His editing and suggestions contributed much to the clarity of the final version.
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SALADO POLYCHROME POTTERY

JON NATHAN YOUNG

INTRODUCTION

In 1967 I wrote a dissertation on The Salado Culture in Southwestern Prehistory. A major portion of that monograph dealt with a detailed analysis of the decoration of 521 whole Salado Polychrome vessels in the collections of the Arizona State Museum in Tucson. This paper is a summary of some of the observations resulting from that analysis. Supporting details, data, and documentation not included here are to be found in the dissertation. The accompanying illustrations flow from the pen and genius of Karen Sue Young. Although Ellis (1928, 1930, 1936) was the first to mention Salado pottery in anything more than a cursory fashion, the most detailed and useful descriptions of the Salado Polychromes are those of Colton and Hargrave (1973:87-91) and Haury 1945:63-80). The description of Colton and Hargrave do not agree with those of Haury in every particular, but with one major exception they are essentially similar. I will examine this exception later in my discussion of the red-base variety of Tonto Polychrome.

I used the Colton and Hargrave and Haury definitions as the foundation of my examination of the large collection of Salado Polychrome vessels. As I became more familiar with the material I began to notice many relatively minor areas where the descriptions could be amplified or modified. These gradually coalesced into several general observations. In the pages that follow, I will outline several of the incidental observations and three of the major ones.

INCIDENTAL OBSERVATIONS

Dual-Balanced Designs

Haury (1945:73) uses Kidder's (1924:110) concept of the dual-balanced design in his discussion of the design structures that are
Figure 1. Example of Dual-Balanced Design. Gila Polychrome bowl from Kinishba, Arizona (Arizona State Museum Cat. No. 20000). Maximum diameter 22.5 cm.
characteristic of Salado Polychrome bowls (Figure 1). He states that: "while suggestions of this form are to be seen in Pinto Polychrome, it reaches its greatest degree of multiplicity in Gila Polychrome." My investigations indicate that the situation may not be quite as clearly and sharply defined as Haury's statement would indicate. Although 43% (115) of the 266 specimens of Gila Polychrome that I examined exhibit a dual-balanced design, the Tonto Polychrome exhibit a slightly greater percentage: 45% or 27 of 60 bowls. In the Pinto Polychrome sample, almost 50% (19 of 39 bowls) display this form of design structure.

Undecorated Centers

The very center portion of all Salado Polychrome bowls is always covered by a solid color. Usually it is white; occasionally red; and, very rarely, black. This central portion often carries no design elements whatsoever, giving the visual impression of being left undecorated. Haury (1945:74) sees this as an early trait that "lost ground, giving way to all-over patterns" in later Salado Polychromes.

The data presented in Figure 2 tend to support Haury's comment that the popularity of undecorated bowl centers decreases through time: 56% of the Pinto Polychrome vessels analysed are characterized by undecorated center areas, but only 44% of the Pinto-Gila, 34% of the Gila, and 42% of the Tonto vessels. However, whereas rectangular undecorated centers slightly predominate over circular ones in the Pinto Polychrome vessels, circular centers become increasingly popular in subsequent types (59% of the Pinto Polychrome undecorated centers are rectangular, 50% of the Pinto-Gila, 50% of the Gila, and 24% of the Tonto).

Figure 2 also indicates that closed undecorated bowl centers (center portion separated from the rest of the design field by a fully closed circle or rectangle) always predominate over undecorated centers with circular or rectangular boundaries that are not formally closed: 76% of the Pinto Polychrome undecorated centers are closed, 67% of the Pinto-Gila, 56% of the Gila, and 60% of the Tonto. The decrease in popularity is especially marked in the case of the formally closed circular centers. They
Figure 2. Frequency of Undecorated Center Areas in Salado Polychrome Bowls.
constitute 100% of the Pinto Polychrome bowls with circular undecorated centers, but only 83% of the Pinto-Gila, 80% of the Gila, and 63% of the Tonto.

**Life-Lines**

A number of scholars have offered comments concerning the life-line phenomenon as it appears in the decoration of Salado Polychrome vessels (Chapman and Ellis 1951:257; Colton and Hargrave 1937:88-91; Ellis 1927: 52; Kidder 1916:266, 1924: 110). The most succinct and useful introduction to this subject is that provided by Haury (1945:76) "the heavy broken line. .  .  which is such a prominent feature in Gila Polychrome, occurs both on bowls and jars alike. The band is not ever present nor is it always broken, but it is, nevertheless, one of the outstanding traits of the decorative complex. Jars sometimes exhibit two life-lines."

Figure 3 provided documentation for Haury's statements. The life-line is not always present on Salado Polychrome vessels, and when it is, it is more often unbroken than broken. Although Colton and Hargrave (1973:89-91) and Ellis (1928: 52, 57) state that life-lines do not occur on Pinto Polychrome vessels, they occur 18% of the time in the present sample (seven vessels out of forty). Similarly, although Colton and Hargrave (1937:88-90) claim that the life-line is always present on Gila Polychrome vessels, 6% of the sample analyzed in this study lack it (15 vessels out of 266). My analysis indicates that there was a rapid increase in the popularity of life-lines from Pinto through Gila Polychrome and an equally rapid decrease in the popularity from Gila to Tonto Polychrome.

In 1916 (p. 266) Kidder recorded that the line-break is "always present" in Salado decoration. Chapman and Ellis (1951:257) restated virtually the same idea by saying that the broken life-line is "almost a constant element" of the Salado types. Data available now indicate that these statements must be modified, because the broken life-lines are never as popular as the unbroken variety (Figure 3). The life-lines that appear on Pinto Polychrome vessels are always unbroken. Broken life-lines begin to appear in the Pinto-Gila Polychrome sample, but are present on only about one-sixth of the total number of vessels of that type which carry life-lines. In the Gila Polychrome sample there are almost as many vessels
Figure 3. Frequency of Life-Lines on Salado Polychrome Vessels.
carrying only broken life-lines as there are vessels with only the unbroken variety. The faint beginnings of the practice of including at least one broken and one unbroken life-line on the same vessel (2% of the total life-line sample) also appear on Gila Polychrome. In the Tonto Polychrome sample the percentage of vessels that carry no life-line whatsoever increases markedly, from 6% in Gila Polychrome to 38% in Tonto Polychrome; the ratio of unbroken life-lines as compared to broken ones increases; and the percentage of vessels that incorporate both broken and unbroken life-lines quadruples from 2% in Gila Polychrome to 8% in Tonto.

Haury's comment (1945:76) that Salado Polychrome jars sometimes carry two life-lines is a definite understatement, as far as the present sample is concerned. Jars may carry not only two life-lines, but also three, and occasionally four (Figure 4). Multiple life-lines appear in the decoration of bowls as well as jars. All of the examples of multiple life-lines that appear in the Pinto, Pinto-Gila, and Gila samples occur exclusively on bowls (only two of the 334 vessels in the total sample of Pinto, Pinto-Gila, and Gila vessels are not bowls). Six of the 51 bowls in the Tonto Polychrome sample have multiple life-lines; three others have three life-lines each.

The relative popularity of the practice of placing more than one life-line on a single vessel remains at a fairly low and uniform level in Pinto, Pinto-Gila, and Gila polychromes. Then, in Tonto Polychrome the percentage of vessels that include more than one life-line increases markedly, even though the percentage of vessels that do not have even a single life-line in their decoration is more than six times as great as it is in Gila Polychrome. In the Pinto Polychrome sample, 14% (one of the seven specimens) have multiple life-lines, as opposed to 11% (two of the 19 specimens) of the Pinto-Gila, 11% (27 of the 251 specimens) of the Gila, and 41% (47 of the 116 specimens) of the Tonto.

Not only is there a marked increase in the popularity of including more than one life-line in the decoration of Tonto Polychrome vessels, but also there is a considerable variation in their location. When more than one life-line occurs on Pinto, Pinto-Gila, or Gila vessels, the total is always two. These two are always arranged so that one occurs at or
Figure 4. Examples of the Use of Multiple Life-Lines in the Decoration of Salado Polychrome Vessels.


c. Tonto Polychrome from Roosevelt 5:9, (Arizona State Museum Cat. No. GP 11680).

d. Tonto Polychrome from Gila Bank Ruin, (Arizona State Museum Cat. No. 18345).

Scale 1 (a-c). Maximum diameter of a is 18 cm.
Scale 2 (d). Maximum diameter of d is 37.5 cm.
Figure 5. Examples of the Placement of Life-Line Breaks on Salado Polychrome Vessels with more than One Broken Life-Line.


e. Tonto Polychrome jar from University Indian Ruin, (Arizona State Museum Cat. No. 21354).

Scale 1 (a, b, d). Maximum diameter of b is 14 cm.
Scale 2 (c, e). Maximum diameter of c is 37.5 cm.
Figure 6. Examples of Tonto Polychrome Effigy Vessels.

a. from Christmas, (Arizona State Museum Cat. No. 16923).

b. from Anglers Inn, (Arizona State Museum Cat. No. 17285).

c, g. provenience unknown, (Arizona State Museum Cat. Nos. GP 11478, 23705).


h. from Kinishba, (Arizona State Museum Cat. No. A 7370).

Maximum diameter of g is 16.5 cm.
Figure 7. Frequency of Hachure on Salado Polychrome Vessels.
near the rim of the vessel, forming the uppermost (excluding possible rim-ticking) segment of black decoration. The other occurs near the base constituting the lowermost portion of black decoration or, often, enclosing a unitary center design. In Tonto Polychrome vessels this arrangement is still popular, but it is not the only one. In addition to appearing at the very top or near the bottom of the design field, life-lines also appear on Tonto Polychrome in positions that are intermediate to these two. These intermediate life-lines occur in all possible combinations with the other two. An intermediate life-line may occur with an upper life-line, or an intermediate with a lower life-line, or an intermediate life-line with both upper and lower life-lines (Figure 4).

Multiple life-lines occur much more frequently on the red-base variety of Tonto Polychrome than on those Tonto Polychrome vessels that incorporate red into the decoration. All seven of the Tonto Polychrome bowls that have multiple life-lines are of the red-base variety; 30 of the 44 Tonto Polychrome jars that have multiple life-lines are also of the red-base variety. The practice of leaving an intentional break in these life-lines increases in popularity through time. When more than one broken life-line appears on a single vessel, the breaks sometimes occur in approximately the same position on both life-lines, such that a vertical section cut through the vessel so that it would pass through one line-break would also cut through the other (Figure 5 a, c). More often, though, the breaks are so arranged that they fall in multiples of approximately 90 degrees, often 180 degrees, from each other (Figure 5 b-e). The breaking of life-lines is carelessly done and the relative positioning of breaks, although normally arranged in various multiples of 90 degrees from each other, is never exactly in those proportions. Even when two line-breaks are arranged so that the breaks occur one above the other, they are never positioned in a completely accurate fashion.

**Life Forms**

Although Kidder (1924:110) found no "life forms, either plant, animal, or symbolic" on the Salado Polychromes, later workers have identified several. Animal forms and symbols as well as corn symbols appear
Figure 8. Examples of the Intermediary Relationship of Pinto-Gila Polychrome to Pinto and Gila.
Figure 9. Frequency of Apparently Intentional Imperfections in the Decoration of Salado Polychrome Vessels.
Figure 10. Examples of the Presence or Absence of Apparently Intentional Imperfections in the Execution of Designs on Salado Polychrome Vessels.


d, e, g. Tonto Polychrome jars from Gila Pueblo, (Arizona State Museum Cat. Nos. GP 12738, GP 12542, GP 12489).


Maximum diameter of d is 18 cm.

a, b - no obvious imperfections
c-e - a single obvious imperfection
d, g - several obvious imperfections
fairly frequently. Those life forms which I was able to recognize on the Salado Polychrome vessels in the present sample are summarized in Table 1.

All of the effigy vessels in the Salado Polychrome sample are Tonto Polychrome jars. Even though all but one of the 14 effigy vessels appear to represent birds, they present a wide range of variation (Figure 6). In most of the examples of effigy art, the head and tail portions have been modeled in the round and extend out from the body of the vessel. In bird effigies that have elongated beaks, the small wing protrusions have been given similar treatment (Figure 6c, d). In one instance there are neither tail nor wing extensions from the body, and the face protrudes in relief from the neck of the jar (Figure 6g). The vessel fragment pictured in Figure 6h is structurally similar to the latter vessel and has been included only for comparative purposes and because of its unique nature; because it is only a fragment and not a whole vessel, it and its various features have been excluded from the analysis.

There appears to be a general increase in the popularity of the use of life forms from Pinto Polychrome through Tonto Polychrome (Table 1). This increase is gradual at first, but is marked between Gila and Tonto: 8% of the Pinto vessels in the sample carry life forms, 11% of the Pinto-Gila, 12% of the Gila, and 29% of the Tonto. Tonto Polychrome is distinguished not only by the fact that a much higher percentage of its vessels carry life forms, but also by the fact that it is the only type in the sample that carries (occasionally) more than one type of life form on a single vessel. In the Tonto Polychrome sample, life forms are twice as likely to occur on traditional vessels as they are on the red-base variety. Corn symbols are four times more likely to occur on traditional Tonto vessels than they are on redbase vessels. All five occurrences of the ram's-head variety of the bird wing motif are on traditional Tonto vessels.

Hachure

Colton and Hargrave (1937:88, 91) have written that the designs encountered on Pinto Polychrome vessels consist mostly of opposed solid and hachured elements, that the occurrence of hachure is "very rare" on
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Hachure

Colton and Hargrave (1937:88, 91) have written that the designs encountered on Pinto Polychrome vessels consist mostly of opposed solid and hachured elements, that the occurrence of hachure is "very rare" on
Gila Polychrome vessels, and that the occurrence of hachure is "rare" on Tonto Polychrome vessels. Insofar as the present Salado Polychrome sample is concerned, 60% of the vessels bear hachured designs. The popularity of hachure as an element in the design of Salado Polychrome vessels steadily decreases through time (Figure 7). Hachure is present on 87% of the Pinto Polychrome vessels, 79% of the Pinto-Gila vessels, 55% of the Gila vessels, and 41% of the Tonto vessels. Thus, it cannot be said that hachure is "very rare" in the Gila Polychrome sample, nor that hachure is "rare" in the Tonto Polychrome sample.

Designs carried on Pinto Polychrome vessels in the present study are not mostly opposed solid and hachured designs. The popularity of the technique of opposing solid and hachured elements decreases very rapidly from Pinto through Tonto Polychrome. After a high of 46% in Pinto, only 14% of the Pinto-Gila vessels carry opposed solid and hachured element, 3% of the Gila and 2% of the Tonto.

MAJOR OBSERVATIONS

Red-Base Variety of Tonto Polychrome

Haury (1945:64) writes: "Tonto Polychrome is distinguished by its use of red with the black and white as a decorative color, while Gila Polychrome employs only black and white in patterns, and red was used to cover those areas not ornamented." This is opposed to Colton and Hargrave (1937:91) who say that in Tonto Polychrome the "painted zone never extends much below greatest diameter of body; red below that point." At issue here is the typological classification of those vessels whose basal (or, in one instance, neck portions are red, but which do not incorporate red into the design proper. Of the 521 whole vessels I examined, 86 (16%) fell into this category. Based on a wide variety of objective and subjective criteria, it is my belief that the red-base vessels are a variety of Tonto, rather than Gila Polychrome.
<table>
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* Figures and percentages in the Tonto Polychrome column are correct. Sums do not total because more than one category of life forms occasionally appear in the decoration of a single vessel. x Percentage less than 0.5

Table 1. Frequency of Life Forms in the Decoration of Salado Polychrome Vessels.
Pinto-Gila Polychrome

In several instances (28 out of 334) it was impossible to decide whether a given vessel was Pinto Polychrome or Gila Polychrome. It had already been ascertained that, contrary to earlier conceptions, life-lines do occasionally (18% of the time) occur on Pinto Polychrome vessels and are not always present on Gila Polychrome vessels. Thus, a factor such as the presence or absence of life-lines could not be used for assigning the 28 vessels (which accounted for 8% of the Pinto Polychrome-Gila Polychrome sample) to either the Pinto or Gila categories. In almost every aspect that was examined these vessels appeared to be stylistically mixed, lying in a position intermediate between Pinto and Gila Polychromes. Figure 8 presents some of the more pronounced and easily documented examples of this intermediacy. In addition to those more specific factors, there is a whole series of less objective impressions which I gained as a direct result of my familiarity with the total number and range of vessels in the Salado Polychrome sample. These more subjective impressions included such aspects as specific design elements and layouts, rectilinear versus curvilinear elements, relative line widths and numbers, relative care in the execution of designs, relative simplicity or complexity of designs, amount of available space that is left undecorated, vessel size and shape, and rim forms. Aspects such as these serve as the basis for a subjective feeling that Pinto-Gila Polychrome is, indeed, a style that lies in a position intermediate between Pinto and Gila Polychrome.

Intentional Imperfections

Soon after I began to closely examine individual specimens in my collection of whole Salado vessels, a rather curious and fairly regular phenomenon became noticeable. As the course of repeated elements and motifs was followed in the decoration of a given vessel, it became apparent that in almost half of the vessels in the sample one or several of the motifs, rather than being exact replicas of their fellows, were slightly different (Figure 9). For example, a single negative white rectangle with a black dot in the center would appear in one half of a dual-balanced design, but not
in the other half (Figure 10c). In other contexts the same white rec­tangular motif, which normally contained a black dot in the center, in a single instance would omit the dot (Figure 10e). There are perhaps a dozen situations, such as the two just mentioned, which recur over and over again in the Salado Polychrome sample. Because this phenomenon occurs with such frequency and because the imperfections are usually quite obtrusive and obvious, I am inclined to believe that they were made intentionally rather than inadvertently. If these imperfections were made intentionally the question immediately follows is: Why? Certainly no definitive explanation can be put forward here. But it's fun to speculate. Maybe we are seeing here a parallel between the practice of breaking the life-lines on Salado and certain other ceramics and the Navajo practice of leaving a similar spirit-exit in the decoration of such items as ceramics, rattle sticks, sandpaintings, and woven articles (Ellis 1928:58; Franciscan Fathers 1929:287, 294, 367, 375; Hill 1937:16, 21; Kluckhohn and Leighton 1962: 201, 306; Tschopik 1941: 48). And maybe there is a parallel between the Salado incorporating one or more obvious imperfections into the decoration of a vessel and the Navajo practice of intentionally placing one or more obvious imperfections in those sandpaintings that are not going to be destroyed before the sun has set on the day of their construction (Kluckhohn and Leighton 1962:306; Reichard 1963:160).
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A RIO GRANDE GLAZE BOWL FROM SOUTHERN ARIZONA:
ROUTES OF PUEBLO TRADE

ALAN FERG and KARL J. REINHARD

The Sobaypuris on the San Pedro were in commercial intercourse with some of the northern pueblos. Fray Marcos mentions among other objects which he saw in use turquoises brought from Zuni....explorers should not be startled at finding...objects peculiar to the religious and house life of the natives of New Mexico and Northern Arizona. Such finds should not be taken as evidence of anything but aboriginal commerce in ancient times.

Bandelier 1892a:476

INTRODUCTION

In the fall of 1978, Robert Temarantz brought a small decorated bowl into the Arizona State Museum for identification. It had been found along with three shell ornaments and two (or possibly three) plainware vessels eroding out of the bank of the Santa Cruz River at, or very near to the site of Mission Guevavi (Arizona State Museum site no. AZ EE:9:1), some five miles north-northeast of Nogales, Arizona. These items were originally collected in the 1930's by Temarantz's great uncle, Jim Pendilton. Contacted in November 1980, Pendilton could not recall any additional information concerning their discovery. The small size of the decorated bowl and the one plainware bowl brought into the Museum, their association with shell ornaments, and the fact that all of the objects were found together suggests they may well have been grave goods for an aboriginal burial, although no human remains were reported.

While inhumations of various ages and prehistoric cremations are not uncommonly found washing out of drainages in southern Arizona, the decorated bowl in this assemblage is a Rio Grande glaze-on-yellow type, apparently the first recovered from southern Arizona. The remainder of this paper will
Figure 1. Glaze bowl and shell ornaments found at Mission Guevavil.
first describe the materials examined and then discuss the possible routes and agencies which brought a bowl some 400 miles from its place of manufacture to Mission Guevavi.

THE ARTIFACTS

The glaze bowl (Figure 1) has an almost flat base with short walls and an almost vertical rim (Figure 2a). Slightly out of round, the mouth's diameter ranges from 12.5 - 13.5 cm. The rim is almost imperceptibly incurving, with the greatest vessel diameter actually about 0.5 cm. below the lip, and ranging from 12.8 - 13.6 cm. Bowl height is 5.4 cm. Wall thickness ranges from 5 - 7 mm. Though rim height and thickness are not perfectly even, the lip is consistently flattened. The base of the bowl is heavily spalled and there is a chip out of the rim; from these exposures the paste can be seen to be bright orange. The bowl has an unevenly applied and polished cream-colored slip, inside and out. It is so thin in spots that the paste color can be seen through it; where extra thick it is crazed. On the interior there are several faint streaks of red paint or slip atop the cream slip but under the glaze decoration; they suggest slip material which may have been left on the polishing stone from its last use on a red slipped vessel. The exterior has two black fire clouds, one small, one large. The glaze paint ranges from greenish to very dark brown in color. The designs consist of four more or less evenly spaced "x" marks around the exterior and three hatched triangular motifs on the interior, placed immediately below the lip (Figure 1). The lip is not painted.

A megascopic and microscopic examination of the paste and temper by A. Helene Warren (pers. comm.) revealed that this bowl is tempered with subangular quartz particles, possibly sand (20-30% of the temper), feldspar (40-50%), and hornblende (15-20%). Such temper can be classed as sandy hornblend latite. While positive identification of the source of this temper type is yet to be made, it appears to be local in the Galisteo Basin, and may well be diagnostic of pottery made at Galisteo Pueblo (Museum of New Mexico site no. LA 26) (Warren, pers. comm.; 1974:89-90; 1979:191-192, 194). Galisteo Pueblo is located about twenty miles south of Santa Fe.
Figure 2. (a) Cross section of the glaze bowl. (b) and plainware bowl with a rim coil found at Mission Guevavi. Life size.
Unfortunately this bowl is small and not particularly diagnostic in either form or decoration, and has attributes which can be found on both Cieneguilla Glaze-on-yellow or late, post-1700, glaze types. The points of interest here are:

1. The vessel form, in particular the flattened rim, is typical of early Rio Grande glaze vessels, but this form reappears late in the sequence (Warren, pers. comm.); therefore this bowl could date either around 1375-1400 or post-1700. Very similar looking small glaze-on-yellow bowls were recovered at Tonque Pueblo (Barnett 1969:177-178, Figure 133) but it cannot be determined from the report whether they are of early or late types.

2. The design is similarly inconclusive: the "x" marks on the exterior are "typical of the early glazes and rarely occur on late bowls, unless the bowls...are forms generally termed 'condiment' or 'prayer-meal' bowls (Snow, pers. comm.)." This bowl is small enough that it could be considered as one of these specialized or aberrant forms. The hatched interior designs are unusual, but may well be more typical of the early end of the glaze sequence (Harlow, pers. comm.).

3. Sandy hornblende latite can occur as temper in early types at Galisteo Pueblo (Warren 1974:89) but is more typical of late types (Warren, pers. comm.). For glazes made after 1700, Warren believes Galisteo to have been the main production center (up to about 1750), and that these wares were widely traded (pers. comm.; 1974:89; 1979:191-192).

The above information indicates the bowl was probably made at Galisteo Pueblo, and brackets its dates of manufacture as either 1375-1400 or 1700-1750. The form and decoration strongly suggest that the bowl is early, Cieneguilla Glaze-on-yellow, while the temper and an associated Piman bowl (discussed next) hint at the possibility of a late date of manufacture.

Of the plainware vessels found with the glaze bowl, the only one to be examined was a small complete bowl which had been reconstructed from sherds. The vessel forms of the other one or two plainware pots are unknown. The reconstructed bowl was examined only once, and no measurements were taken at that time. The bowl has subsequently been lost, and the
dimensions and cross-section (Figure 2b) were derived from color slides with a scale in them, taken at the time of its examination. This bowl is approximately 14 cm. in diameter, 6 cm. in height and subhemispherical in shape. The paste is light brown in color and sand tempered. About one-third of the exterior is covered with a black fire cloud. The only temporally diagnostic feature of this bowl is the presence of a rim coil. A rim coil is simply the last coil added to a vessel during its manufacture; it is then left unobliterated. In this case it was slightly pinched to form a triangular lip (Figure 2b). Though the exact origin or inspiration for this rim treatment is unknown, rim coils can be found on Papago ceramics throughout the 19700's, less frequently in the 1800's, and probably disappear entirely by 1900 (DiPeso 1953:148-151; Haury and others 1950: 344-345; Fontana and others 1962: 103-105; Robinson 1976:155; Masse 1981:37-38). Rim coils also occur on historic Western Apache (Gifford 1980:164, Figures 117 and 125) and Hope (Jeddito Plain) jars, but their derivation and dating is nebulous at present.

Little else can be said about this plainware bowl. Its rim coil places it definitely within the historic period, and a date of manufacture in the 1700's is most compatible with its more typically early use of a rim coil and absence of organic temper. By association, the glaze bowl, regardless of whether it is an early or late type, probably arrived in southern Arizona in the 1700's.

Of the three shell ornaments found, two are Glycymeris sp. bracelets or pendants and one is a Conus sp. finger ring or pendant (Figure 1). All three are slightly chalky in texture but generally unweathered. The bracelets have no marine worm holes and some purpose coloring is still present on the muscle scars, indicating they were manufactured from fresh valves. The bracelets measure about 5.5 cm. and 6.1 cm. in diameter, with band widths and thicknesses of 5.7 x 4.6 and 6.1 x 4.3 mm., respectively. Both bracelets had been ground on top and bottom with the perforations in the umbos also accomplished by grinding. The Conus ring is 1.7 cm. tall with a maximum exterior diameter of 2.8 cm. It was ground to shape, top and bottom.
If the glaze bowl was made after 1700, ethnographic references support four possible explanations as to how it might have found its way to Guevavi. They are presented below in what appears to be their increasing order of probability. If, as seems more likely, the bowl is Cieneguilla Glaze-on-yellow, made between about 1350-1425, the picture is somewhat more complicated. The bowl must have been kept as an heirloom, either (1) prehistorically, before it was traded out of the Pueblo region in historic times, or (2) if traded to southern Arizona in prehistoric times, it was kept there in some sort of care or circulation until it was ultimately buried in the 1700's. If traded prehistorically, only the last three explanations below would be applicable, and would have to be viewed as ethnographic analogies extrapolated back into prehistory. Even so, such analogies should be eminently suitable for the discussion of late 14th/early 15th century Pueblo trade routes and mechanisms.

(1) A priest may have received the bowl as a gift during a visit to the Rio Grande, Zuni or Hopi areas, and returned with it to Guevavi.

(2) The bowl could have come directly from the Rio Grande area with traders bound for Sonora.

(3) The bowl could have been traded from the Rio Grande to Zuni and thence to southern Arizona.

(4) The bowl could have been traded to Hopi (either directly or through Zuni) and then on to southern Arizona.

Each of these possibilities is discussed below.

MISSIONARY TRAVELS

Even as Pueblos will often exchange small gifts (often pottery) with Indian visitors, so too might a travelling Catholic priest have received the Guevavi glaze bowl upon his arrival or departure from Hopi, Zuni or a Rio Grande Pueblo. In fact, gifts were frequently given to priests upon their arrival, as Ayres (1970:47) notes, but all of his examples (Karns 1954:138; Bolton 1960:273; DiPeso 1956:49) are early in time and from tribes...
in southern Arizona. It is unknown whether priests would have received similar cordial treatment at the Pueblos, especially after the Revolt of 1680 and reconquest in 1692.

Mission Guevavi was sporadically visited, staffed, abandoned and restaffed between 1691 and 1774. Though presumably situated near to the native villages it served, no early historic Piman sites have been recorded in its immediate vicinity or beneath the Jesuit convento itself, built around 1746 (Robinson 1976:137). Thus, though a priest may or may not have had anything to do with the procurement of the glaze bowl, it most probably arrived in the area during the years in which Guevavi was functioning as a visita or full church, and a hub of activity to Pimans and Europeans alike. See Kessell (1970) and Robinson (1976) for histories of the Mission and the archaeological work carried out there from 1964-1966. No puebloan ceramics of any kind were recovered during these excavations.

RIO GRANDE TRADE

The Rio Grande Pueblos maintained extensive trade networks with the Plains Apache, Comanche, Ute and Navajo (Kenner 1969; Warren 1970; Ford 1972; Snow 1981). Trade was also strong, of course, with the Zuni and Hopi areas, as will be described later.

The Rio Grande Pueblos rarely traded with non-pueblo peoples to the south, Bandelier (1892b:4) notes annual Pueblo trading expeditions into Sonora up until 1859, "exchanging blankets, buffalo robes, turquoises, etc., for shells, coral, and parrots' feathers." A more detailed description appears in Bandelier's journal entry for March 7, 1884 (Lange and Riley 1970:237):

Up to 1859, regular caravans of Pueblo Indians from New Mexico visited Sonora annually, about October. Until they reached Magdalena (Sonora), they were under one common head or captain. Then, they separated into three bands to trade. They had zarapes, buffalo hides, etc., and traded them for rebosos, oranges, etc.
On the last day of November, the bands met at Hermosillo, and whichever did not come in until the third of December was given up for lost and all the rest left for home. In 1859, owing to an attempt at collection of duties, they never returned since.

Given the probability of earlier such expeditions, it is conceivable that Rio Grande traders themselves could have transported the Guevavi glaze bowl into southern Arizona or adjacent Sonora. This bowl might have been a trade item (though pottery does not appear to have been of interest to either the Pueblos or the Sonorans), or it could have been brought along as a gift to reaffirm friendly relationships.

**ZUNI TRADE**

The nature of trade at Zuni differed markedly from both the Rio Grande Pueblos to the east and the Hopi to the west. The Zuni seemed to rarely venture away from their villages to trade except with other Pueblo groups. Non-pueblo Indians who wished to trade with the Zuni had to travel to Zuni to do so. These tribes included the Pima, Opata, Southern Pima (Papago ?), Sobaipuri, Apache, Navajo, Havasupai and Walapai (Bandelier 1892b:3-4); Goodwin 1942:76; Cushing 1920:528-534, 635; Bahti 1974:1).

The Zuni traded for two main classes of goods: ceremonial needs and foodstuffs. Bandelier (1892b:3-4) remarked that:

...there existed, in 1539, and prior to it, quite an intercourse between Zuni and the land-tilling aborigines south of the Gila River. That intercourse took the form of journeys made by the Opatas, the Southern and Northern Pimas, and possibly the Eudeves and Jovas, to Cibona-Zuni, for the purpose of acquiring turquoises and buffalo hides, in exchange for which they gave parrots' feathers, and probably sea-shells, or which they earned by working for the Indians of Zuni. No mention is made of the people of Cibola visiting those of the south, which is quite natural, since buffalo hides and turquoises were more important to the latter than plumes and shells were to the former.
This also points up an apparently unique feature of Zuni trade, and that is Zuni willingness to barter goods for labor. This information is drawn from Fray Marcos de Niza's journal of 1539. However, Bandelier elsewhere (1890: footnote on 134-135), in discussing Opata whom the friar met, who were also bedecked with turquoise, directly contradicts this;

Where the Zunis obtained their turquoise is not yet positively ascertained; but it is quite certain that no Indians from another tribe went to Zuni to hire out their services in exchange for trinkets, or any other object of barter. They may have gone to distant countries to trade for them, or to dig for them themselves; but they certainly did not perform any work as journeymen or as hired hands among utter strangers.

Hence we are left in doubt as to whether such a labor-for-merchandise system was ever really in effect. So, though the medium of exchange is dubious, it is nevertheless generally indicated above, and is more strongly stated in the opening quotations of this paper, that the Sobai-puri (a Piman speaking tribe related to the Papago and Pima) were among those trading with Zuni. This is supported by other statements by Bandelier based on de Niza's journal. Speaking of de Niza among the Sobai-puri, he says (1890:144):

...the people knew Cibola from having been there. He (de Niza) even met a man who was a native of Cibola. He was aged, and had fled from there owing to some difficulty.

The importance of Zuni-Sobaipuri trade here is that the Sobaipuri occupied the San Pedro River Valley and probably portions of the Santa Cruz River Valley to the west. Hence a bowl traded from the Rio Grande to Zuni could have ultimately come to Guevavi via Sobaipuri entrepreneurs. Also, the glaze bowl could have come to Guevavi with a Sobaipuri during their retreat from Apache raiding in the San Pedro Valley. The Sobaipuri completely abandoned the San Pedro in 1762, going to live with (and ultimately be absorbed by) Papago along the Santa Cruz, who themselves were being enticed into the Santa Cruz Valley from desert areas further west, by the Spanish.
HOPI TRADE

The Hopi were perhaps the most trade oriented of all the Pueblo groups. Hopi trading parties travelled all over western and southern Arizona as well as to Zuni and the Rio Grande Pueblos. They served as important middle men in the east-west trade of goods between the Walapai and Havasupai peoples and the Rio Grande Pueblos. Since natural resources suitable for trade were not abundant at Hopi, they specialized in the manufacture of finished products such as pottery and garments of cotton or skin. They also traded for exotic goods which were then traded onward for profit. The Hopi trading sphere was extensive, and the exchanges made could be quite involved. For example, the Walapai traded deer skins to the Havasupai for agricultural goods. The Havasupai then prepared the hides and bleached them white to trade to Hopi for pottery and cloth. The Hopi made the white hides into moccasins for their own use and also for trade with the Rio Grande Pueblos, from whom they received indigo, turquoise, and jewelry (Colton 1960:86). Other finished products produced by the Hopi were ceremonial trappings for Rio Grande burials, dresses, belts, pottery, stone beads, shell beads, and incense (Colton 1960:86; Hill 1948:376; Beaglehole 1937:82).

The Hopi trading sphere included most Southwestern groups, Pueblo and non-pueblo. The literature indicates that the Walapai, Havasupai, Paiute, Apache, Navajo, Mojave, Maricopa, Pima and Sobaipuri all trafficked with the Hopi. Hopi traders have been recorded in most of these areas (Beaglehole 1937:82-85; Beaglehole and Beaglehole 1935:19; Colton 1960:86; Coues 1900:325-326; Dunne 1955:29,34; Goodwin 1942:74; Hill 1948:376; Karns 1954:248-249). Among the Pueblos, the Hopi are recorded as trading at Zuni, Acoma, Santo Domingo, Jemez, Cochiti and Isleta (Beaglehole 1937:84; Colton 1960:86).

Considering the nature of Hopi trade which involved the trade of finished commodities into remote areas, and also the considerable range of Hopi traders, there is a strong possibility that the glaze bowl was traded into Hopi from the Rio Grande and then brought into southern Arizona by Hopi traders. As with Zuni trade, the Sobaipuri again figure in the postulation of paths and agencies by which the bowl could have arrived at
Guevavi. In 1716 Velarde reported that:

For several years past, as related by the older Pimas, the Sobaipuris had trading communication with the Moquinos, establishing fairs and markets among themselves. This is the reason the Pimas give such accurate information on the Province of Moqui, of the location of their pueblos, of their government and other matters.

Some time ago, when the Moquinos came down to the valley of the Sobaipuris at a place called Jaibanipita, for what reason we do not know, the two nations quarreled. The Pimas, being at the time very numerous, killed several Moquinos. With this incident the friendship and trading between the two tribes stopped. Although the Pimas wished to make peace with them, they did not have a route open by which they could make the necessary visits to reestablish trade, since the Apaches have occupied the pass of the Jila River where the road to Moquino lies. The distance from the last Sobaipuris settlement to the Moqui is only three days' travel. (Karns 1954:248-249)

If not traded to the Sobaipuris, the bowl might have come to them from their Cocomaricopa neighbors to the northwest, with whom the Hopi also traded (Dunne 1955:29, 34).

**DISCUSSION**

Four possible means by which the glaze bowl could have travelled from Galisteo to Guevavi have been presented here. While none can be positively discounted, on the strengths of the various ethnographic accounts we believe that as more archaeological data is uncovered we will see increasing evidence that Hopi, and probably to a lesser extent Zuni, traders were both at work in southern Arizona. Existing archaeological data support this. Ayers (1970) has reported on a complete Hopi polychrome bowl (circa 1700) found in an Indian burial near Tucson. Three sherds of "Hopi yellow corrugated" (presumably Jeddito Corrugated) were also found at Paloparado (DiPeso 1956:344). The senior author has
also seen a Jeddito Black-on-yellow sherd on a site in Tucson.

From the Zuni area, a partial Kechipawan Polychrome jar has recently been found in Tucson, associated with a partial glass arrowpoint and a hearth radiocarbon dated to around 1700 (Bruce B. Huckell, pers. comm.). Sherds of Pueblo polychrome were recovered at the Tubac Presidio (Shenk and Teague 1975:64-65), located on the Santa Cruz River some twenty miles north of Nogales. All of those illustrated (Shenk and Teague 1975:Fig. 47) were submitted to Francis H. Harlow by the senior author for further analysis. Concerning purely descriptive matters, Harlow's evaluation (pers. comm.) differs from that in Shenk and Teague (1975:64-65) on several points. Several jar-body and at least one jar-rim sherds are present in the sample, and only one sherd has a slipped interior. Based on various features of design, paste and slip, and form, Harlow feels that all are Kiapkw Polychrome from Zuni, "most likely made in the period dating from 1770-1790, not very likely earlier, but just possibly slightly later (perhaps as late as 1800)." These vessels are very similar to two illustrated in Frank and Harlow (1974: Fig. 148).

In sum, while the archaeological data may give the appearance of only sporadic contacts between northern Pueblo groups and southern Arizona Pimans, the historical accounts available indicate a more regular participation in a widespread trade network throughout the late prehistoric and early historic periods. Possibly future finds of Puebloan material in the south, or Piman materials in the north will allow further definition of the nature, extent and intensity of this network.

ACKNOWLEDGEMENTS

We would like to thank Robert Temarantz for bring these very interesting materials into the Arizona State Museum in the first place, and for his, Jim Pendilton's and Nat Pendilton's patience with our repeated inquiries.

Personal time and effort contributed by A. Helene Warren, Francis H. Harlow and Bruce B. Huckell all enhanced the completeness of the information presented here. Huckell also took the slides of the now lost plain-
ware bowl which proved so valuable.

Helga Teiwes (Arizona State Museum Photographer) took the photograph used in Figure 1, which is courtesy of the Arizona State Museum, University of Arizona. The cross-section in Figure 2a was drawn by Amy Henderson.

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KIVA WALL PAINTINGS
AT SALMON RUINS, NEW MEXICO

HOWARD N. SMITH, JR.

The Salmon ruin, west of Bloomfield, New Mexico, has been known for many years. Due to the imminent destruction of the site from pothunting, excavation was undertaken by the San Juan Valley Archaeological Project of Eastern New Mexico University in 1970. Full scale investigation began in 1972 and continued through 1977. During the 1972 and 1973 field seasons, excavation revealed the remains of wall paintings in four kivas. The kiva art was recorded by the author in 1973 as an ancillary project to a rock art survey of the San Juan Basin (H. Smith 1974). It is the purpose of this paper to describe the kiva paintings of Salmon ruin and place them into a cultural perspective.

The prehistory of the San Juan Basin in northwestern New Mexico is long and complex and is thus generally beyond the scope of this paper. However, two specific developments are of primary significance: the intrusions of Chacoan and Mesa Verdean cultures into the region. These two cultural influences had a profound effect on the indigenous people of the area and are an integral part of the history and development of the Salmon pueblo and thus the kiva paintings which are the subject of this paper.

The Salmon pueblo, as originally constructed in the late 11th century A.D. (Irwin-Williams 1972), reflects the intrusion of Chacoan culture into the San Juan Basin. This Chacoan influence is especially manifested in the architecture of the pueblo. The original community was built in the form of a large 'C' with a Great Kiva in the central plaza. The structure stood four stories at the highest point and contained several hundred rooms. The original construction of the pueblo mirrors traditional Chacoan building techniques. An unusual feature of the pueblo is the Tower Kiva, a relatively large Chacoan kiva built on the third floor of the structure. However, despite the complexity and development of Chacoan society, the Salmon
Figure 1. Map of Salmon Ruin. Map drawn by R. Barbara Smith after San Juan County Museum Association map.
pueblo was abandoned less than 100 years after its construction.

The pueblo was reoccupied and rebuilt in the late 12th century. This restructuring of the settlement does not reflect Chacoan culture; rather it appears to embody Mesa Verdean culture. The evidence of Mesa Verdean cultural influence is exemplified in ceramics and a change in architecture and building techniques. The new occupants constructed rooms within the original structure and a large number of kivas were built within what have been identified as Chacoan rooms. The Salmon pueblo was abandoned for the last time in the latter half of the 13th century. The history of the Anasazi settlement at Salmon is very complex and the above summary is brief due only to the limits of this paper.

The significance of the Salmon kiva paintings, and Anasazi wall paintings in general, lies in the fact that they represent an important and beautiful aspect of a little known and even less understood prehistoric art form. Although archaeological investigations in a number of Anasazi settlements have revealed evidence of kiva wall painting, the amount of evidence which has withstood the weathering of time and neglect is relatively meager. In 1978 and 1979 Constance Silver carried out a study of Southwestern kiva paintings. The study documented about 600 mural paintings in kivas, of which only about 60 have been preserved, most in poor condition (Silver 1980:2-6). The art forms of the Salmon kivas represent a significant contribution to the slowly accumulating data.

Before examining the specific examples found at the Salmon site, it is essential to have some understanding of the development of kiva painting as a Pueblo tradition. In an extensive analysis of Anasazi wall painting, Watson Smith (1952) concluded that the practice of painting murals on the walls of kivas began in the 11th century, during the latter part of the Pueblo II period. The center of origin appears to have been in the eastern San Juan drainage basin of southeastern Utah and southwestern Colorado.

Within 200 years (Pueblo III period) the art form had spread throughout the San Juan region and to the Little Colorado and Rio Grande drainage areas. Although the practice of all painting spread geographically, Watson
Figure 2. Kiva wall painting in room 33. Illustration by R. Barbara Smith based on photograph by author.

Figure 3. Fragments of painted wall plaster from room 64. Illustration by R. Barbara Smith based on photograph by author.
Smith states that "it failed to develop very much in technical or artistic features in its imagery" (1952:67) during this period. Kiva art during the Pueblo II-III periods consisted of simple geometric forms with the occasional depiction of zoomorphic figures and the even rarer portrayal of anthropomorphs (W. Smith 1952:55-68).

The above developmental period is the focus of this paper, however it is important to note that somewhere near the beginning of the Pueblo IV period in Anasazi prehistory the art of kiva wall decoration took on a new vigor in several regions. From the 14th through the 17th century, kiva wall painting became an almost flamboyant art form. The probable origin of this change and its socio-cultural implications are presented by Polly and Curtis Schaafsma (1974) in their discussion of the origin of the Pueblo Kachina Cult. The most beautiful and significant examples of this vitalized art form are found at Pottery Mound (Hibben 1975), Kuaua (Dutton 1963), and Awatovi (W. Smith 1952) pueblos.

The practice of painting wall murals in kivas has continued at most pueblos into historic and modern times as reported by many researchers. As an art form, the vigor of the paintings has diminished. However, the ceremonial significance of the art continued and represents the development and maintenance of a thousand year old tradition of which the paintings at Salmon pueblo are a part.

As stated previously, evidence of wall painting was found in four of the kivas at the Salmon site. These kivas are denoted by the room numbers 33, 64 (Tower Kiva), 121 (Painted Kiva), and 124 as shown on the map in Figure 1. The art is described and illustrated in the above numerical order.

The first example of kiva painting at Salmon comes from room 33. This was a small kiva located in the northern part of the pueblo. The painting is a portrayal of two anthropomorphic figures, probably representing hump-backed flute players (see Figure 2). The figures are small, approximately 20 cm. in height. They were painted in white on the adobe plastered western wall of the kiva. The wall on which these paintings were found collapsed in 1973 and the painting was destroyed.
Figure 4. Fragments of painted wall plaster from room 64. Illustration by R. Barbara Smith based on photograph by author.
The Tower Kiva (room 64) provides evidence of the second painting at the site. Fragments of wall plaster, baked when the kiva was destroyed by fire, were located on the floor surface of the room. The Tower Kiva wall art included the depiction of what appears to be an unidentifiable animal (Figure 3) and a geometric pattern: a triangle shape with a border of small dots (Figure 4). The figures appear to have been painted in red on a white background. The original location of the paintings on the kiva wall is unknown due to the effects of the fire.

The third example of kiva painting at Salmon was found in room 121, which has come to be known as the Painted Kiva. The paintings in this kiva were the best preserved at the site and they contain the largest number of elements. The Painted Kiva mural consists of a dark red dado, 60 cm. in height, the upper edge of which is embellished by sets of triangle shapes in pairs or threes) with intervening sets of four small 'hook' figures (see Figure 5). These 'hook' figures have a stepped design on the left side of their base. The apices of the figures is upward. The upper portion of the wall was painted white with small round red dots around each of the triangles. The dots appear to have been painted with fingertips. It should be noted that the triangle figure with bordering dots was a feature of the Tower Kiva paintings also.

Another figure in the Painted Kiva mural is an anthropomorph—a human figure with a humped back and apparently holding a bow (Figure 6). This human figure is located on the western wall of the kiva and is approximately 25 cm. in height. It was painted in red on a white background above the dado. The figure appears to be contemporaneous with the rest of the exposed painting in the kiva. An interesting feature of this human figure is the depiction of movement (i.e., running). There is evidence of possible painting on the underlying levels of plaster in the Painted Kiva, however the investigation of such evidence has not been undertaken to date.

The kiva located next to the Painted Kiva revealed the fourth example of wall painting at Salmon. The painting in this kiva (room 124) consists of a series of round white dots painted on a tan plastered wall surface
Figure 5. Painted wall design in room 121.
Illustration by J. Barbara Smith
based on photograph by author.
(Figure 7). The dots are located on the northeastern wall of the kiva near the floor surface. They appear to have been painted with finger-tips and are located so as to encircle a small wall niche. The painting in this kiva does not show the same quality of technique as seen in the other examples.

Of central importance to the analysis of the Salmon kiva paintings are the kivas themselves. Three of the kivas (rooms 33, 121, and 124) were built within what have been identified as Chacoan rooms in the original structure. As noted above, the Tower Kiva (room 64) has been identified as a Chacoan feature; the paintings found in the Tower Kiva appear, however, to be a manifestation of the second occupation of the pueblo. This conclusion is based on the fact that the kiva burned late in the settlement's occupation (circa 1250 A.D.) and the wall painting fragments appear to be on the most recent layer of wall plastering. Such evidence suggests that the wall paintings are indeed a feature of the later, post-Chacoan influenced occupation of the site.

Additional evidence which suggests that the concept of kiva wall art at Salmon was not a result of Chacoan cultural intrusion comes from Chaco Canyon. Kiva art does not appear to have been a significant feature of Chacoan ceremonialism. The examples of kiva wall art at Chaco Canyon sites are very meager and Watson Smith (1952:64) concludes that the art form was introduced to the Chaco area at a relatively late date.

Thus a Chacoan origin for wall painting in the San Juan Basin and at Salmon pueblo specifically can be eliminated. But was kiva painting an indigenous development or was the art form inspired by yet another outside cultural influence? The evidence, while not substantial, is consistent and seems to suggest a conclusion that kiva art, as practiced at Salmon, was a Mesa Verdean feature and not a local development.

The primary evidence for such a conclusion is the distribution of a specific mural design element: dados embellished with repeated series of triangles bordered with dots such as those found in Salmon rooms 64 and 121. This particular design element is found in the kivas of several Mesa
Figure 6. Human figure in wall painting in room 121. Illustration by R. Barbara Smith based on photograph by author.

Figure 7. Kiva wall painting, room 124. Illustration by R. Barbara Smith based on photograph by H. L. Hadlock.
Verde sites including Painted Kiva House, Cliff Palace, Spruce Tree House, and New Fire House (Nordenskiold 1893; W. Smith 1952; and Schaafsma 1980). Additional examples of this design motif are found at Three Turkey House (W. Smith 1952) and Canyon de Chelley (Mindeleff 1897) in Arizona. Significantly, the same design motif was also painted in three kivas at Aztec Ruin, a pueblo with a history identical to that of Salmon and located only ten miles away.

The portrayal of the hump-backed flute players and the hump-backed hunter in the Salmon kiva paintings is also of importance to this analysis. Two hump-backed and phallic hunters are depicted in a painted mural at New Fire House at Mesa Verde in association with triangles bordered in dots (W. Smith 1952:63; Schaafsma 1980:141-142). The significance of this occurrence is obviously limited and inconclusive. However, in conjunction with the evidence of the distribution of other kiva mural elements and the relative dates of the Salmon kivas exhibiting wall painting, it is apparent that by the mid-13th century Anasazi kiva painting was not only widespread geographically, its symbolism was (or at least was becoming) homogeneous. Such evidence also would seem to suggest that the ceremonial practices and beliefs of the Anasazi were likewise coalescing.

In summary, excavations at the Salmon site have brought to light wall paintings in four kivas. The evidence indicates that these paintings were a feature of the late occupation of the pueblo (most probably 13th century) and were the result of Mesa Verdean cultural influences of the period. The Salmon kiva paintings represent the Pueblo III expansion of an art form and, most likely, the spread of new or innovative cultural concepts.

Without a doubt, a great deal more research is needed to more fully understand the development of kiva wall painting. Such research can and should explore several areas. It is essential that we increase our understanding of the origin and cultural development of this art form. Kiva painting was and is a highly specialized art and hardly would be a casual or sporadic cultural feature.
It is most probable that kiva painting, even in its earliest stages of development, was an important, if not essential, feature of Anasazi ceremonialism. In the case of Salmon, the ultimate question concerns the cultural significance of the elements in the paintings.

Kiva art, much like rock art, was long considered to be an interesting facet of southwestern archaeology. It was beautiful to behold, but was peripheral to the goals of research. However, this situation seems to be changing and increasing attention to the subject cannot help but shed a new light on the understanding of the dynamics of Anasazi culture and the origins of contemporary Pueblo religious practices.

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A CONSIDERATION OF PREHISTORIC MEXICAN-SOUTHWEST RELATIONS

Joseph L. Chartkoff

Late prehistory in the Southwest saw the florescence of a number of remarkable cultures. The emergence, zenith and waning of these traditions have been subjects for a good deal of archaeological speculation. The predominant antidiffusionist orientation of most U.S. archaeologists has helped focus such interests on hypotheses of local cultural evolution. It has long been appreciated that various Southwestern cultures had some interactions with the more advanced civilizations of central Mexico, but the relationship between these contacts and the florescences of Southwestern cultures has generally been ignored. This essay does not propose to return to the days of simplistic diffusionist explanation, but it does propose to explore some aspects of the connections between Mesoamerican and Southwestern cultures in order to ask what relationship there might be between the ebb and flow of such contacts and the emergence and dissolution of distinct Southwestern cultural traditions. In doing so, a theoretical perspective will be suggested to account for the consequences of the Mexican-Southwestern connection on Southwestern cultures.

The perspective to be considered here concerns prehistoric exchange. What follows will be a consideration of what is meant by the term, how it might have worked in the past, and what its economic, adaptive and social dimensions might have been in relation to prehistoric cultural florescence.

Exchange and Sociocultural Complexity

The term "exchange" is used here to refer to the transfer of goods from community to community or from individual to individual through any of a variety of means or relationships. Exchange is a more comprehensive concept than trade or barter, since the reciprocity implied in making exchanges need not be in kind, or even of material goods for material goods, nor need it occur at the same instant or under the same social circumstances.
Anthropologists generally understand exchange to be a social as well as an economic phenomenon. It occurs in social settings. It is a manifestation of social relationships that exist, and may function to build and maintain new relationships.

In this regard, Service (1975) emphasizes the importance of exchange in the formation and maintenance of complex social structures at the tribal and chiefdom levels of complexity. In his discussion of the "big man" pattern of chiefdom, he notes that a "big man" gains in power and prestige by being able to recruit exchangeable surpluses and to convert them into desirable acquisitions, as well as by rewarding his supporters through the differential distribution of acquired goods (see Service 1975:79-80, for example). This pattern creates different levels of wealth, power and prestige within a community. If the pattern allows an elite leadership position to become hereditary, this degree of stratification can become institutionalized.

It is important to appreciate that this pattern does not inherently increase the carrying capacity of the environment for a population, nor the size of a population, although it could have that result under specific circumstances. Rather, the pattern leads to the emergence of greater structural complexity within a population's social organization. The organization becomes more complex internally as exchange and redistribution expand, and the organization necessarily forms relationships with other societies in order to conduct the exchanges, which creates higher intercultural levels of structure across regions.

This greater degree of cultural complexity with its regional superstructure is an essential part of the patterns that archaeologists recognize as manifestations of "high culture" traditions. Elements of these traditions include the appearance of high-quality prestige goods made for and consumed by socially elite persons, exotic goods imported for use by elites, regional patterns of design styles, differential size and significance of communities, and the appearance of prestige or elite burials in the most important communities.

When cultures arise that display such traits, their systems depend heavily on exchange for their continuity. At such levels of cultural
complexity, exchange over long distances between cultures does not necessarily move large quantities of goods, but the goods that move through long-distance exchange may be disproportionately important to the fabric of the culture. Some goods may be exceptionally important to the general population even if their volume is not great. Critical raw materials, such as flint or obsidian for chipped stone tools, basalt for milling tools, or salt for nutrition, may be obtainable only by means of exchange with other communities.

Exchange developed comparatively late in Southwestern prehistory. The need for exchange in most Archaic communities was very small or absent. In general, Archaic communities existed at low densities in vast, highly variable territories, through which people migrated seasonally so as to encounter a wide variety of key resources (Flannery 1968). As communities evolved toward sedentariness, generally in association with increasing reliance on food production in their subsistence, the ability to acquire varied resources through seasonal migration decreased, and the ability to acquire key resources through specialized expeditions also decreased as communities emerged in different parts of what had been single ethnographic territories and began to maintain their frontiers with increasing rigor. The practice of exchange can be seen to have evolved in a deviation-amplifying relationship with sedentariness as the Archaic evolved into post-Archaic cultural traditions (Maruyama 1936).

Such exchange also results in the acquisition of exotic goods which become prestige emblems for the elite individuals or kin groups which dominate a society. Much of the substance of prehistoric long-range exchange involves the acquisition of such goods. The goods themselves are not adaptively essential to the system, but the elites who acquire them are essential to the system, and the exotic goods become both the object and the consequence of the exchange—symbols of elite status and rewards for the contributions of those who hold high status positions.

Since exchange is a social phenomenon among other things, it tends to occur in specific social settings, such as large-scale feasting. The occurrence of long-range exchange is often accompanied by the acquisition of large food surpluses by elites, contributed by kin and other supporters, and the subsequent differential redistribution of the surpluses within the community as part of the exchange occasion. Surpluses may be acquired as
contributions from supporters, or as taxation from subjects. While these surpluses are not moved over long distance, their accumulation and redistribution would not tend to take place at the same order or magnitude were it not for the occurrence of exchange. Because of the feasting and redistribution elements of exchange, the practice of surplus food acquisition is promoted, and the elites who conduct redistribution function as mechanisms to even out variations in food supplies within communities, within regions and over the seasons. By ameliorating the impacts of food supply fluctuations, the elites who redistribute food function to raise the carrying capacity of the environment for populations (Boughey 1968). The practice of exchange therefore promotes the accumulation of surpluses through the use of the surpluses as a kind of banking system to maintain a higher base level of subsistence throughout a society.

It can be argued that the rise of exchange is related to the rise of complex social organizations, so it would follow that the decline or breakdown of an exchange relationship would lead to a reduction in the complexity of an organization. This does not mean that the organization itself would necessarily disappear, although in some circumstances it might. Rather, it would be the elites and the manifestations of regional complexity that would disappear. For example, the classic Maya collapse (Culbert 1973) led to the abandonment of ceremonial centers and the decline of political complexity, but not the wholesale depopulation of the countryside. After the abandonment of the Maya centers, the Yucatan and Peten remained filled with hamlets of subsistence-level village farmers (Weaver 1972). Similarly, the decline of the Middle Woodland Hopewell tradition in eastern North America was associated with the disappearance of elite leaders and an abandonment of mound complexes and high-status burials, but the countryside was not depopulated (Griffin 1978). In fact, the decline of Hopewell may have been associated with changes that led to increases in local populations.

Mexico-Southwest Exchange and Southwestern Cultural Complexes

This discussion provides a basis for reconsidering the nature of distinctive Southwestern cultural complexes and the forces that may have
stimulated their emergence and disappearance. While it is possible to speak of a Southwestern cultural tradition in general terms, archaeologists have defined a large number of local manifestations with discrete histories. Obviously the best known of these traditions are the Mogollon (A.D. 200-1000), Hohokam (300 B.C.-A.D. 1450) and Anasazi (A.D. 100-1200). Other specific manifestations are particularly relevant, however, such as Mimbres (A.D. 900-1100), Salado (A.D. 900-1200), Sinagua (A.D. 900-1200) and the late El Paso phases associated with El Paso Polychrome pottery (A.D. 1200-1450). In some cases these manifestations are associated with the appearance or abandonment of settlements (e.g. Mimbres) and in other cases not (e.g. El Paso), but rarely if ever can we speak of entire regional abandonment (Lipe 1978). This point implies that it was primarily the elite superstructures and badges of regional culture that rose and fell rather than societies as a whole.

If so, it is possible to hypothesize that the rise and fall of these manifestations bears some relationship to the dynamics of central Mexican civilizations, which formed the other end of the exchange relationship between Mesoamerica and the Southwest. It is suggested that the expansionist phases of these civilizations led, among other things to the initiation or marked expansion of exchange relationships with the Southwest, and that the collapse of the Mexican civilizations led in turn to the breakdown of those relationships. Why the various Mexican civilizations should have waxed and waned is important but need not be considered here. It is the consequence of the formation or deterioration of the long-range exchange relationships between central Mexico and the Southwest that is germane. It is hypothesized that the development of such relationships was central to the emergence of distinctive Southwestern regional cultures, and the breakdown of the exchange relationships was central to the deterioration of those traditions.

This hypothesis is testable, and the first test is the determination of whether there is any relationship between the histories of specific Mexican civilizations and those of the Southwest. Even if such a correlation can be shown to exist, it will not necessarily mean that the hypothesis is valid, but it would provide some support and would provide encourage-
ment for further testing. If no correlation can be found, it would be a clear indication that the hypothesis is invalid.

A number of high cultures developed in prehistoric Mesoamerica, but only a few can be identified as having had the potential of extensive international relations north across the Gran Chichimeca to the American Southwest. Of them, Teotihuacan was undoubtedly the most significant, but the civilizations centered at Tula or Tollon (Toltec), Tzintzuntzan (Tarascan), Monte Alban (Zapotec) and Tenochtitlan (Aztec or Mexica) also deserve mention (e.g. Weaver 1972). As was noted of the Southwest, central Mexico enjoyed a generalized cultural tradition (in this case, one of urban civilization) which existed continuously from 300 B.C. to the Spanish Conquest in A.D. 1521, even though specific, localized manifestations arose, flourished and declined within that period. It is also important to draw attention to Casas Grandes, the key gateway community in the northern reaches of the Gran Chichimeca (Di Peso 1974; Di Peso et al. 1974).

At Teotihuacan, the period of the dynamic expansion in trade beyond the Valley of Mexico began about 300 B.C., although the period of Teotihuacan's most extensive influence occurred between A.D. 300 and 600. It seems clear that Teotihuacan submerged the cultural sovereignty of West Mexican chiefdoms in that period. It strongly affected the Gulf Coast civilizations such as El Tajin, and the southern highland centers such as Monte Alban. There is some suggestion that Teotihuacan may have occupied some centers militarily, as far south as Guatemala, as at Kaminaljuyu (Service 1975:167-185). The contraction of Teotihuacan's sphere of influence had apparently begun before A.D. 600 and was well-advanced by A.D. 650 (Millon 1973). Patterson (1973) has a particularly nice summary of Teotihuacan's decline, following the thinking of Sanders and others.

Monte Alban had a longer history of cultural integrity than even Teotihuacan. In its early history, it showed the strongest affinity for the Gulf Coast centers, but during the Early and Middle Classic (A.D. 300-700), its affinities lay principally with Teotihuacan. After the decline of Teotihuacan, however, it enjoyed its greatest florescence as an autonomous center of civilization as the capital of Zapotec high culture. The apparent overwhelming of the Zapotecs by the Mixtecs in the latter part of
Early Post-Classic (A.D. 900-1200) brought Monte Alban’s florescent state to a close (Blanton 1978).

The histories of the other pre-eminent central Mexican civilizations were briefer. Tula enjoyed prominence for only about two centuries, roughly between A.D. 950 and 1150, and its apparent sphere of influence in central Mexico was apparently much smaller than that of Teotihuacan (Diehl 1974). Tzintzuntzan and its associated Tarascan communities had achieved major trade importance by A.D. 1300-1350, and successfully resisted Aztec domination until Spanish conquest ended their sovereignty (Pollard 1980). The Aztecs themselves had developed their potent confederation and had begun to dominate the central highlands during the late 14th Century and enjoyed their peak influence during the 15th and early 16th Centuries (Wolfe 1976).

It is useful to point out in this context that the maximum northward expansion of Mesoamerican civilization did not occur with the Aztecs, but rather occurred during the Classic and early Post-Classic, prior to about A.D. 1200 (Weaver 1972:211). In that light, the exchange hypothesis would imply that the peak of Southwestern cultural florescence should have occurred before A.D. 1200.

What relationship might there be between these dates and Southwestern chronology? Several correlations suggest themselves. It is possible, for example, to correlate the emergence of the distinctive Hohokam, Mogollon and Anasazi traditions with the expansion of Teotihuacan. Haury (1976) has felt that Hohokam may have been established by means of an actual colonizing expedition from central Mexico. Martin and Plog (1973) have argued against the migration hypothesis in favor of a local evolution explanation. A model of cultural interaction stemming from exchange and resulting in local cultural florescence offers a third possible explanation.

The so-called Chaco Interaction sphere offers the case of the greatest degree of cultural complexity and centralization in Southwestern prehistory (Lipe 1978). Recent space satellite mapping has even revealed the existence of a network of roadways extending from Chaco to distant points around the Southwest. Chaco’s peak period falls between A.D. 1000 and 1150. Further south, the southern New Mexican Mimbres Tradition had a history of roughly
the same age and certainly did not last beyond A.D. 1130-1150. Di Peso (1974) originally dated Casas Grandes to overlap with Chaco and its successors (A.D. 1060-1344), but LeBlanc (1980) has recently published a persuasive reanalysis of Casas Grandes dates and puts it after the decline of Chaco to around A.D. 1150-1500. The Black Mountain Phase emerges by A.D. 1150 and lasts for perhaps a century, and the Animas Phase is roughly contemporary. El Paso Polychrome, St. John's Polychrome and similar wares fall into the 13th-14th Century period.

Based on these dates, a case can be made to hypothesize that the earliest distinctive Southwestern regional cultural traditions developed along with the growth of long-range exchange relationships with Teotihuacan. If it can be assumed that ancient Teotihuacanos followed an expedition trade system somewhat similar to the Pochteca system of the Aztecs, a high degree of centralization at the Southwest end of the network would not be implied. It is noteworthy that the contraction of Teotihuacan coincided with the evolution of increasingly centralized communities in the Southwest, climaxing with the Chaco Interaction sphere. If Monte Alban and Tula were both too localized to have carried out the same degree of expeditionary interaction as Teotihuacan, but that Mexican population overall expanded over time, the collapse of Teotihuacan may have been accompanied by the evolution of a more complex long-range exchange network, involving greater degrees of centralized authority in the Southwest. From that point on, the rise and fall of specific local traditions may represent nothing more than the shifts in political fortunes of various leaders and their dynasties, under whose authorities particular artistic traditions came to be defined in the form of decorated goods for exchange and high-status consumption. Just as the population of the Valley of Mexico clustered around Teotihuacan in relation to its degree of economic power, and redistributed itself when that power declined, the emergence of local "big men" exchange/redistribution leaders in the Southwest may have been sufficient for the clustering of people in specific communities and the emergence of specific artistic traditions, within the framework of the larger Southwestern cultural tradition.

In this light LeBlanc's re-dating of Casas Grandes takes on significance as a replacement of Chaco as the pre-eminent redistribution
center of the Southwest. If the early Post-Classic marks the maximum northward extent of Mesoamerican civilization, as Mesoamerica contracted the degree of centralization reached in the Southwest may have become increasingly impossible to sustain. Systems such as Casas Grandes and Hohokam may have finally broken apart, not to be replaced by anything quite as centralized. By the time of the Spanish settlement of Santa Fe in 1580, the regional pottery styles of earlier prehistory had given way to pueblo-specific styles, and there were no more regional interaction spheres in the Southwest.

Whether this view of Southwestern cultural florescence is valid or not remains to be seen. Much of the specific data that might reflect on its validity is not available, or has not been given much attention. The nature, content, volume and age of Southwestern-Mexican exchange still requires a great deal of definition. While it will be difficult to trace Southwestern materials into central Mexico, the occurrence of artifacts of Mesoamerican origin in the Southwest is easier to determine. One of the key areas of research lies in Chihuahua State, whose archaeology is largely unknown but which must contain much of the evidence of interaction between Mexico and the Southwest.

That trade with the Southwest could not have had a very profound impact on the course of Mesoamerican prehistory is quite likely, simply because Mesoamerica was so vast compared to the Southwest. The impact on the course of history in the Southwest must have been considerably greater. Since many aspects of Southwestern cultural florescences are not completely understandable when the Southwest is viewed in isolation, it is hoped that a new emphasis on the prehistoric relationships between the Southwest and Mexico can lead to better understandings of the course of Southwestern prehistory.

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HOW DO YOU BECOME A KNAPPER?

JAMES G. BAIN

Who among us has not admired the beautiful, precision of the ancient points made by the Paleo-Indian people? Later cultures exhibited, if not the same elegance, at least an appreciation of the necessity for efficient performance of the hunting and killing so vital to their survival. Chipped stone tools, such as scrapers and knives, show the same attention to their intended functions as the more glamorous weapon types.

The perfection of these lithic artifacts makes one wonder about the source of their manufacture. Were all of the points of one type, for instance, made by a single artisan? This, I am sure, is impossible. The sheer numbers of such points and their distribution over a wide area are such that a peripatetic flint-knapper would have had to live longer than the Biblical Methuselah to have made them all. Unquestionably then, many different people, some more skilled than others, fashioned various lithic tools. To those who have tried it, it is quite obvious that you do not grab a proper size rock and a piece of deer antler and turn out a usable point on the first try. It takes practice to make a serviceable artifact and, in addition, knowledge of such things as suitable types of stone, chipping techniques and the proper overall design for accomplishment of the desired task.

How was this knowledge acquired? In many cases it was probably passed from father to son or from friend to friend. Or an individual might, after observing a skillful knapper, practice on his own until the desired degree of expertise was acquired. It would seem, though, that either of these methods would result in far more variations in size, technique, and distribution than are evident in points of the same type.

On a sun-baked hillside in the Mexican state of Jalisco there is a site which may provide some food for speculation concerning this problem. It is an area approximately twenty meters in diameter which contains literally thousands of obsidian flakes. The exact size of the site is difficult to determine since a large part of it is covered by a farm road and
a cornfield. But the sheer quantity of flaked obsidian which is visible is astonishing. The nearest source of obsidian is several miles distant. Within a half mile or so are a few unexcavated sites that are believed to be small ceremonial centers but there is no evidence of ordinary habitations in the immediate vicinity. People must have lived in the area but their dwellings have been obliterated by time and later use of the land.

Aside from the vast quantity of obsidian at the site, an intriguing characteristic is the size of the flakes. With only a few exceptions they range from 10 to 18 cm. in length and 5 to 10 cm. wide. Most are rather thick, perhaps two or three centimeters. The obsidian is of the highest quality: jet black and opaque with no impurities. Most of the flakes contain a striking platform and show a definite bulb of percussion for the initial strike. Evidence of smaller bulbs of percussion in some cases indicates that smaller secondary flakes had been removed from the large flake by striking (Fig. 1, a and b).

Of the several hundred pieces examined, all had worked edges but the pressure flaking was very irregular with both coarse and fine chips having been removed rather randomly (Fig. 1, c and d). In several instances it appeared that the maker had leaned a little too heavily on his pressure tool with the result that a larger chip was removed than was intended (Fig. 1, a).

A few long, thin obsidian blades had been struck from the core. These were similar to those often seen in Mexican museums and were used as knives. Without any retouching their edges were sharp enough to serve as surgical scalpels. But those found at this site had all been retouched along the long edges. Again, this had been done in an irregular manner, fine and coarse flakes being mixed in a haphazard manner (Fig. 2).

It was quite evident that none of these artifacts were intended to be used either as tools or weapons. There was no uniformity of size or shape. With the exception of the striking platforms each piece was worked along all of its edges. This alone made them extremely uncomfortable.
Fig. 1 - Obsidian Flakes from Jalisco, Mexico.
(a) Convex Face.

(b) Edge view showing Thinness

Fig. 2. Obsidian Blades
and even hazardous to grasp and there was no sign of any provision for hafting.

So we have a large number of outsize obsidian flakes that have been chipped to no apparent purpose and which also have seemingly been discarded as waste. Lithic scatters are, of course, quite common in the United States but usually consist of small, obviously waste flakes with little or no retouching. The poor and irregular workmanship would seem to indicate that whoever worked here was inexperienced in knapping and was trying to learn the trade. Based on the size of the area and the great quantity of obsidian it is fairly obvious that a large number of people must have worked here for a long period of time.

Have we perhaps discovered the remains of a school for knappers where young men were trained by a master tool maker? In imagination one can almost see a group of earnest students busily chipping away while the instructor moves about checking their work and correcting their mistakes. One wonders how long it took for a student to become truly proficient. And when he had satisfied the master as to his abilities, did he receive some tangible evidence of his skill? Perhaps his first really perfect tool became his diploma to prove to the home folks his qualification to pursue a career in weapon and tool manufacture.

No scientific analysis can prove this hypothesis. So it is certainly speculation and rather romantic speculation at that. But that is one of the joys of archaeology: to be able to reconstruct in our imagination some small aspect of an ancient culture which, even though unprovable, seems to be supported by the physical evidence.

Albuquerque, New Mexico
CLIMATIC CHANGES AND POPULATION SHIFTS IN THE CHUSKA VALLEY: 
A TRIAL CORRELATION

Regge N. Wiseman

ABSTRACT

An analysis of archeological survey data and the dendroclimatic reconstruction of the climate for the Chuska Valley, northwestern New Mexico, indicates a close correlation between prehistoric population movements and climatic changes. Analysis suggests a gradual deterioration of the climate from the earliest ceramic periods onward, leading ultimately to the abandonment of the valley.

INTRODUCTION

Southwestern archeological investigations over the past 100 years have frequently cited the environment, especially moisture, as an important variable in the course of prehistoric events. A major problem in assessing the role of the environment has been the absence of sufficient and reliable (unambiguous) data for climatic reconstructions. A recent study (Dean and Robinson 1977) is a major step forward in remedying the situation.

Recent analyses of highway contract archeological excavations by the writer led to the investigation of climate and population aggregation/dispersion in the Chuska Valley of northwestern New Mexico. The archeological data and interpretations for this study were obtained from a manuscript on surveys made by Peckham and Wilson of the Museum of New Mexico for the Navajo Nation and the Bureau of Indian Affairs (1967). The environmental data were extracted from Dean and Robinson and interpreted by the writer. Only one location, referred to herein as the "central area" of the Chuska Valley, was monitored for the climatic data. While it can be validly argued that extrapolating these data and the interpretations to the entirety of the Chuska Valley is questionable, similar reconstructions for two other projects in the San Juan Basin (one a few kilometers to the north and the other to the east near Chaco Canyon National Monument) have shown very similar, though not identical, patterning. The basic outline seems
Figure 1
Chuska Valley Survey Localities
Adapted from Harris et al. 1967

RC/79
to hold over a fairly large area.

It might be stated at the outset that the writer is aware of the problems engendered by two-variable correlations and the oversimplifying effect such correlations can have in multi-variable situations. In fact, indications that other variables are at work can be seen in the following analysis as "lags" and other minor incongruities. Further elucidation of these variables, however, is not pursued here. The main thrust of this paper revolves around a correlation of survey data with climatic reconstruction data. The correlation spans a culturally significant amount of time—the 730 years between A.D. 680 and 1410—representing the last documented centuries of prehistoric occupation in the Chuska Valley. It involves a set of normalized climatic data with a degree of resolution heretofore unavailable for such a comparatively long time period and relatively broad area of coverage.

THE SURVEY

The survey was performed in 1962-1964 by Stewart L. Peckham and John P. Wilson (1967). Nineteen tracts of land totalling over 200 square kilometers were surveyed along the drainages in the Chuska Valley (Fig. 1). The area of the tracts is roughly bounded by the town of Shiprock on the north, the Chaco River on the east, the village of Naschitti on the south, and the Chuska Mountains on the west. The primary consideration in the selection of the tracts to be surveyed was land potentially useful for modern-day, large-scale irrigation farming by the Navajos. Consequently, low-lying areas along drainages (including the Chaco River) were principal locations investigated. Higher ground in between and surrounding the tracts received little attention. Subsequent surveys, mostly in response to highway construction, have shown that sites do occur in the interstitial areas, but the overall impression is that most are quite small and that the 1962-64 survey recorded the major occupation foci of the investigated drainages. Although understanding the total subsistence and population picture of the region will require more work in the areas not covered by the Peckham and Wilson survey, it is anticipated that the results of their work are basically accurate, especially for the purposes at hand.
Each survey tract was covered in its entirety. All sites (excepting modern Navajo) were recorded. Analysis of the data resulted in the establishment of a series of Ceramic Groups (originated by Peckham and Wilson 1967; cf. Reher 1977: Table 10.2) which will be used here, as did Peckham and Wilson, as the temporal and analytical framework. Population sizes were calculated by Peckham and Wilson using Pierson's (1949) figures for average number of persons per pithouse and surface room. Once these population estimates by site, locality, and period had been calculated, overall patterns of aggregation and dispersion were investigated by Peckham and Wilson by means of a series of maps showing the sites in their localities by Ceramic Group. A summary of the observations follows:

Ceramic Group 1 (A.D. 500-725) occupation of the Chuska Valley very light, particularly in the more northerly and southerly localities.

Ceramic Group 2 (A.D. 725-800) population began to concentrate in what later became a central focus of occupation in the entire valley. This "central area" includes the Skunk Springs, Crumbled House, and Blue Shale survey localities actually lies in the south-central part of the survey area. Future uses of the term "central area" refers to these core localities. Populations of most localities also increased during this period but not as rapidly.

Ceramic Group 3 (A.D. 800-875) saw an intensification of occupation in the central area relative to the remaining localities. A pattern of a larger village surrounded by several smaller villages began to emerge.

Ceramic Group 4 (A.D. 875-950) saw continuation of the population concentration in the central area. The pattern of larger villages surrounded by smaller ones increased in that the numbers of smaller villages per cluster increased and the areas encompassed by each aggregation expanded. This aggregation pattern can be seen in other localities where fairly sizeable populations were present.
Ceramic Group 5 (A.D. 950-1000) saw a slight decentralization of the central area and a concommitant increase of populations in the more lightly populated localities, particularly those on the margins of the survey area.

Ceramic Group 6 (A.D. 1000-1075) witnessed a continuation of the decentralization of the central area. Some localities supported fairly large populations for the first time.

Ceramic Group 7 (A.D. 1075-1125) began a shifting back of the population into the central area as the outlying localities lost population, most never to regain it.

Ceramic Group 8 (A.D. 1125-1200) saw a definite recentralization of the population in the central area. However, an overall decrease of population in the Chuska Valley is evident.

Ceramic Group 9 (A.D. 1200-1300) continued the recentralization in the central area and the depopulation of the valley as a whole. The general depopulation of the valley was apparently due to emigration.

Terminal Ceramic Group 9 (A.D. 1300-1325) was the last occupation of the valley. The population was still concentrated in the central area with little evidence of use of many of the other localities, especially those on the margins. After A.D. 1325, the Chuska Valley was apparently abandoned.

THE CLIMATIC RECONSTRUCTION

The recent study by the Laboratory of Tree-Ring Research (Dean and Robinson 1977) presents the results of a dendroclimatic reconstruction for northern Arizona, northern New Mexico, and adjacent parts of Utah and
Figure 2: Palaeoclimate of the Skunk Springs Area, A.D. 680-1410.
Colorado. A series of maps displays computer-generated isopleths or contours of relative departures from the mean temperature/precipitation gradient in ten-year increments. The gradient was established on the basis of tree-ring series from 26 stations scattered throughout the region and covers the time period A.D. 680 to 1970. In the words of the authors:

Each local tree-ring chronology in the data network represents the variation of annual tree growth around the mean growth for the station. (p.8)

In practice, this means that we are dealing with the combined effects of annual precipitation and temperatures at each station. The maps, then, represent changing spatial patterns of variations in tree growth, and therefore yearly rainfall, throughout the Southwest during the period of analysis. (p.9)

The differences from the mean are presented in standard deviations rather than absolute values. Plus-values indicate moister, cooler periods, and minus values represent drier, warmer periods. The authors feel:

- Variation that exceeds two standard deviation units in either direction is considered to be significant in the sense that such departures are sufficiently rare to have potential adaptive consequences for plant, animal, and human populations. (p. 8)

The reconstructed climate for the central area of the Chuska Valley for the period A.D. 680-1410 was produced by monitoring the location on each successive map during the period. This was accomplished by placing a mylar template (with an X for the central area marked on it) over each map and noting the contour. In some cases, interpolation between contours was required. Each value thus obtained was then plotted on graph paper at its respective ten year increment midpoint (Fig. 2). The line connecting the points was then studied by visual inspection in order to delimit what are referred to here as "short-term climatic intervals" or ST's. Each interval differs from those before and after it in terms of amplitude
(distance between connected peaks on opposite sides of the mean), frequen-

cy (distance between peaks on the same side of the mean), or both.

The characteristics of each interval as defined in this analysis are:

Interval 1 (ST 1) (before A.D. 685 to 795) had rather strong amplitude
between relatively dry, warm periods and relatively moist, cool periods. The frequency was approximately 50 years.

Interval 2 (ST 2) (A.D. 795-850) had weaker amplitude than ST 1. The
interval was quite mild compared to the others during the period of study.

Interval 3 (ST 3) (A.D. 850-990) saw a resumption of strong amplitude
but a shortening of the frequency to 20-30 years.

Interval 4 (ST 4) (A.D. 990-1085) had a continuation of the strong
amplitude and an increase of the frequency to 30-40 years.

Interval 5 (ST 5) (A.D. 1085-1140) was a period of great extremes
for the entire span with a strong drouth about A.D. 1095
followed by a much cooler, much moister period around A.D. 1115.

Interval 6 (ST 6) (A.D. 1140-1300) began and ended with strong drouths.
The amplitude was rather strong and the frequency of 30-40
years was notably irregular.

Interval 7 (ST 7) (A.D. 1300-1340) was an abnormally long, moist, cool
period for the time span under consideration here.

Interval 8 (ST 8) (A.D. 1340 to and past 1410) saw a lessening of the
severity of the amplitude (also, generally milder than most
of the preceding periods) and a shortening of the frequency
to 20-30 years.

Further study of Fig. 2 revealed larger scale amplitudes which are
approximated by the flatter line called herein the "long-term climatic
trend." The time period encompassed by the graph is too short to accurately
characterize this trend. Also, Robinson (1980: personal correspondence)
warns: "There are good and convincing arguments that this type of chronology (the Dean and Robinson study) does not by its very nature preserve long-term trends." (Emphasis his.) I have chosen to retain this aspect of the analysis for two reasons. First, the apparent change in frequency around A.D. 1050 corresponds in general with the findings of Jorde's (1977) study. That is, though the level of analysis differs (see below), Jorde, using the data which also underlies the Dean and Robinson study, found a lengthening of what he terms the "periodicity" after A.D. 1050 (p. 385). It should be noted, however, that the terms "frequency" and "periodicity" are not precisely synonymous (Robinson 1980: pers. corres.). Secondly, the correlation of certain aspects of the long-term trend with certain population movements in the Chuska Valley, as suggested here, are logical and predictable, given the current state of such studies. The claim here is not one of fact but rather is intended to point to possibilities for future investigation.

Finally, the Ceramic Groups or periods were added to Fig. 2 to facilitate the comparison of population aggregation/dispersion with both the short term intervals (ST) and the long-term trend (LT) of the climate. The discussion of this covariation is then followed by an assessment of the ranking of the short-term intervals relative to both the long term climatic trend and the population aggregation/dispersion data.

THE CORRELATION

A comparison of the population aggregation/dispersion pattern of the central area with both the short-term climatic intervals (ST) and the long term climatic trend (LT) reveals close correlations (Fig. 2). The beginnings of the initial aggregation during Ceramic Group 2 (or Group 2) and the subsequent strengthening of the pattern during Group 3 took place during ST 2. At no other time in the study period (A.D. 680-1410) was the climate so relatively mild. ST 2 also signaled a turn in the LT from a moist-cool peak toward a dry-warm trough. Population aggregation continued into Group 4 as the LT dry-warm trend developed.

In group 5 and 6 times the population decentralized in tandem with an LT moist-cool peak. The population did not begin reaggregating in the
central area until well into the second LT dry-warm trough and at the time of one of the harshest ST's (#5). From this point on, although the central area remained the population focal point for the Chuska Valley, the absolute number of people declined throughout the valley. A moist-cool peak in the LT during late Group 9, followed by a second harsh ST (#7) during Terminal Group 9, terminated the habitation of the Chuska Valley.

In summary, the population trends were for aggregation in the central area during drier-warmer times and dispersion during moister-cooler times. While most of the other localities were not abandoned during the dry-warm periods, it is clear that they lost population. Basically, the pattern seems to be aggregation around principal/dependable water sources during the drier periods and dispersal to the less dependable drainages (or a bolstering of the population in them) during wetter periods. But why did gradual abandonment of the valley begin sometime around the beginning of the second LA dry-warm trough? Further assessment of the short-term climatic intervals indicates at least one probable cause.

**CLIMATE QUALITY THROUGH TIME**

The delineation and interpretation of the short-term climatic intervals employed here is based on a crude evaluation of the climate graph in Fig. 2. Basic to the process are considerations of amplitude and frequency. The conception of the significance of amplitude used here is that relatively short movements indicate a comparatively mild climatic swing with respect to precipitation and temperature and that strong ones are indicative of comparatively harsher changes. The reader must remember, however, that these interpretations of mild versus harsh are relative to the mean for the entire time span. The differences are not as extreme as those between the Pleistocene glaciations and interpluvials; they are less strongly contrastive. The conception of the significance of frequency as used here is that greater frequency generally indicates more rapid shifts in climate and that lesser frequency generally indicates less rapid shifts.

Obviously, there are a large number of nuances in the interpretations of the potential covariations in amplitude and frequency. For the sake of
simplicity in the analysis presented here, any combination of amplitude and frequency falling within plus or minus one standard deviation from the mean indicates a fairly optimum climate for the interval. Any combination of frequency with strong amplitude indicates less time within the optimum. Intervals of strong amplitude with lesser frequency might be more favorable than those with greater frequency since there would be longer, less-often interrupted stretches of optimal climate. The intervening periods of less optimal climate would also be relatively long; during these periods a shift in subsistence emphasis or even a temporary change in settlement location or both might be expected. Intervals of strong amplitude with greater frequency might be somewhat less favorable than those with lesser frequency because of the more numerous changes between extremes of dry-warm and moist-cool during a given period of time. Although the number of returns to more optimal conditions (through the "middle") would be greater, the actual length of each optimal period would be shorter and less conducive to stability in sedentary subsistence and settlement patterns. Finally, intervals exceeding two standard deviations of amplitude in either direction from the mean, as suggested by Dean and Robinson (quoted above), and extended periods of dry-warm or moist-cool probably had fairly severe consequences for man and may well have forced relatively long periods of abandonment of his sites and even of some localities.

The analysis presented here appears to conflict, at least in part, with that rendered by Jorde (1977). The differences probably result primarily from resolution of scale. Even though both analyses use the same basic data, Jorde's analysis divides the information into two time intervals and covers a much larger geographic area; that offered here, based on Dean and Robinson's manipulations of the data and further manipulations by the writer, breaks the data into eight time intervals and covers a smaller geographic area.

In order to assess and compare the short-term climatic intervals, values referred to herein as "optimality values" were assigned to each based on the assessment presented above. The values, from most optimal, are:

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Figure 3: Climate Quality, A.D. 700-1375

Curve of Optimality Values

Long-Term Climatic Trend
(cooler, moister)
(warmer, drier)

Trend of Optimality Values

Population Centralization Curve
(decentralization)

Optimality Values

Ceramic Groups

A.D.

1000
975
875
800
725
700
1125
1250
1300
1375
1400
1 Mild amplitude (1 standard deviation) and any combination of frequency.

2 Strong amplitude (1 and 2 standard deviations) with lesser frequency.

3 Strong amplitude (1 and 2 standard deviations) with greater frequency.

4 Amplitude 2 standard deviations and/or extended periods of 1 standard deviation.

In borderline cases, a combination value such as 1-2, 2-3, or 3-4 may be used.

Once values for each interval had been determined a graph (Fig. 3) was prepared. Since the points are rather disparate but form a trend, a smoothing line was added to characterize this trend. The Ceramic Groups, a population aggregation/ dispersion curve, and the long-term climatic trend curve were added to facilitate analysis by inspection.

Fig. 3 reveals a pattern of fluctuation in the "optimality curve" which closely parallels both the population curve and the long-term climatic trend. Perhaps even more significantly, ST 2, the interval during which the initial population aggregation in the central area developed, was the most optimal of all the intervals. From that point onward, even though the optimality values fluctuate in tandem with the other curves, the overall trend declined through the remainder of the prehistoric occupation sequence. Thus, it appears that over the long run, the climate generally degraded from the early ceramic period occupations onward.

CONCLUSIONS

The reconstructed climate for the Chuska Valley, when compared with archeological survey results, indicates a strong correlation between climate events and population movements. Basically, during the drier-warm periods the population of the Chuska Valley tended to aggregate in the areas with more dependable water, and during the moister-cooler periods
it tended to disperse from the better-watered areas, made greater use of the somewhat less well-watered areas, and moved into the least well-watered (marginal) areas. During the latter part of the study period (A.D. 950 or 1000 to 1325) there was a greater lag in population response to climatic change. Whether this is due to cultural buffering mechanisms (Jorde 1977) or other reasons remains to be determined. Perhaps more importantly, although the quality of the climate varied throughout the study period, the analysis presented here indicates that it gradually deteriorated from the early ceramic periods onward. If these results are accurate, the potential ramifications add a new dimension to cultural processual studies.

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LOCAL VARIABILITY IN A MARGINAL ENVIRONMENT

THE ARCHAEOLOGY OF THE WESTERN COAL COMPANY BISTI LEASE

MARK GANAS
With Contributions By
FRED YORK
MARILYN SWIFT

PROJECT BACKGROUND

In April and May, 1977, a tract of land, including the parcel discussed in this report, was examined by New Mexico State University. This survey has been assessed by the Bureau of Land Management to be a "reconnaissance survey in detail." On the 3.75 sections of land that are the subject of this report, the previous survey recorded thirteen archaeological sites (Rorex and Conners 1977:Figure 1). The site frequencies recorded by NMSU are considerably lower than those recorded in adjacent areas. NMSU's average number of sites per section is 3.85 in the area of the present survey. Reher (1977), in the CGP survey, located northwest of the Western Coal Company Lease, reports an average of 7.17 sites per section. The Division of Conservation Archaeology found 61 sites on the 3.575 sections of federal land during the course of this survey, as well as 129 isolated cultural manifestations. DGA's survey located all of the sites noted by NMSU's reconnaissance with the exception of BP-36, an historic Navajo horno and corral.

Fieldwork and data analyses were governed by an explicit set of research goals which were deemed essential for assessing the relative significance of the resources for mitigation planning and for other agency management needs. Although the survey area is relatively small, and thus may not fully represent the cultural variability of the region, the research goals were designed to draw upon previously published works pertaining to the area, and hence place the study area in a regional perspective.
Figure 1. Location of the Study Area.
This enables the preparation of an overall mitigation plan into which each site can be seen to fit.

Specific research goals included measuring the intensity of human usage of the study area. Thus, the importance of data that would facilitate the analysis of intersite relationships, including data pertinent to both spatial and chronological patterning, was a factor in field data collections. This was addressed by means of detailed field maps, the detailed recording of artifacts, including the use of special data collection forms for lithics, ceramics, and historic artifacts, and the separation of the artifacts and features in the field into spatial clusters. In the case of historic sites, these data were augmented through the collection of ethnohistoric and ethnographic information from local informants.

A second research objective was to examine intrasite patterning with respect to environmental data. Features and artifacts associated with seasonal-specific activities were analyzed in the context of determining behavioral patterns as they related to seasonal or year-long site occupations. The two research goals are interrelated topics, and their analyses and results are unified in this report.

ENVIRONMENT OF THE STUDY AREA

MARK GANAS AND MARILYN SWIFT

The Western Coal Company Bisti lease is situated within the San Juan Basin, north and east of the Chaco River (Figure 1). The dominant geological features of the lease are the Bisti Badlands, manifested by the exposed beds of the Cretaceous Kirtland and Fruitland Formations which cover the northern third of the study area. The Kirtland Formation contains thin interbeds of sandstone and siltstone as well as tabular, fine-grained arkosic sandstones and shales (Molenaar 1977; Fassett and Hinds 1971). The Fruitland Formation consists of interbedded layers of carbonaceous shale and thick coal deposits among coquina beds, silt and sandstone strata (Molenaar 1977; Fassett and Hinds 1971).
Landforms

The southwestern third of the study area is characterized by parallel southwest-to-northeast trending dunes, which were formed from existing sandstone outcrops by prevailing winds (Hack 1941). This aeolian activity and subsequent dunal formation has been consistent, though intermittent, since Miocene times. This is specified by the placement of parallel drainages, regulated by the longitudinal dunes (Hack 1941; Loose 1977). The dunes are semistabilized and, in areas, exhibit blowout basins or areas which are deflated to a hardpan surface, indicating a constant wind direction and a dry climate, permitting only sparse protective plant cover (Gilluly et al. 1951).

The area is primarily within the drainage basin of De-na-zin Wash, which is located directly south of the study area. Alamo Wash flows through the eastern part of the study area, and enters De-na-zin Wash immediately south. De-na-zin Wash subsequently enters the Chaco River a few miles west. The eastern third of the study area is characterized by numerous small drainages which flow to De-na-zin and Alamo Washes and by alluvial plains.

Soils

The three major landforms are each associated with a particular soil type. The distribution of the soil types is described by Keetch (Western Coal Bisti Project 1977) and is illustrated in Figure 2. The shale badlands are characterized by an eroded Badland Rockland area comprised of interlensed shale and sandstone members. Soils are extremely shallow, and only in narrow valleys or drainages do they support vegetation.

The dunal ridge areas are characterized by soils of the Sheppard-Huerfano type. The Sheppard components are deep and sandy aeolian soils deposited along ridge areas. The Huerfano components are fine textured, pale brown to light yellowish brown soils originating from shale formations in playa bottoms, rolling uplands, and steep slopes. The Huerfano soils are high in sodium content and, where exposed, sustain sparse, salt-tolerant vegetation. In the dunal area, the Sheppard and Huerfano components are intermixed by wind and water.
The drainage ways, alluvial fans, and upland valley bottoms are characterized by Stumble-Laton-Huerfano soils while the major washes are characterized by Riverwash-Duneland soils. Stumble soils form along valley slopes and bottoms. These yellowish or olive brown loamy soils are slightly calcareous in nature. The Laton silty clay and clay loams are grayish brown in color and are found in valley bottoms. High sodium content within the soil restricts plant growth. The Riverwash soils consist of sandy alluvium and drain the bandland areas while Duneland soils originate from the washes and form active dunes which are relatively devoid of vegetation.

The soils of the study area are saline and generally silty clays and shales, and thus are largely unsuitable for agriculture. The components which favor agriculture most strongly are the Sheppard, Riverwash and Duneland components. These are often mixed with other components however, which limits their suitability for agriculture. During the course of the survey, no evidence was found for agricultural activities during the Anasazi period. Ethnographic data indicate limited usage of the study area for agriculture during the historic period. This use was apparently limited to a single garden plot.

Climate

Three glacial advances occurred in North America in the interval between the end of the Pleistocene (approximately 11,000 BP) and the present. These are dated at ca. 5000 BP, ca. 3000 BP and finally between 300 and 150 BP. The interstadial between the first two of these advances was marked by a warming trend and a probable concomitant increase in moisture, especially in the period from 5000 to 3800 BP (Loose 1978:391). Greater moisture resulted in dune stabilization and soil formation, and probably in an increase of economically important flora and fauna (Loose 1978:391), which undoubtedly affected Archaic settlement within the study area.

On the basis of annual precipitation and evaporation rates, the present climate of the study area has been described as arid, in which annual evapotranspiration rates greatly exceed the amount of precipitation (Allan 1977, Ferril 1978).
Data provided by Allan (1977) for the Farmington area indicate that the period from June through August is the wettest time of the year with a mean average of 1.97 inches, while the period from September through November shows the second highest rate of precipitation, 1.78 inches. Total annual mean precipitation for the 1891-1954 interval is 6.62 inches. Highest evaporation rates occur from April through August, with July being the month of greatest evaporation. Winter precipitation is generally in the form of frontal storms, while summer precipitation is more often in the form of more violent convection storms.

Water is currently obtained by the local population from a number of wells which have been excavated near Alamo Wash, and from a pump which is located in Section 17, southwest of the study area, in the bed of De-na-zin Wash.

Flora and Fauna

Observations of plant and animal species were made by the survey crew. The Atriplex zone described by Noisat (Huse et al. 1978:30), containing xerophytic, salt-tolerant species, most closely corresponds to the vegetation types recorded by the DCA survey. Dominant vegetation observed along the dunal ridges includes: galleta grass (Hilaria jamesii), muhly grasses (muhlenbergia spp.), Indian rice grass (Oryzopsis hymenoides), dropseeds and alakali sacaton (Sporobolus spp.), Three awn (Aristida sp.), four-wing saltbush (Atriplex canescens), shadscale (Atriplex confertifolia), and wolfberry (Lycium pallidum). Within the drainages and floodplains Atriplex and Sporobolus species occur most frequently. The active nature of the riverwash dunes limits plant growth; here sodium tolerant greasewood (Sarcobatus vermiculatus) and the grasses are most common.

Within the Atriplex zone are smaller plant communities, particularly stands of snakeweed (Gutierrezia sarothrae) and Russian thistle (Salsola kali), which were observed most frequently within the floodplain areas. Although the presence of these communities has been linked with overgrazing (Huse et al. 1978), their occurrence within the study area may also suggest the adaptability of these species to the poor soils within the floodplain.
Animal sightings recorded during the September survey included jackrabbits (*Lepus californicus*), cottontail (*Sylvilagus audoboni*), pocketmouse (*Perognathus* sp.), little striped whiptail lizard (*Cnemidophorus inornatus*), prairie rattlesnake (*Crotalus viridis*), short horned lizard (*Phrynosoma douglassi*), and horned lark (*Eremophila alpestris*). Domesticated species included sheep, goats, cattle, horses and dogs.

**Present Use**

Present use of the area includes the grazing of domestic stock. In other areas, overgrazing has been associated with changes in the floral communities, which has led to increased erosion and subsequent arroyo cutting (Cooke and Reeves 1977). Certain changes in vegetation have occurred on the Western Coal Company Bisti lease. In some areas, the presence of *Gutierrezia* and *Salsola* communities undoubtedly is related to overgrazing. However, this seems not to have led to greatly increased erosion of the area.

The building materials for the present and recent habitations in the region of the study area were obtained from the sandstone-shale outcrops of the Kirtland-Fruitland formations in the badlands, and from the beds of sandstone belonging to the Pictured Cliffs formation, which outcrops along De-na-zin Wash in several places. A sandstone quarry which was used by numerous local residents is located in this formation directly southwest of the study area.

**FIELD METHODS**

MARK GANAS AND MARILYN SWIFT

The survey was performed by individuals walking systematic parallel transects across defined portions of the lease area. The entire lease area was inspected, except for portions of the bed of Alamo Wash. The surveyors spaced themselves at regular intervals (either fifteen meters or thirty meters) and oriented their transects with Silva or Brunton compasses. The "outside" crew member marked his transect with pinflags.
and recovered the pinflags on the return sweep, thus ensuring complete coverage.

Alternating 13m and 30m surveyor spacings were employed for Sections 9 and 10 and a majority of Section 11. The remainder of Section 11, and Sections 12 and 1 were surveyed using 30m surveyor spacings, except in the dunal areas where narrow intervals were employed. The efficiency of the wide and narrow transects with respect to cultural resource detection is discussed below.

All prehistoric and historic cultural remains, with the exception of isolated roadside trash items, were recorded and located on maps of the project area provided by Western Coal Company. These maps, at a scale of 1:2400 with five-feet contour intervals, permitted accurate site location. These locations were later transferred to USGS 7.5-feet series topographic maps (Tanner Lake and Alamo Mesa West Quadrangles).

The cultural remains were assigned to either of two classes. *Isolated loci* were those remains for which the information potential were virtually depleted through recording in the field. These were located on the map and briefly described. *Sites* were defined as those cultural occurrences which contained significantly more information than could be extracted at the time of the survey. These were located on the map and staked with a piece of reinforcing bar to which was attached an aluminum tag bearing the site's field number (WCB series). The site was then recorded on DCA site inventory forms which included location, physiographic and environmental setting, cultural/temporal affiliation, and description of site content. All sites were mapped using Brunton or Silva compasses, with the site stake serving as datum. For each site and isolated locus, the crew also noted whether it had been found on a wide or a narrow transect. These data were collected for subsequent evaluation of the survey methods. No subsurface testing was conducted. One sherd was collected for identification purposes. This artifact and all field notes, maps and other data collected during the course of this project are curated at the San Juan County Archaeological Research Center and Library at Salmon Ruin.
Two additional data retrieval forms were utilized in the field. All flaked and ground stone artifacts were recorded on lithic attribute forms. Data recorded included the morphological type and material type of each artifact, as well as the presence or absence of retouch or use-wear. Historic artifacts were recorded on an artifact checklist.

All pertinent site inventory information has been submitted to the Bureau of Land Management Farmington Resource Area Office, to the State Historic Preservation Office, and to the central files at the Laboratory of Anthropology, Museum of New Mexico. In keeping with the spirit of the 1979 amendment to the State of New Mexico Cultural Properties Act designed to curb loss of resources through vandalism, precise site locational information is restricted in this report.

The survey program also included an ethnographic study of the historic sites. After the sites were identified and recorded by the survey crew, they were revisited by two archaeologists and the ethnologist, who recorded pertinent facts about the sites and hypotheses to be explored. The ethnographer subsequently visited the sites with a series of informants, and collected data concerning the periods of usage, the functions, and the names of individuals who used the sites. An interpreter was employed to enhance communication with the Navajo informants. These data were combined in the analysis with the archaeological data, as well as information collected by the ethnographer from adjacent areas and the region as a whole, and with information concerning the culture history of the area.

EVALUATION OF ARCHAEOLOGICAL FIELD METHODS

The use of alternating wide and narrow surveyor spacing intervals was evaluated to assess the effectiveness of resource detection. A considerable proportion of the survey area consisted of sand dunes, with dense populations of edible seed grasses. The presence of lithic sites was expected in these areas. Thus in Sections 9 and 10 and a portion of Section 11, the alternating wide-narrow transect method was adopted to test the effectiveness of data recovery.
Given the fact that a wide transect (50 meter spacing) covered twice as much area as a narrow transect (15 meter spacing), and assuming that sites and isolated loci were randomly distributed with respect to survey transects, it was hypothesized that twice as many cultural occurrences would be located on the wide transects as on the narrow transects. This hypothesis was tested for the data collected in Sections 9 and 10 and part of Section 11, using a Chi-square test (Table 1).

Table 1. Effectiveness of Wide and Narrow Transects in Locating Cultural Remains

<table>
<thead>
<tr>
<th>Isolated loci</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs.</td>
</tr>
<tr>
<td>Wide</td>
<td>55</td>
</tr>
<tr>
<td>Narrow</td>
<td>36</td>
</tr>
<tr>
<td>Totals</td>
<td>91</td>
</tr>
</tbody>
</table>

No significant difference at 0.1 level. df = 1

The wide and narrow transects were equally effective in the location of isolated artifacts. However, considerably fewer sites were located on wide transects than were expected. This may be due to the types of sites which were found in the area (Table 2). Navajo sites with, structure foundations, ash pile mounds and so forth, have a relatively high visibility. These sites are well represented in the wide transects.

Table 2. Incidence of High and Low Visibility Sites on Transects

<table>
<thead>
<tr>
<th>Lithic (low visibility)</th>
<th>Navajo (high visibility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide</td>
<td>9</td>
</tr>
<tr>
<td>Narrow</td>
<td>16</td>
</tr>
</tbody>
</table>

As shown in Table 2, low visibility lithic sites are better represented in the narrow transects. It was first thought that the dunal situations of the lithic sites, with a relatively heavy grass cover at the time of the survey, may have obscured a proportion of the low visibility sites, given the wider field of view required for the wide transects.
If low visibility cultural remains are underrepresented on wide transects, then it would be expected that isolated loci (generally consisting of single artifacts or features which thus have low visibility) would also be underrepresented on wide transects. However, the isolated loci have been shown in Table 1 to have been well recovered by the wide transects. Sampling error probably explains these discrepancies. It may be that fortuitous arrangement of the lithic sites and a relatively low number of both sites and transects led to an underrepresentation of these sites on the wide transects, and that the data on recovery may be misleading. The data concerning isolates, which are much better represented than sites on both wide and narrow transects, indicate that the recovery of isolated cultural remains was both adequate and complete on both wide and narrow transects.

The landforms, soils and vegetation of the remainder of Section 11 and Sections 1 and 12 indicated that the density of lithic sites would be low in those areas. Therefore, in the interests of time, these areas were covered almost exclusively with wide transects. When dunal areas were encountered, these were covered by narrow transects to ensure adequate site recovery. Section-by-section data on site densities of this project area, when compared with data on site densities from adjacent or nearby survey areas, indicate that site recovery during this project equalled or exceeded that of previous surveys in this region. This indicates that the method of making field determinations as to the use of wide or narrow transects, based on previous experience in the area and expected site densities, is time-effective without the loss of accuracy or recovery of data.

SITE DENSITIES

A total of 61 archaeological sites were located and recorded. In addition, 129 cultural isolates were located. Approximately half of the archaeological sites are lithic scatters, and the remainder are Navajo sites. No unambiguously Anasazi sites were recorded.
The densities of specific site classes in the study area are shown in Table 3. Overall, the densities range from a low of 3.08/km$^2$ (eight per section) in Section 12 to a high of 15.44/km$^2$ (40 per section) in Section 10. The site density for the entire project area is 6.98/km$^2$ (17.98 per section).

Table 3. Site Densities by Section in the Study Area

<table>
<thead>
<tr>
<th>Sec.</th>
<th>Lithic sites/km$^2$</th>
<th>Lithic sites/mi$^2$</th>
<th>Navajo sites/km$^2$</th>
<th>Navajo sites/mi$^2$</th>
<th>Total sites/km$^2$</th>
<th>Total sites/mi$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.77</td>
<td>4.57</td>
<td>4.41</td>
<td>11.43</td>
<td>6.18</td>
<td>16.00</td>
</tr>
<tr>
<td>9</td>
<td>4.63</td>
<td>12.00</td>
<td>1.54</td>
<td>4.00</td>
<td>6.18</td>
<td>16.00</td>
</tr>
<tr>
<td>10</td>
<td>11.84</td>
<td>30.67</td>
<td>3.60</td>
<td>9.33</td>
<td>15.44</td>
<td>40.00</td>
</tr>
<tr>
<td>11</td>
<td>0.41</td>
<td>1.07</td>
<td>4.53</td>
<td>11.73</td>
<td>4.94</td>
<td>12.80</td>
</tr>
<tr>
<td>12</td>
<td>1.54</td>
<td>4.00</td>
<td>1.54</td>
<td>4.00</td>
<td>3.08</td>
<td>8.00</td>
</tr>
<tr>
<td>Total</td>
<td>3.78</td>
<td>9.78</td>
<td>3.20</td>
<td>8.20</td>
<td>6.98</td>
<td>17.98</td>
</tr>
</tbody>
</table>

In the following sections of this report, sites are identified by field number.

LITHIC SITES

MARK GANAS

GENERAL CHARACTERISTICS

Within the Western Coal Company lease area, 36 sites were recorded which contained lithic components. Four can be assigned to the Archaic Period, and 25 are undiagnostic lithic scatters. Four sites contain both lithic and historic Navajo features, and three contain scatters of undiagnostic lithics and a few sherds.

The Archaic sites are found exclusively within the system of longitudinal semi-stabilized dunes found in the southern half of Section 10 (see Figure 3). The dunal areas are characterized by
Figure 3. Archaic Site Distributions
relatively large populations of seed grasses. Other areas of the lease are characterized largely by shale badlands or by level areas of sandy clay/silt in which the predominant vegetation is largely Atriplex spp.

The undiagnostic lithic scatters show distributional patterns similar to the Archaic sites (see Figure 4). Some of the lithic components may be examples of Navajo stone tool usage, or perhaps non-ceramic Anasazi loci. However, it can be seen by comparing Figures 3 and 4 that the undiagnostic lithic scatters are located in largely the same areas as the Archaic sites, and analysis shows that they fall into the same functional groups. Therefore, the undiagnostic and Archaic sites will be considered together in this study.

Three sites (WCB-30, -31 and -60) contain, in addition to lithics, small scatters of ceramics. However, the association of the ceramics with the lithics is not well established. The ceramics at each site are derived from a single vessel, and thus may, in each case, be the result of a later intrusion. Therefore, these three sites are included in the discussion of the lithic sites.

Four sites (WCB-33, -56, -57, -66) contain both lithics and historic Navajo features. These sites are excluded from the analytical sample, with the exception of WCB-33. The chipped stone may be fortuitously in association with the Navajo remains or they may reflect sporadic Navajo collection or use of stone tools. The prehistoric component of WCB-33 is, however, included in this sample, for the two components are clearly separate.

A total of 63 isolated lithic loci were found and recorded (see Figure 5). While these may indicate limited activity loci (plant procurement, limited lithic reduction, etc.), or may be derived from nearby sites, the techniques of lithic site analysis which involved examination of the characteristics of more complex lithic assemblages precluded the use of isolates in all analyses.

Lithic sites tend to be arrayed into two clusters which can be understood in terms of biotic resource proximity. The less populous cluster is arranged linearly along Alamo Wash. Six sites are found
Figure 4. Undiagnostic Lithic Scatter Distributions
Figure 5. Isolated Lithic Loci Distribution
immediately adjacent to the wash. These six sites tend to be large in areal extent (greater than 500 m$^2$), however, the number of artifacts visible on the surface ranges from fewer than 20 to greater than 500. Since these sites have been subject to both erosional and alluvial processes, further testing would be necessary to determine the actual site boundaries.

The second and larger cluster of lithic sites is located on the system of longitudinal dunes centered in the southern half of Section 10. Sixteen sites are located on the largest series of dunes. An additional six sites are located in areas peripheral to the largest dunes, in sandy areas with relatively high populations of seed grasses. The site areas range from small (less than 300 m$^2$) to very large (18,500 m$^2$). Artifact assemblages range from fewer than 20 items to several hundred. With respect to areal extent and assemblage size, the lithic sites follow no spatial distributional patterns, other than the clustering discussed above. There is no differential distribution between small and large sites. A set of nearest neighbor statistics was computed for the cluster of sites in the southern half of Section 10. The result indicated that these lithic sites are randomly distributed (nearest neighbor score = 0.96; p = 0.765).

Dating of the lithic sites is inconclusive. Based on projectile point styles one site, WCB-35, was dated to the Jay phase (ca. 7500-ca. 6200 BP); two sites (WCB-23, -36) were dated to the San Jose phase (ca. 5200-ca. 3800 BP). One site, WCB-18, contains two projectile points. One was identified as a Jay point, and the other was identified as an Armijo point (ca. 3800-ca. 2800 BP). Although the dating for WCB-18 is uncertain, it probably dates to the later period. With this last exception, all sites were dated on the basis of single projectile points. Thus, the accuracy of site dating is certainly not unquestionable.
METHODS OF ANALYSIS

The lithic sites were partitioned into six groups on the basis of artifact assemblage characteristics. Prime criteria for distinguishing among the sites were the collective attributes of the flaked stone assemblage for each site, including the stage of lithic reduction, the size of the flaked stone assemblage, and the diversity of material types utilized relative to assemblage size.

The flaked stone assemblage was viewed to be representative of one or more stages of lithic reduction behavior in terms of the techniques of core trimming and tool production (both formal tools and ad hoc implements). The reduction phase as indicated by a given artifact was determined by the amount of cortex present.

Definitions of terms used in the analysis are the same as those used by Powers (1979:27-28) in the analysis of lithic sites on an adjoining parcel of land:

- **Primary flake** - Cortex is present on both the platform and entire dorsal surface.
- **Secondary flake** - Cortex is absent from portions of the dorsal surface or from platform.
- **Tertiary flake** - No cortical material is present on any portion of the flake.
- **Core** - A cobble exhibiting two or more flake scars.
- **Angular debris** - Lithic fragments which do not exhibit either positive or negative bulbs of percussion (e.g., broken cores, flake fragments, and pieces which fractured along planes or cracks within the parent material).
- **Formal tool** - A class including bifaces, knives, projectile points, drills, scrapers, and other purposely shaped products of tool manufacturing.
- **Ad Hoc Tool** - A class containing unshaped utilized flakes, angular debris fragments and cores which represent tools which possess use/wear attributes, but no purposeful shape modification characteristics.

To ensure consistency in recording of the assemblages, the data categories were maintained within the above definitions. This also provided a simple and efficient gauge of lithic reduction behavior. Primary flakes and some angular debris are the outcomes of material
testing and primary reduction behaviors. Secondary flakes are indicative of core trimming and the production of unifacial and bifacial tools from the core. Tertiary flakes are generally the products of tool production, either from a prepared core or from a biface or preform, and of tool resharpening behaviors.

Attempts were made to record every surface artifact at each site. At a few of the larger sites, where the recording of each artifact would have been prohibitive in terms of time, transects were drawn on the site through larger artifact concentrations in areas where representative samples could be drawn. The sizes of these transects varied according to the site (generally 1m x 20m or 2m x 10m). The percentage of the assemblage which was included in the transect was also estimated. All artifacts within transects were recorded.

Along with the morphology of each artifact, its material type was recorded. The variable "material type" included lithology (chert, chalcedony, quartzite, basalt, petrified wood, etc.), the quality of the material (fine, medium or coarse grain), and the color(s), based on the Munsell color system. Previous experience has demonstrated that the same parent material may in fact contain a range of colors. When these were encountered, the artifacts were assigned as subtypes within the same parental material types, and were designated as "Type 1," "Type 2" and so on.

Three indices were utilized in material type analyses. First, the average number of flakes of each material type was calculated for each site by dividing the number of artifacts in the chipped stone assemblage by the number of material types. In the second index, the effects of assemblage size were minimized by using the formula:

$$I = \frac{M}{\sqrt{L}}$$

where

- $I$ = diversity index
- $M$ = number of material types at the site
- $L$ = number of artifacts in the flaked stone assemblage

Finally, an index was used which produced values which were intuitively easy to understand:
\[ D = \sqrt{\frac{M}{L}}, \text{ where } D = \text{diversity index} \]

\[ M = \text{number of material types at the site}, \]

\[ L = \text{number of artifacts in the flaked stone assemblage}. \]

This index produced values ranging, theoretically, from 0 to 1, with 0 being the imaginary case of an infinite number of artifacts, all of the same material type (infinitely homogeneous), and 1 representing the case of each artifact being of a different material type (infinitely diverse) (Kemrer et al. 1979:43).

In addition to the above attributes concerning the flaked stone assemblage at each site, artifact morphology (stages of lithic reduction), size of assemblage, and ranges of material types, the percentage or absence of ground stone artifacts was also recorded for each site. These included manos, metates, grinding slabs, and fragments of these items. The groundstone artifacts were predominantly sandstone, but ground cobbles of quartzite and other materials were occasionally found. Artifacts revealed information concerning subsistence activities and related behaviors other than lithic reduction behaviors. Finally, the presence or absence of features or possible features, such as hearths, oxidized areas, charcoal/ash stains and scatters of sandstone were noted at each site.

The sites were separated into functional categories in a stepwise fashion using the data categories outlined above. These steps are outlined in Figure 6.

**FUNCTIONAL GROUPS**

On the basis of the above criteria, the lithic sites arrange themselves into six groups, which are argued to have functional significance.

**Secondary Lithic Reduction**

One site (WCB-12) appears to be a secondary lithic reduction station. A total of 88.5% of the artifacts at the site are made from basalt, probably derived from the same cobble. Although no cores were found, approximately half of the artifacts were tertiary flakes, with
<table>
<thead>
<tr>
<th>Ground Stone</th>
<th>Tool Type Diversity, Hearths</th>
<th>Site Size</th>
<th>Material Diversity</th>
<th>Functional Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low tool type diversity, Hearths present or absent</td>
<td>Large</td>
<td>High material diversity</td>
<td>Large plant processing area</td>
</tr>
<tr>
<td>Lithic Site Inventory</td>
<td>High tool type diversity, Hearths present</td>
<td>Large</td>
<td></td>
<td>Late camp</td>
</tr>
<tr>
<td></td>
<td>Low tool type diversity, Hearths absent</td>
<td>Small</td>
<td>Low material diversity</td>
<td>Small plant processing area</td>
</tr>
</tbody>
</table>

Figure 6. Method of Categorizing Lithic Site Function.
a few primary secondary flakes as well. A large amount of angular debris was also present. A few of the flakes showed evidence of use/wear or retouch. No ground stone was found, although the site may have had a function not conclusively indicated in the assemblage, such as plant procurement, the behavior that can be clearly identified as the knapping of basalt flakes from primary or secondary flakes brought in from elsewhere, or alternatively, the production of a single basalt core tool which was then transported from the site.

**Plant Procurement**

Five sites (WCB-14, -15, -19, -31, -32) were classified as plant procurement loci. These sites possess low percentages of ground stone (see Table 4), high percentages of artifacts made of quartzite, and relatively large percentages of utilized flakes and high artifact material type diversity. In general, these are function-specific sites. The high percentages of items with cutting edges, such as secondary, tertiary, and utilized or retouched flakes, indicates that the main activity was the collection, and preparation for collection, of the wild grasses in the area. These sites are in areas that would be used repeatedly, but the sites themselves are ephemeral. No evidence of permanent features, hearths, or other indicators of protracted usage are found at these sites. The low frequency of ground stone indicates that the preparation and processing of the collected plant material occurred elsewhere.

The percentage of artifacts made from quartzite is much higher at these sites than at any other class of sites. Donald Clifton (personal communication) has suggested that plant procurement and plant processing areas may be distinguished by a higher incidence of artifacts made of coarser materials, such as quartzites and basalts. These materials would be more efficient for cutting plants, because of the natural "serration" that would be produced on a flake of macrocrystalline material, and because the coarser flakes removed through edge attrition would often renew the edge of the artifact. The use of secondary and tertiary quartzite flakes may have been more efficient for plant collecting.
than those for faunal processing.

The relatively high incidence of utilized and retouched flakes at these sites may indicate that *ad hoc* tools rather than formal tools were preferentially utilized in the collection of plants. This is further supported by two additional measures. First, the average percentage of cores is somewhat higher than at many other types of sites (15.18%; all sites average 12.14), indicating that some lithic reduction and flake manufacture occurred at some of these sites. Second, excluding the quartzite artifacts, the remaining artifacts show a high material diversity value. This may also indicate the use of *ad hoc* tools and the utilization of whatever materials were immediately available for the production of tools.

**Small Plant Processing**

Ten sites (WCB-17, -24, -26, -27, -28, -33, -34, -43, -45, -52) were classified as small plant processing sites. These loci are characterized by an absence of formal tools and by a high percentage of ground stone artifacts. These sites are probably not as functionally specific as the plant procurement sites, and the term, "plant processing," denotes only the predominant activity. The assemblages indicate that some lithic reduction also occurred. However, the sites appear to exhibit limited usage intensity. None contain more than 45 surface artifacts, and no hearths or other evidence of protracted usage were found. Presumably, some preliminary preparation of food materials from wild plants was taking place at these sites. Although the activities occurring at these loci and at plant procurement sites are related, there is little functional overlap between these two categories.

**Large Plant Processing**

Four sites (WCB-22, -30, -35, -36) were included in this category. Again, there is a high percentage of ground stone present at these loci. Although there is some evidence for lithic reduction, the high incidence of ground stone indicates that the dominant activity performed within these sites was plant processing. These sites differ from the other plant processing sites in two respects. First, they have larger
assemblages, ranging from 55 to 106 surface artifacts. Second, the usage intensity seems to be greater. This is evidenced by the larger assemblages and by the occasional presence of hearths which suggest a longer use-life for these sites.

Irwin-Williams (1973:8) has suggested that post-Pleistocene adaptations specified by a mixed hunting-gathering subsistence economy, continued through the Jay phase (ca. 7500-ca. 6800 BP), and large-scale exploitations of plant foods began during the San Jose phase (ca. 5200-ca. 3800 BP). It is at this time that ground stone implements first occur in the Arroyo Cuervo area. One of the large plant processing sites of this survey (WCB-35), with 31.06% of the surface artifacts consisting of ground stone, contained a Jay point. Of course the dating of this site, based on one diagnostic artifact is tenuous, but if this dating is corroborated by additional evidence, it would suggest that wider ranges of subsistence activities occurred earlier in the Archaic than had previously been supposed.

Early Camps

Given the assumption that intensive utilization of plant resources did not begin until the middle Archaic, five sites (WCB-37, -58, -63, -67, -71) were designated as early camps. In general, these loci had little or no ground stone. Only one site in this group had any ground stone, and this amounted to only 2.44% of the total site assemblage. Criteria for inclusion into this group were the low incidence or absence of ground stone and the presence of hearths or other features, which indicate a fairly long term occupation or intensive site utilization. Four of the five sites had hearths in association; the remaining site (WCB-37) is located in a sandy area, and evidence for hearths, if any, may be buried. Presumably the subsistence-related activities at these sites would be related more to hunting than to plant procurement and
processing. The artifacts would indicate activities such as lithic reduction and tool manufacture took place. Assemblages at these sites indicate that tool manufacture was one of the main activities and the percentage of formal tools is high at most of the sites. One large site (WCB-71), however, had no tools; either they have been removed from the site, or activities centered around flake production. Diversity of material types is low, indicating that lithic manufacture at these sites included a narrow range of materials. The incidence of quartzite is low which would tend to support the notion that the activities at these sites were not strongly associated with plant procurement or processing.

Later Camps

The eight sites included in this category are WCB-18, -21, -23, -29, -40, -41, -60, and -64. They range in size from 14 artifacts (WCB-64, which has been subject to erosion) to the largest lithic site of this survey (WCB-40), containing hundreds of artifacts. Except for the presence of hearths or other features, indicating intensive or extended usage, the most diagnostic attribute of the assemblages at these sites is that they are highly variable. Percentages of artifact classes and other indices are, in all cases, very close to the average for all sites (see Table 4). This suggests that a wide range of activities, including plant and animal processing, lithic reduction and tool manufacture was occurring at these sites, with no particular activity dominating. Functionally, the differences between these sites and the plant processing sites are: 1) as indicated by the presence of hearths, usage of these sites may have been for a long period, and 2) a wider range of activities took place. These sites probably functioned as full-scale base camps.
One of these loci (WCB-23) dates to the San Jose phase. Another site (WCB-18) contains a Jay point and an Armijo point. It is likely that the site dates to the later period, and that the Jay point may represent curation by the later occupants.

PATTERNS OF COMPLEXITY AMONG FUNCTIONAL GROUPS

The six lithic site categories serve as the empirical basis for developing a model which specifies relations among and between tool-processing and subsistence activities during the Archaic period. The following assumptions are made:

1) The lithic sites were occupied during the Archaic period.
2) The occurrence of ground stone specifies plant processing activities, and that these activities did not begin on a large scale until the middle of the Archaic period.
3) Lithic reduction and tool-making behaviors are reflected in the flaked stone assemblages.
4) Sites containing hearths were occupied longer than those that do not contain fire features.

An examination of Table 4 indicates that several criteria serve to distinguish among the groups. The percentage of ground stone was the first criterion used to distinguish among the groups, and the differential distribution of ground stone among the sites is pronounced. An examination of the other columns of the table shows that criteria not included in the initial stepwise site categorization also discriminate well among the groups.

In order to test some of the assumptions concerning the stone tool assemblages in relation to the hypothesized activities at the sites, the groups were ranked according to the expected proportions of flakes in the assemblages. The single lithic reduction site WCB-12 was excluded. The plant procurement sites were assumed to consist of assemblages composed almost entirely of flakes. Therefore, the plant procurement sites were assigned a rank of one. Lithic production at the early camps would be expected to consist largely of the production of flakes and flaked tools. Thus, this group was ranked second. Because of increasing diversity of
Table 4: Mean Values of Selected Lithic Attributes by Functional Types.

<table>
<thead>
<tr>
<th>Type of Site (N)</th>
<th>Percent Formal Tools</th>
<th>Percent Utilized and Retouched Flakes</th>
<th>Percent Ground Stone</th>
<th>Percent Quartzite</th>
<th>Items/Material Type</th>
<th>Diversity Index I = M/FL</th>
<th>Diversity Index D = M/LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary Reduction (1)</td>
<td>0</td>
<td>3.85</td>
<td>0</td>
<td>0</td>
<td>8.3</td>
<td>0.6</td>
<td>0.340</td>
</tr>
<tr>
<td>Plant Procurement (5)</td>
<td>1.64</td>
<td>4.21</td>
<td>3.58</td>
<td>26.89</td>
<td>2.11</td>
<td>2.94</td>
<td>0.934</td>
</tr>
<tr>
<td>Small Plant Processing (10)</td>
<td>0</td>
<td>3.47</td>
<td>28.94</td>
<td>11.54</td>
<td>2.35</td>
<td>2.07</td>
<td>0.664</td>
</tr>
<tr>
<td>Large Plant Processing (4)</td>
<td>2.11</td>
<td>1.46</td>
<td>31.42</td>
<td>15.05</td>
<td>3.10</td>
<td>1.96</td>
<td>0.579</td>
</tr>
<tr>
<td>Early Camps (5)</td>
<td>3.36</td>
<td>1.88</td>
<td>0.49</td>
<td>3.06</td>
<td>6.34</td>
<td>1.39</td>
<td>0.504</td>
</tr>
<tr>
<td>Later Camps (8)</td>
<td>3.48</td>
<td>2.61</td>
<td>18.56</td>
<td>16.06</td>
<td>2.81</td>
<td>1.84</td>
<td>0.606</td>
</tr>
<tr>
<td>All Sites (33)</td>
<td>1.98</td>
<td>2.88</td>
<td>16.92</td>
<td>13.83</td>
<td>3.33</td>
<td>1.89</td>
<td>0.619</td>
</tr>
</tbody>
</table>
activities at the remaining sites, the third, fourth and fifth ranks were given respectively to small plant processing sites, large plant processing sites, and late camps. The sum of the actual percentages of primary, secondary, and tertiary flakes was then calculated for each group, and the groups were then ranked according to these sums. A Spearman rank order correlation statistic was then calculated to compare the two rankings with a significant positive correlation value of $R = 0.80; p = .933$. An identical result was achieved when the sums of the percentages of only secondary and tertiary flakes were considered ($R = 0.80; p = .933$).

These analyses demonstrate that the functional groups reflect an ordered range of behavioral complexity among the sites. The above statistics support the hypothesis that the site categorization differentiates among sites with respect to increasing deviation from simple lithic reduction behavior. That is, sites with wider ranges of artifact types, indicating wider ranges of behaviors, were analytically separated from sites at which the primary activity was the production or use of flakes.

If one were to consider a wider range of behaviors than the production of flakes, the groups would rank differently. The widest range of activities would probably occur at the later camps, because of the combination of hunting and more intensive gathering. The next would be the earlier camps, at which the full range of subsistence and maintenance activities occurred, but presumably with a less intensive utilization of plant food. Following these would be, respectively, large plant processing sites, small plant processing sites, plant procurement sites, and lithic reduction sites.

This differentiation of behavioral complexity among the functional groups is also reflected in the lithic material type diversity indices. The groups were ranked according to their average diversity indices ($I = M/L$), and these ranks were compared with the ranks of expected complexity of behavior, as described above. Again, Spearman's rank order correlation was used, with the result $R = -0.90; p = 0.95$. 

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The ranking for the average lithic material type diversity index specifies the relative complexity of each group. However, an examination of the correlation value and Table 5 shows that the relationship between complexity and diversity index is strongly inverse. The more complex sites (early and late camps) have lower average diversity indices than the simpler sites. This finding is consistent with the notion that the occupants of the small procurement and processing sites tended to select stone materials immediately available to them for their tool needs and thus generated high material type diversity values.

SPATIAL PATTERNING OF FUNCTIONAL GROUPS

The locations of the sites belonging to each group are shown in Figure 7, along with the location of the main sand dune areas. Certain sites are in close proximity to each other and it is possible that these sites may be physically connected. These possible associations are indicated by lines connecting individual sites in Figure 7. These sites may, in fact, represent intrasite activity loci. Because of the semi-stabilized nature of many of the dunal deposits, some site areas may lie beneath the surface, and the connections between some components of larger sites may have been hidden beneath the shifting sand.

Examination of Figure 7 reveals certain trends concerning functional groups and resource availability. The distances of each site to a major water source (Alamo or De-na-zin Washes) and to a major area of sand dunes were measured and are plotted graphically in Figure 8. Early camps tend to be located fairly close to both a major water supply and to the dunal areas. In contrast, later camps are all located immediately adjacent to the dunal areas, but tend to be widely distributed with respect to distance from the washes. This may represent the difference in subsistence activities between the two groups. It is expected that earlier inhabitants would depend approximately equally on hunted animal foods and collected plant foods. Traditionally, archaeologists have assumed the emphasis in the early period to be toward the animal food. Since water is necessary for sustaining life, the placement of these camps in close proximity to water would have served two functions: it would have provided water for the in-
Figure 7. Distributions of Lithic Site Types
habitants of the camps, and it would have put the hunters adjacent to areas that must have been frequented by game animals, which periodically visited the washes for water. However, the proximity of the later camps to the dunal areas, with their large populations of seed grasses, reflects an increasing dependence on collected plant foods. None of the later camps is more than a mile from one of the major washes, but it is apparent that the need for a close source of seed grasses outweighed the immediate need for water.

Another possible explanation for the differential spatial distribution and artifact assemblage differences among campsites is the season of occupation. The sites located on or adjacent to dunes may have been located adjacent to seed plants at the season when they were most abundant. The camps located adjacent to water may represent hunting oriented activities that were conducted in the season when plant procurement would have been a less productive subsistence activity. Thus, the differentiation of campsite location may not be a strictly cultural/temporal relationship.

The locations of the remaining site categories also seem to be related primarily to dunal areas. This is true of the single lithic reduction site, WCB-12. The remaining sites, plant procurement and plant processing loci, are found almost exclusively in the dunal areas of Section 10.

Within the main cluster of sites in the dunal area, some patterns emerge. The plant procurement sites are located in the deepest dune areas which support the densest stands of grasses. Assuming that the dunes in prehistoric times were in essentially the same location as today, this would place the procurement sites in the most favorable collecting areas. However, in many cases, the plant processing sites are some distance removed from both the procurement sites and the main camps. This suggests that collected plants were transported to the processing areas, which may have been centralized and located peripherally to the main camps. The three isolated plant processing sites in the northern portions of Sections 10 and 11 may be related to plant procurement loci or campsites located beyond the survey area.
Figure 8. Site Distances from Major Washes (A) and Dunal Areas (B)
The locations of the isolated lithic occurrences were compared with the site locations. Many of the isolated grinding stones, manos and metates occur near plant processing sites and camp sites, and are probably associated with them. Several isolated metate and mano fragments (e.g., IL-65, -71, -76) probably represent other small plant processing loci.

IL-150 is probably the remains of a small, badly eroded camp in a dunal area near Alamo Wash. Several loci (e.g., IL-41, -48, -78, -83) probably functioned as limited lithic reduction loci. The remainder of the isolated loci consists of single flakes and cores, and their interpretation is difficult. Although their distribution tends to mirror that of the sites, they are more widespread and occur in environments such as the shale-saline *Atriplex* areas, that contain no lithic sites. They may represent small, isolated plant procurement or other special function loci.

REGIONAL SUMMARY OF LITHIC SITES

**Paleoindian (9500-7500 BP)**

Evidence for human activity in the San Juan Basin during the Paleoindian period has been found during the course of other surveys in the area (cf. Huse et al. 1978:35; Sessions 1979:45). These finds usually occur as isolated artifacts or as single items on later sites. Although there is occasional evidence for Paleoindian camp-sites (Hadlock 1962) the Paleoindian utilization of the Colorado Plateau and the San Juan Basin appears to have been minimal. No evidence of Paleoindian activity was found during the present survey.
Archaic (7500-1600 BP)

The archaeological record contains evidence of much more intensive occupation in the ensuing Archaic period. Irwin-Williams (1973:7-11) has provided the most detailed chronological description of Archaic occupation in northwestern New Mexico. She described five phases:

1) Jay (ca. 7500-6800 BP), with "a mixed spectrum of subsistence activities, adapted to a year-round exploitation of local resources, whose maximum concentration was accessible from permanent water localities."

2) Bajada (ca. 6800-5200 BP), which "reflects considerable continuity from the preceding Jay phase. It is distinguished by shifts in technology . . . and possibly by a slight population increase, which apparently reflects increasingly effective adaptation to a broad spectrum subsistence base."

3) San Jose (ca. 5200-3800 BP), with evidence of increased effective moisture and dune stabilization, and a shifting, systematic exploitation of regional microenvironments.

4) Armijo (ca. 3800-2800 BP), during which appears to have been the beginnings of maize agriculture, and probable seasonal patterns of population aggregation, and

5) En Medio (ca. 2800-1600 BP), which Irwin-Williams (1973:11) described as "the link to the . . . Anasazi Pueblo sequence."
In general, the area around the Bisti Badlands appears to have been sparsely populated throughout the Jay and Bajada phases. In the Bisti-Star Lake survey, located to the south and east of the study area, no Jay sites or isolates were reported; of the 42 sites and 15 isolates with diagnostic artifacts, seven sites and one isolate were dated and two sites (both with later Archaic components) were dated to the Jay or Bajada phases during the course of the EPCC survey, located several miles west of the study area (Anderson and Sessions 1979:92-94). The survey of the Western Coal Company lease produced two Jay points; one of these was in association with an Armijo point, and may have been transported from elsewhere.

The San Jose phase appears to have been a time of increased usage of this area. The post-Altithermal increase in effective moisture may have supported larger populations of grasses and other vegetation. This is also supported by stratigraphic evidence of dune stabilization during that period. In the Bisti-Star Lake sample (Huse et al. 1978:46), more sites date to the San Jose phase (nine sites, five isolates) than to any other Archaic period except the En Medio (18 sites, four isolates). In the EPCC area, the San Jose phase shows "the largest occupation during Archaic times" (Anderson and Sessions 1979:98). This also is the case on the NIIP Blocks IV and V (Alyea et al. 1979:59). These sites have been classified as a base camp and a large plant processing area, and indicate some intensive utilization of the area during that period.

During the Armijo and En Medio phases, usage intensity seems to decline in the Bisti Badlands. The EPCC survey recorded only three sites dating to the Armijo, and two sites to the En Medio (Anderson and Sessions 1979:98-100). However, this may indicate a population shift to nearby, higher areas to the south, especially in the En Medio phase. The Bisti-Star Lake survey recorded its highest proportion of datable sites as dating to the En Medio phase (Huse et al. 1978:46).
SPATIAL DISTRIBUTION OF ARCHAIC SITES

In general, the presence of Archaic sites is known to highly correlate with dunal and riparian settings (cf. Marshall and Stein 1978:6). Reher and Witter (1977:124) have hypothesized, however, that vegetative diversity is a main determinant of the locations of Archaic sites. Specifically, they have suggested that Archaic sites are distributed not only in ecotonal or multi-ecotonal situations, but also where other physiographic factors, such as the juxtaposition of riparian zones, badlands and shaley upland grass zones, enhance the ecotonal effect.

Baker and Sessions (1979:288) have noted that the presence of Archaic sites is highly correlated with vegetative diversity when large areas are considered. However, in local areas the smaller scale may tend to obscure the relationships between local species diversity and Archaic site density. They suggested that the occurrence of Archaic sites is primarily related to the presence of deep sands and stabilized sand dunes.

Powers (1979:56) on the other hand, has noted that the incidence of Archaic sites on the PNM lease abutting the Western Coal Company Bisti lease to the south, correlate with the number of blowouts in an aeolian soil area. Her analyses demonstrate that Archaic sites are also likely to be found in semi-stabilized aeolian situations, but often less likely to be detected archaeologically.

The lithic sites of the Western Coal Company lease show distinct distributional patterns, related to dunal and riparian zones. The study area is small, and large-scale patterns are not apparent. Predictive models based on these data would likely have little validity. However, site distributions in this area indicate that the presence of lithic sites is not explained by high vegetative diversity. Several physiographic zones are represented in the survey area, including dunal areas, riparian zones, shale badlands, and sand/shale zones and saline plains (see Figure 2). Site locations are not correlated with the ecotones between these zones.

In many cases, the sites are found in deflated areas. However, very few blowouts (areas deflated to hardpan) occur on the lease, and
thus it is difficult to evaluate Powers' findings independently.

Site locations appear to be most strongly correlated with proximity to riparian and dunal areas. The strength of association with either zone seems to be dependent on period of occupation and site function, but, in general, the strongest association is with deep sand areas on stabilized or semi-stabilized dunes. These areas support the densest stands of seed grasses, especially *Oryzopsis*, *Sporobolus*, and *Aristida*.

Some areas of the lease contain large stands of *Guiterrresia* and *Salsola kali*. Both ethnographic and ethnohistoric evidence indicates that these areas have been (and continue to be) overgrazed. However, physiographic and ethnographic evidence also indicates that many areas have not been extensively overgrazed, and other areas show evidence of having returned to the original climax community. If one were to assume, therefore, that the present-day vegetation is closely similar to that extant in prehistoric times, then the locations of many of the sites (plant procurement and processing, and largely plant-dependent camps) would be explained by the presence of large populations of seed grasses, which occur on stabilized and semi-stabilized deep-sand dunes.

**ARCHAIC SITES: FUNCTIONAL CATEGORIZATION**

After analysis of the data obtained on the areally extensive CGP survey, including use of principal-component, cluster, and discriminant analyses, Reher (1977:98) concluded that the Archaic sites arrayed themselves in a functional continuum: "Sites at one end were definitely large habitation sites, while sites at the other end were small, special-use sites, but a large number of sites ranged in between, by whatever characteristics measured."

Other researchers have found it useful to overlay a functional structure on the sites based on expected characteristics of certain functional groups, and then test the fit of that structure. For example, the sites of the Bisti-Star Lake survey (Huse et al. 1978:51-3) have been divided into five groups, based on certain attributes of the assemblage. Hunting loci were identified by isolated projectile points, milling loci by isolated grinding implements. Scavenged components con-
sisted of diagnostic Archaic artifacts in occurrence at sites of later temporal affiliation. *Spacial activity—temporary camps* were identified by small and limited artifact diversity, while *campsites* were large sites with large and complex artifact inventories.

Similarly, Anderson and Sessions (1979:63-70) have grouped the EPCC survey sites into several categories, based on size, characteristics of the assemblage, and presence or absence of features:

1) Habitation sites: medium to large: features and formal tools present.

2) Secondary sites:
   a. Temporary camps: medium to small: features present.
   b. Undifferentiated limited activity: chipped stone only.
   c. Hunting camp: medium to small; ground stone absent; projectile points present.
   d. Floral processing sites: medium to small; ground stone present; hearths and projectile points absent.

3) Quarry sites: many cores; features, ground stone and formal tools absent.

4) Multi-component: multiple functional and temporal components.

Powers (1979:27) analyzed the lithic sites of the PNM lease in terms of the techniques of lithic reduction, examining the proportions and amounts of primary, secondary, and tertiary flakes, tested cobbles, cores and formal tools. Material diversity and assemblage size were also considered. The sites were thus separated into eight groups; these groups were then examined with reference to other characteristics (frequencies of chipped vs. ground stone, etc.) and described in functional terms (Powers 1979:41-42). These functional groups include plant harvesting loci, plant processing areas, primary lithic reduction areas, and a few basecamp sites.

In all cases, the researchers have acknowledged the fact that any model of Archaic site function will, to some extent, mask the element
of functional continuity. Within the classificatory scheme presented here considerable behavioral overlap exists among functional groups. Behavioral redundancy however, did not preclude discernment of differential site functions and model development which can be tested in other surveys or in excavation.

As Powers has stated (1979:113), the differences in the treatment of data in regard to site function have yielded different site classifications which are difficult to compare from region to region. However, some local comparisons can be made between areas from which the data were analyzed in similar ways.

The data from the sites of the Western Coal Company Bisti lease were initially analyzed using a framework derived from Powers' PNM study. However, it soon became apparent that the distribution of functional site classes on the Western Coal lease and the adjacent PNM tract differed (see Table 5).

<table>
<thead>
<tr>
<th>Site Type</th>
<th>Percentage of Total Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PNM</td>
</tr>
<tr>
<td>Tool manufacturing</td>
<td>2.8</td>
</tr>
<tr>
<td>Primary lithic reduction</td>
<td>13.0</td>
</tr>
<tr>
<td>Plant procurement</td>
<td>38.0</td>
</tr>
<tr>
<td>Small plant processing</td>
<td>29.6</td>
</tr>
<tr>
<td>Large plant processing</td>
<td>15.7</td>
</tr>
<tr>
<td>Camps</td>
<td>0.9</td>
</tr>
</tbody>
</table>

The PNM lease area shows significantly higher percentages of both plant procurement and lithic reduction loci. The higher percentage of plant procurement loci may be explained by the fact that isolated artifacts were considered in the analysis of the data from that area. Some of the isolated lithics on the Western Coal Company lease undoubtedly represent small, special-use area, including plant procurement loci. If these loci were included in the analysis, the percentage of plant procurement loci within the Western Coal tract would probably equal or
exceed that of the PNM lease. The higher percentage of primary lithic reduction loci on the PNM lease is explained by the fact that lithic source areas in the form of lag gravels are located on that lease; no such source areas were found on the Western Coal lease.

The Western Coal Company lease area, however, was preferred for campsite location. The reasons for this are not explicable at present, but two possible can be forwarded. The first is the nature of the aeolian deposits. The deposits on the PNM lease are generally shallower than those of the Western Coal Company lease, and areas of deep stabilized or semi-stabilized dunes are less frequent. As discussed earlier, the incidence of Archaic sites is highly correlated with the occurrence of deep sand dunes with large populations of seed grasses. The presence of these dunes on the Western Coal Company lease may have made that area more attractive to Archaic populations.

The second explanation is the exposure of the area. The area north of De-na-zin Wash is sheltered from prevailing northwest winds by the shale bandlands and high dunal areas above the badlands, while the area of the PNM lease is open to the north. This hypothesis can be evaluated by assessing the incidence of sites in the high dunal areas directly to the north of the Western Coal Company lease in future surveys.

The above discussion of the lithic sites on the Western Coal Company Bisti lease has provided a model of behavioral complexity levels reflecting functional differences. The fit of this model can be tested through excavation or collection of the sites, with detailed analyses of the lithic items, and through comparisons of the analytic outcomes from this survey with those from other areas. It is highly likely that a region-wide model of Archaic behavioral complexity, as related to environmental resource availability and culture change factors, can be developed.
Figure 9. Sites Containing Anasazi Ceramics
Usage intensity of this area during Anasazi times is very low. Four isolated loci containing ceramics were found. These ranged in size from one to four sherds, and as shown in Figure 9 were widely scattered over the lease. Three sites (WCB-30, -31, and -60) contained small numbers of ceramics and lithic material. The association of the ceramics with the lithic artifacts is not clear cut. In each case, the ceramics are derived from single vessels, and are probably the result of later intrusion. Therefore, these three sites were included in the discussion of lithic sites.

Reports from nearby areas indicate generally low Anasazi utilization. Elyea et al. (1979:60) reported that only 11% of the prehistoric sites on NIIP Blocks IV and V have Anasazi artifacts (usually only a few sherds). In the EPCC survey area (Sessions 1979), 50 Anasazi sites (19.4% of all sites) were located. The sites are primarily from the Pueblo II phase (ca. A.D. 900-1150) with a few dating to the Pueblo III phase (ca. A.D. 1150-1300). None of the sites contains more than four rooms. Anasazi occupation thus appears to be restricted to small, rural special function sites or field houses (Sessions 1979). Huse et al. (1978:78) and Powers (1979:59) likewise report low Anasazi usage intensity and small sites in the Bisti-Star Lake and the PNM areas respectively.

The limited utilization of this region during the Anasazi phase is probably dictated by its marginal agricultural potential. Site densities are higher adjacent to more permanent water supplies such as the Chaco River (Reher 1977:75). Wait (1976:474) has reported that Anasazi occupation of the Star Lake area, southeast of the Western Coal Company Bisti lease area, appears to be highest during periods of high effective moisture.
HISTORIC SITES
MARK GANAS and FRED YORK

A total of 28 historic sites were located on the Western Coal Company Bisti lease. All of these are associated with Navajo usage. The proximity of the project area to the Navajo Reservation, which lies several miles to the west, governs the period and type of usage. The project area was actually part of the Navajo Reservation from November, 1907 to January, 1911 (Correll and Dehiya 1972:25).

The survey of the adjacent PNM lease to the south has revealed several historic loci that were probably associated with Anglo-American ranching and mining operations in the area, including the operation of the Tanner Trading Post, located one mile to the east, in the 1930s and 1940s (York 1979:279). Although it is possible that some isolated features (such as cairns) on the Western Coal Company Bisti lease may be related to Anglo-American ranching activities, site characteristics and ethnographic information indicate that they are exclusively associated with Navajo use and occupancy.

HISTORY OF THE STUDY AREA

The Western Coal Company Bisti lease was probably first settled in about 1870-1880. Although no sites have been specifically dated to that period, the De-na-zin trading post, which was built about 1878 (York 1979:264; McNitt 1962:339) has recently been located approximately one mile west of the study area (York 1980). It may be assumed that the post served a population of Navajos who were living in the area. Ethnographic and archaeological information obtained during the survey demonstrate that several sites on the lease were utilized during the latter part of the nineteenth century.

The Navajos probably entered this area as the pastoral population expanded from the Fort Defiance area beyond the boundaries of
the 1868 Treaty Reservation. The first period of large-scale Navajo occupation of the study area corresponds to the 1881-1933 Trading Post phase (Bailey and Bailey 1978a:23). During this interval the Navajos began the process of integration into the Anglo-American economy through purchase of manufactured products and interaction with the white traders. Local Navajos also herded sheep for the trading post owners in exchange for credit or for sheep. Numerous trading posts were located in the region. These are shown in Table 6, although this list is not exhaustive.

Table 6. Trading Posts in the Region of the Western Coal Company Bisti Lease (from York 1979:278).

<table>
<thead>
<tr>
<th>Trading Post</th>
<th>Dates of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>De-Na-Zin</td>
<td>1878-ca. 1910</td>
</tr>
<tr>
<td>Tanner</td>
<td>1936-1945</td>
</tr>
<tr>
<td>Tsaya</td>
<td>1880s-1961</td>
</tr>
<tr>
<td>Bisti</td>
<td>1900-1971</td>
</tr>
<tr>
<td>Whiterock</td>
<td>1900-1961</td>
</tr>
<tr>
<td>Carson's</td>
<td>1916-present</td>
</tr>
<tr>
<td>Gallegos</td>
<td>1896-1972</td>
</tr>
<tr>
<td>Burnham</td>
<td>1927-1970</td>
</tr>
<tr>
<td>Pueblo Bonito</td>
<td>1890s-1910</td>
</tr>
<tr>
<td>Blanco</td>
<td>ca. 1919-present</td>
</tr>
</tbody>
</table>

Another factor which contributed to Navajo occupational patterns in this early period is the system of federal land distribution. As early as 1862, the federal government granted four parcels of land to the Union Pacific-Central Pacific Railroads (Mosk 1944:11). In 1886, the Atlantic and Pacific Railroad Company was chartered by Congress to construct a line from Springfield, Missouri, to the Pacific Coast. In order to encourage investment, the company was granted every other 640 acre section of land consisting of the odd-numbered sections for 40 miles on either side of the railroad line in the territories (Mosk 1944:11). These grants were severely contested, and the policy of granting lands
to the railroads was terminated in 1871 (Mosk 1944:11). However, this characteristic system of land tenure, which came to be known as the "checkerboard" because of the alternate-section land jurisdiction had been established in the project area.

Additional complexities were subsequently introduced into the land tenure system. In 1898, Section 16 and 36 of each township were granted to the territory which included the present State of New Mexico for the purpose of supporting the public school system. In 1912, upon the granting of statehood, Sections 2 and 32 of each township were added to this state land grant (Mosk 1944:23). Under the Dawes Act of 1887 (Mosk 1944:18), the heads of qualified Indian families became eligible for land allotments of up to 160 acres. With the withdrawal of the study area from the Navajo Reservation in 1911 (Correll and Dehiya 1972:25), many of the Navajo families in the area were advised by the Bureau of Indian Affairs to control their holdings through allotments.

Further complexities were introduced as homesteads were granted on public lands and as the railroads leased, sold, or traded portions of their holdings (York 1976:6444; 1979:261). The present status of the lands within and surrounding the Western Coal Company Bisti lease is shown in Figure 10. In addition, several families have the rights to use certain parcels of federal lands as grazing areas. On the Western Coal Company Bisti lease, these grazing parcels include Sections 1, 11 and 12.

The period from 1933 to 1950 is termed the Modern Transitional Period by Bailey and Bailey (1978a:32), and was characterized by increasing Navajo involvement in the Anglo-American wage economy. The period was marked by a number of events, each of which had a different effect on the Navajo population. Consequently, York (1979:281-7) has separated this period into the Depression-New Deal Era (1929-1940) and the period of World War II and its aftermath (1941-1950). The first event which directly affected the Navajos was the stock reduction program begun in 1933. The effects on the Navajo of removing approximately half of their subsistence base were profound, and stimulated a
Figure 10. Land Status in the Study Area and its Environs
decreased dependency on traditional production activities such as herding, agriculture, and handcrafts, and stimulated movement to cities and other areas of increased wage-labor opportunities. With the stock reduction occurring at the height of the Depression, Navajo employment opportunities were slim. These problems were somewhat offset by the institution of a large number of economic development programs, such as the Fruitland Irrigation Project, which hired Navajo laborers (Bailey and Bailey 1978b:198), and local WPA and CCC projects in off-reservation areas (Bailey and Bailey 1978a:34).

In the late 1930s, these programs were curtailed. The Navajos, who had become increasingly dependent upon the wage-labor market, again found themselves under economic duress. The advent of World War II, however, provided them with renewed prosperity. Over 3,600 Navajos entered the armed services, and many others entered into areas of employment which had been opened by the war-related labor shortage (York 1979:285). The war, with its increase of cash income, drew the Navajos further away from the traditional economic systems, including their dependence on trading posts (Bailey and Bailey 1978a:35).

The Modern Navajo Period of 1951-present (Bailey and Bailey 1978a:41), is represented by the continuation of Navajo inclusion into the wage economy and departure from traditional pastoralist based economies. In the San Juan Basin, two major factors contributing to Navajo incorporation into the cash economy are increased mobility and the burgeoning energy industry. The availability of automobiles and trucks enabled the Navajo to haul people and goods over longer distances (Bailey and Bailey 1978a:42). This has increased contact with non-Navajos, and increased Navajo acceptance and emulation of Anglo-American culture.

The San Juan Basin has become an important source area for coal, oil and gas, and energy related industrial growth has been tremendous since about 1950. The population of San Juan County in 1950 was 18,282 and in 1978, 77,000. This is an increase of 421%. In 1950, Farmington's population was 3,737; in 1978, 36,252, for an increase of 970% (Williams and McAllister 1979:103). The opening of two large coal-fired generating
plants near Farmington has provided jobs for local Navajos, and has stimulated Navajo relocation to Farmington (York 1979:290).

NAVAJO SITES IN THE STUDY AREA

The 28 historic sites inventoried during the survey fall into three groups: habitation sites, camps and special function sites. The locations of these site types are illustrated in Figure 11.

Habitation Sites

Fourteen sites (WCB-16, -42, -48, -49, -50, -51, -55, -56, -57, -59, -62, -65, -66, -70) were classified as habitation sites. All contained one or more hogans or houses, except for WCB-59. However, ethnographic information indicates that this site once contained a hogan. The remaining features confirm that this site was a habitation locus. Seventeen dwellings were located at these sites during the course of the survey. Two of the sites contained more than one habitation structure and ethnographic evidence indicates that a third site also contained more than one dwelling. Associated features included coal-ash piles, coal stockpiles, trash piles or scatters, hornos and corrals. One site (WCB-57) also contained a concentration of lithic flakes. However, ethnographic inquiry did not confirm that these flakes had been produced by the Navajo residents of the site.

Lithic manufacturing areas in clear association with Navajo sites were rare. At WCB-57, a concentrated, non-eroded cluster of secondary and tertiary flakes was located on the periphery of the site. The nondispersed nature of the cluster seemed to indicate that it was relatively recent. However, when a local informant was questioned about the lithics, he replied that he had no direct knowledge of their source or purpose, but surmised that they must have been produced or collected by nearby prehistoric lithic sites by children.

The present survey has recorded several cases in which lithic assemblages and Navajo features (usually sheep camps) have occurred in close proximity. In most cases it has been assumed that the lithic component is Archaic, and the two components coincide because the
Figure 11. Distributions of Historic Site Types
vegetation—seed grasses—was attractive to both the plant-gathering Archaic population and to the Navajos grazing their sheep. Isolated lithics have been found on several Navajo sites. However, no sites have been located in which the association between a lithic assemblage and Navajo features is clear. Thus, it must be assumed that, on the Western Coal Company Bisti lease, the manufacture of lithics by Navajos was either rare or nonexistent.

Camps

Seven sites (WCB-20, -25, -39, -44, -48, -54 and -72) functioned as camps, and were probably related to sheep herding activities. In general, the camps were probably occupied on a relatively short-term basis and contain trash scatters and usually coal-ash piles. Two of the camps also contain hornos. Some of the camps (notably WCB-54) contain evidence of tent structures, and may have been occupied longer than the others.

Special Function Sites

A total of eight sites were classed as special function sites. These were loci at which a particular limited activity occurred, or sites for which the function could not be determined.

Sites WCB-33 and -53 were categorized as corral sites. At each site, a corral was the dominant feature. These sites probably also functioned as camp sites. Site WCB-53 also contained a small lamb pen along with a scatter of automotive trash.

Site WCB-38 consisted of a cluster of three cairns. Ethnographic information indicates that there was a cornfield north of the cairns. Ethnographic information revealed that this site is associated with the habitation site, WCB-42.

WCB-46 is a recent trash dump, probably associated with a currently inhabited house to the north.

WCB-59 was classified with the habitation sites, but it also includes a coal quarry. This is a pit, approximately four meters deep, intruding through the overlying sand and shale and into the coal
Figure 12. Distributions of Historic Isolates
deposits. Two three-pound coffee cans, used as scoops, were found in the bottom of the quarry, which appears to be in use at present.

WCB-61 is a cluster of three hornos, two of which have been converted into cairns. According to ethnographic information, this site functioned as a squaw dance area, and was utilized within the 1945-50 interval.

WCB-68 is a site of unknown function. It consists of two sandstone walls within a deep erosional cut in the shale badlands. A local informant stated that the site was used as a habitation about 80-90 years ago. However, in view of the fact that the site was not actually seen by the informant, and given the probable age of the site, possibly older than the informant, this functional and temporal assignment must be viewed as tenuous.

Site WCB-69 is a burial cist, consisting of a hemispherical wall of sandstone set against a sandstone outcrop in the badlands. It probably dates to circa 1925. Inside are the remains of a young individual. A similar burial cist located by a local informant is located nearby, off the lease area. Since this burial was off the lease no site number was assigned. It is plotted on Figure 11.

Isolates

In addition to the sites, 60 historic isolates were recorded and are shown in Figure 12. Seventeen loci were trash scatters, dumps or isolated trash items; eight were coal/ash trash piles; five consisted of automobile trash or abandoned automobiles. Twelve loci were cairns or small clusters of cairns and ten were scarecrows. Two were isolated hearths. The remaining six were classified as miscellaneous, and included isolated historic ceramics, a petroglyph panel, an upright slab, and some milled lumber. Several of the coal/ash trash piles may represent short-term sheep camps. However, without additional information, it is difficult to assess the isolated loci.
Dating of Historic Sites

Most of the historic sites were dated in the field, using architectural and other attributes as well as characteristics of the trash and other artifacts. In addition, the characteristics of the trash provided data concerning the degree of household acculturation. It was assumed that trash piles containing relatively high frequencies of manufactured goods probably indicated that the household was relatively highly acculturated into Anglo-American consumer traditions.

Ward, Abbink and Stein (1977) have outlined in detail the types of historic artifacts, both of native and of Euro-American manufacture, that have been found on Navajo sites in the San Juan Basin, including chronologically sensitive attributes. Their findings were utilized in this study. The trash was analyzed, and the sites were placed in the Navajo temporal/cultural framework of Bailey and Bailey (1978 a & b) as outlined above.

Dates for several sites were obtained through informants. Several sites had been occupied by relatives of the informants, and the dates for these and other sites are fairly accurate. However, some of the informant estimates may be guess-dates. In any case, these dates do not provide occupational duration in calendrical terms, but rather provide a single date, for which a given site was in use. The results of the chronological assignments are summarized in Table 7.

In most cases, the agreement between archaeologically and ethnographically derived dates for a site is good. In others, there is a discrepancy. Part of this is due to the fact that the trash around a given site usually contains a record of items from the entire span during which the site was occupied. As stated above, dates obtained from an informant for a site usually consisted of a single date or a narrow range of dates, during which the informant remembered the site being occupied. These dates were generally near the end of site occupation. In addition, the informant dates are generally tied to events in his/her life, and thus represent approximations.
Table 7. Dates for the Historic Navajo Sites

<table>
<thead>
<tr>
<th>Site Category</th>
<th>Site Number</th>
<th>Field date (from trash)</th>
<th>Informant Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitation</td>
<td>WCB-16</td>
<td>MNP (1951-present)</td>
<td></td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-42</td>
<td>DTPP-MTP (1907-1950)</td>
<td>1940-1945 (a)</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-47</td>
<td>TPP (1880-1933)</td>
<td>1910</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-49</td>
<td>MTP (1933-1950)</td>
<td>1925</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-50</td>
<td>MTP-MNP (1933-present)</td>
<td>--</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-51</td>
<td>DTPP-MTP (1907-1980)</td>
<td>1925 (?)</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-55</td>
<td>TPP (?) (1880-1933)</td>
<td>1940 (a)</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-56</td>
<td>TPP (?) (1880-1933)</td>
<td>1910 (b)</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-57</td>
<td>MTP (1933-1950)</td>
<td>1925-1930</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-59</td>
<td>MTP (1933-1950)</td>
<td>1920</td>
</tr>
<tr>
<td>Habitation</td>
<td>WCB-62</td>
<td>MTP-MNP (1933-present)</td>
<td>--</td>
</tr>
<tr>
<td>Habitation</td>
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<td>TPP (?) (1880-1933)</td>
<td>--</td>
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<td>MTP (1933-1950)</td>
<td>1935</td>
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</tr>
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<td>Camp</td>
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</tr>
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<td>Special Function</td>
<td>WCB-68</td>
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<td>Special Function</td>
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<td>--</td>
<td>1925</td>
</tr>
</tbody>
</table>

(a) date of abandonment.  (b) latest possible date

TPP - Trading Post Period (1880-1933)
MTP - Modern Transitional Period (1933-1950)
DTPP- Developmental Trading Post Period (1907-1933)
MNP - Modern Navajo Period (1951-present)

The various trash items were tabulated for each site on a check-list, which was based on categories developed by Ward, Abbink and Stein (1977). The artifact tabulation allowed for intersite comparisons in terms of functions and, more importantly, in terms of measuring integration into the Anglo-American consumer economy. Manufactured goods were first assigned to broad categories, such as food cans, grooming
## Table 8. Incidence of Selected Categories of Trash at Dated Historic Sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Date</th>
<th>Canned Goods (Exc. Beverages)</th>
<th>Bottled Beverages</th>
<th>Household Goods</th>
<th>Medicinal</th>
<th>Lanterns</th>
<th>Canned Beverages</th>
<th>Automotive Goods</th>
<th>Flashlights &amp; Batt.</th>
<th>Grooming Aids</th>
<th>Toys</th>
<th>Total Number of Categories Represented</th>
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Figure 13. Dated Historic Sites in the Project Area
aids (e.g., combs, aerosal hair spray cans, shampoo bottles), medicinal (e.g., prescription bottles, over-the-counter drugs, and so forth). The categories that were best represented at all sites were selected for analysis, and the items within each category were tabulated. These procedures were conducted for all datable sites. The results of this analysis are shown in Table 8. It is apparent that the types and amount of manufactured goods used by the Navajos of the lease area increased through time both quantitatively and qualitatively. However, as can be seen in Table 8, the greatest change in the amounts and kinds of manufactured goods occurs in sites dating to the 1950s. Prior to 1950, most of the items of Anglo-American origin found on the sites are related to subsistence or household maintenance. At about 1950 and subsequently, there is a tremendous increase in the number of "luxury" items, such as grooming aids, flashlights, batteries (many of which were probably used to power transistor radios), and children's toys. Items such as soda cans and automotive parts also increased. This undoubtedly specifies a major general economic shift.

A shift in Navajo habitation site location through time is evident in the survey data. The locations and dates of the habitation sites are shown in Figure 13. It was hoped that data concerning the kinship network in the area, coupled with the dates and locations of the sites, would reveal patterns of usage through time. The kinship data are incomplete, however, and there are too few habitation sites to draw meaningful conclusions. One of the few patterns to emerge is the placement of recent (1955-present) sites in open situations, away from the badlands. All of the currently occupied structures are in open settings, while 75% of the hogans or houses that were recorded as archaeological sites are situated against the shale badlands, along the 5900' contour. This may be related to a reduction in sheep herding activities since 1955 among residents of the lease area.

The Navajo population changes are also documented by survey data. The number of dwellings from each decade is tabulated in Table 9. Sites for which informant dates are lacking are not included because of the imprecision of the dates. Presently inhabited structures, most of which are not recorded as sites, are also not included in this table. However, it can be seen that the lease area apparently experienced a sharp population decline around 1930.
Table 9. Number of Dwellings Utilized per Decade

<table>
<thead>
<tr>
<th>Decade</th>
<th>Number of Dwellings</th>
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<tbody>
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<td>1910-9</td>
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</tr>
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<td>1920-9</td>
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<td>1930-9</td>
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<td>1940-9</td>
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<td>1950-9</td>
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</table>

SEASONALITY OF NAVAJO LAND USE

The Navajo have long been considered to be a semi-nomadic people. However, when questioned about their movements, many Navajos will state that they don't move (Downs 1972:43). This is a problem with scale. The Navajo, as a tribe, do not move from place to place; this is the sense in which Down's informant answered the question correctly. However, many different seasonal economic activities for a given family require a cyclical yearly movement from place to place. Movements may be frequent, but they tend to occur in a relatively restricted area. Seasonal movements over greater distances occur within a wider area, but less frequently.

Hoover (1931:432) has outlined eight types of Navajo seasonal movements:

1) Move between summer and winter pastures
2) Seasonal moves controlled by temperature conditions
3) Temporary moves for summer farming
4) Winter moves to convenient fuel
5) Autumn moves for pinyon and peaches
6) Moves in search of water
7) Moves after showers for pasture
8) Moves for social reasons.

The first four are essentially longer distance moves, which occur once or twice a year. The remainder would occur as conditions warrant, and probably would occur within a smaller area.
These types of movements were described in 1931, and refer to a "traditional" economy and subsistence pattern. With increasing inclusion of the Navajo in the wage-labor market, Jett (1978:66) has included as movement factors the locations of seasonal or permanent employment, stores, and schools.

Although the areal extent and number of sites in the Western Coal Company Bisti lease are limited, archaeological and ethnographic data have enabled some patterns to be drawn concerning seasonal movement in the area. The distance of the lease area from Farmington and from any main roads seems to have played a role in the types of activities that occur in the area. Until very recently, the main activities within the study area fall into the "traditional" economic pattern, sheep herding and farming. In recent times, the main effect that wage jobs in Farmington and elsewhere has had on the local population was a certain amount of out-migration. Local residents still herd sheep and, to an increasing degree, cattle. Consequently some seasonal modes of behavior linked with these herding activities are still evident.

Several patterns of seasonal activities on the lease can be inferred from the archaeological record. Kemrer (1974:42-43) has demonstrated that the Navajo practice of aligning the doorway of a hogan with the rising sun can be used to determine the season of construction. From a given point, the apparent point on the horizon at which the sun rises each morning changes from day to day as the sun apparently moves in its cycle from summer to winter solstice and back. At the latitude of the survey area, the sun rises approximately 75 degrees (MN) at the summer solstice, and approximately 165 degrees (MN) at the winter solstice. Doorway orientation between 75 degrees and 115 degrees (MN) will presumably have been constructed in mid-April to late August; those with orientations between 135 degrees and 165 degrees (MN) will have been constructed in early November to early February. Intervening angles are ambiguous, since they would reflect either late winter-early spring or fall building (Kemrer 1974:43). Table 10 lists the historic habitation structures for which a doorway orientation could
be determined, and the probable seasons of construction, by this model.

Table 10. Doorway Orientation and Season of Construction.

<table>
<thead>
<tr>
<th>Site</th>
<th>Entry Orientation</th>
<th>Probable Construction Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCB-42 (House 4)</td>
<td>346° (magnetic)</td>
<td>Outside of range</td>
</tr>
<tr>
<td>WCB-42 (Hogan 6)</td>
<td>110°</td>
<td>Spring-summer</td>
</tr>
<tr>
<td>WCB-47</td>
<td>56°</td>
<td>Outside of range</td>
</tr>
<tr>
<td>WCB-50</td>
<td>97°</td>
<td>Spring-summer</td>
</tr>
<tr>
<td>WCB-55</td>
<td>81°</td>
<td>Spring-summer</td>
</tr>
<tr>
<td>WCB-62</td>
<td>76°</td>
<td>Spring-summer</td>
</tr>
<tr>
<td>WCB-65</td>
<td>50°</td>
<td>Outside of range</td>
</tr>
<tr>
<td>WCB-70</td>
<td>89°</td>
<td>Spring-summer</td>
</tr>
</tbody>
</table>

It can be seen that three of the eight structures (37.5%) fall outside the solstice range. One of these structures is a rectangular house with the doorway on the north, and probably warrants special consideration. If this structure is excluded, 28.6% of the structures, all with roughly east-facing doorways, fall outside the range. Klara Kelley (1980:personal communication) has suggested that other factors may influence the placement of doorways. These may include the location of the apparent horizon if obstructions lie east of the hogan, and personal preference as to where the first rays of the morning sun should strike within the hogan. Kemrer (1974:44) has found that the placement of the doorway does depend upon the apparent horizon. The two hogans of the Western Coal Company Bisti lease whose orientations lie outside the specified range are situated in shale badlands, with some visual obstructions to the east. However, their orientations are north of any possible sunrise orientation. Other unknown factors must be in play.

The remaining hogans all have doorway orientations which indicate that they were constructed in the period from mid-April to late August. However, this does not necessarily imply only summer usage of the
structures. Ethnographic data indicate that the structures were each used for at least several seasons.

If the structures were utilized in the summer, it would be expected that many activities, such as cooking, would often occur out-of-doors. Table 11 illustrates that several of the structures have exterior hornos or hearths associated with them. It has been found through ethnographic information that the three cairns of WCB-38 had originally been hornos, utilized by the inhabitants of WCB-42. In addition, the inhabitants had planted corn north of WCB-38.

<table>
<thead>
<tr>
<th>Site</th>
<th>No. of Hearths</th>
<th>No. of Hornos</th>
<th>No. of Coal Ash Piles</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCB-16</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WCB-42</td>
<td>0</td>
<td>3 (WCB-38)</td>
<td>10</td>
</tr>
<tr>
<td>WCB-47</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>WCB-49</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>WCG-50</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>WCB-51</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>WCB-55</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WCB-56</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>WCB-57</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>WCB-59</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>WCB-62</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>WCB-65</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>WCB-66</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>WCB-70</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

If the incidence of external hearths or hornos is taken as an indication of summertime use, then WCB-42, -50, -57, -59, and -66 were probably utilized in the summertime.

Those structures without exterior hearths or ovens, but with coal ash piles, may have been utilized in the winter, since the cooking and
other activities would have taken place exclusively indoors. Table 11 shows that probable winter habitation sites would include WCB-47, -49, -51, -62, -65, and -70. Of course, the contention that these would have been winter use sites based on the absence of exterior hornos is open to question, since the hornos could have been stone-robbed or eroded, or that bread baking in hornos was conducted in both the summer and winter.

The physiographic settings of several of the sites also suggest winter use. Several sites (WCB-42, -47, -49, -50, -51, -65, and -70) are situated directly southeast of (or, in the case of WCB-65, within) the shale badlands. This position would have served two purposes in the winter: 1) it would have shielded the structures from the cold northwesterly winter winds, and 2) it would have provided a natural corral between the badlands and the structures to contain the sheep.

The evidence stated thus far has indicated distinctly seasonal activities which may have occurred at particular sites. This does not however, imply that these sites were utilized only in the seasons indicated. However, data from local informants indicate that several of these sites were utilized in particular seasons. WCB-47 was the wintertime residence of a family which, in the summer, grew crops across De-na-zin Wash and at Newcomb. WCB-49 was used in the winter by another resident who also grew crops at Newcomb. WCB-51 was the wintertime residence of a family which also maintained a residence across De-na-zin Wash. These three sites apparently functioned only as winter residences. This agrees well with the archaeological data concerning the presence of ash piles and the absence of exterior hornos (see Table 11). Another site (WCB-70) functioned as a summer residence of a family which spent winters nearer to Bisti Trading Post. Primarily a pastoral family, they herded their sheep in this area while the other residents were farming elsewhere.

Evidence concerning seasonal movements in this area is limited to these earlier sites. Recent sites and presently-occupied sites are inhabited on a year-round basis. The latest informant dates for sites
for which there is evidence of seasonal movements are ca. 1925-1930. It appears that after 1930 the seasonal trans-humance patterns of the area changed. After 1930, movement was confined within a more restricted area. The summer moves to farms in the Chaco River Valley were largely abandoned.

Smaller scale seasonal movements continued within the study area. These are primarily related to sheep herding activities, and are manifested archaeologically by the small camps. Seven sites were identified as short-term camps. It is generally presumed that these were utilized in the spring, summer or fall. A tent stake was found at one of the sites (WCB-54), but with this exception, no evidence of shelter (tents, ramadas, structures) was found at the camps. Ethnographic evidence indicates that several of these camps were utilized repeatedly over a number of years by the same families.

The camps all date to the post-1950 period. Since these sites are ephemeral, the absence of earlier camp sites may be due to erosion or other forms of destruction. However, the detectable presence of camps dated from the 1930s may be linked to changing patterns of land utilization.

To summarize, it appears that Navajo occupation of the lease area represent the outcomes of two different movement patterns. The earlier and the first is the large-scale seasonal migrations between the lease area, which appears to have been used primarily for grazing, and farming areas on the Chaco River. This pattern appears to have been replaced circa 1930 by a second, more restricted pattern, possibly consisting of year-round residence at a habitation site combined with the utilization of small, temporary herding camps in the spring and summer.

**PROBLEM DOMAINS AND HYPOTHESES FOR FURTHER RESEARCH**

The preliminary analysis of the archaeological survey data and historic ethnographic data concerning the Navajo sites lead to the identification of four problem domains which require further research. These problem domains are based upon observed temporal variations in
1) site density, 2) the composition of trash associated with the sites, 3) the geographical locations of sites within the project area, and 4) the seasonality of site use combined with wider geographic patterns of seasonal migration within which the sites of the project area were utilized.

The data suggest that Navajo habitation site density in the project area increased in the period from 1910 until 1930. Beginning ca. 1930, there is a decrease in the number of habitation sites. The artifact composition of trash in the period prior to 1945 contrasts with assemblages in the subsequent period. In the earlier sites, trash consists of basic consumer commodities such as food containers and in the later period sites there is an appearance of luxury goods in addition to basic commodities. The more recent items include manufactured goods such as toys, grooming aids, transistor radios, motor vehicles, motor vehicle parts, and related accessories. Ethnographic and archaeological data taken together suggest that the earlier seasonally occupied sites dating prior to 1950 may be tied to geographically extensive seasonal migrations which facilitated subsistence-related seasonal production activities such as agriculture and herding.

More recent sites, on the other hand, seem to have been occupied on a year-round basis and less fully integrated into wider geographic mobility patterns for the purposes of either herding or agriculture. Finally, earlier Navajo habitation sites, especially those considered to be winter homesteads, are clustered in the edge of the badland zone whereas more recent sites and currently occupied homesteads are in a wider variety of environmental settings.

A comparison of the approximate dates at which differences occur in site density, trash composition, seasonality of site use, and the location of sites within the project area with historic trends previously presented for the immediate area (Powers 1979; York 1979) and the region (Bailey and Bailey 1978a; Huse et al. 1978; Ward, Abbink and Stein 1977; Sessions and Williams 1979; York in press; Weiss 1979) suggests that the relationships between changes documented in the
archaeological record of the project areas and the history of the region warrant investigation. However, this research should not exclude the collection of data concerning the local environment, the local availability of water and grazing resources, the specific location of the project area within the region, the history of Euro-American land tenure in the immediate area, and unique political factors in this off-reservation project area which may serve to differentiate its history from that of the region.

The regional history suggests that the early reservation Navajo moved into off-reservation areas such as the project area as early as the 1870s, and proliferated in the period between 1890 and 1930 (Aberle 1966). The economy of the Navajo at that time was characterized by a kinship-based production system (Lamphere 1979) which was integrated into the territorial and national economy through the trade of Navajo pastoral and other products for basic consumer goods at the rapidly growing number of trading posts located throughout the region (Kelley 1977). The basis of the Navajo production system underwent transformation in the period following the Great Depression and during the New Deal era of the 1930s. Navajo socioeconomic change was due in part to the federal government's program of stock reduction from the early to the mid-1930s, the institutionalization of range management programs, and the increasing availability of wage employment through New Deal programs (Parman 1976). However, it was during World War II, that a dramatic rise in Navajo participation in wage employment took place (Adams 1963:50). From the period of the 1940s to the present, the following changes have occurred:

1) steady increase in the importance of cash from wages and other non-traditional sources,
2) concomitant changes in the degree of dependency on traditional production activities,
3) an increase in the range of purchased consumer goods, and
4) a growing diversity in the sources of consumer goods.
Since 1940, Navajos acquired motor vehicles, traveled to towns to shop on a more frequent basis, and became less dependent on rural trading posts and the credit available at local stores.

The level of congruence which seems to exist between this general economic history of the region and our interpretation of the archaeological survey data and local informant data concerning the project area led to the development of the following working hypotheses for further ethnoarchaeological, ethnographic and ethnohistoric research.

Hypothesis 1: Site density in the project area has declined since the 1930s due to changes in the local productive economy which are related to changes in the regional economy.

Hypothesis 2: Temporal changes in the composition of trash reflect increased integration into the cash economy as wage employment has increased.

Hypothesis 3: The higher incidence of seasonally occupied sites among the earlier sites in the project area is tied to geographically extensive herding and agricultural activities organized by kinship relations, whereas more recent sites occupied on a year-round basis are tied to a constriction of geographical extent and change in the organization of production activities.

Hypothesis 4: The clustering of early occupation sites especially those identified as winter homesteads, is related to traditional patterns of resource exploitation in the project area, whereas the locations of the more recent homestead sites are tied to a departure from traditional patterns of resource exploitation.

While these hypotheses are offered as guides to further research, it may be expected that additional data collection may require their modification or generate alternative hypotheses to explain fully the variability in the local environment and its resources, and more
precise knowledge concerning variability in the local environment and its resources, and more specific information about local history than is currently available. It is possible, for example, that favorable environmental conditions for both local grazing resources and agriculture have contributed to the proliferation of camp sites in this area and therefore explains the high density of sites observed in the survey. Likewise, while available information suggests that the traditional local Navajo production activities were altered by the stock reduction program of the 1930s, it may be important to gather data on factors which operated exclusively in this off-reservation area. Here, for example, it might be equally important to understand the specific history of Euro-American ranching activities, the political forces operative in the debate of the Boundary Extension Bill of the 1930s, and local repercussions of the Taylor Grazing Act (York 1979). While it would be important to document changes in the geographic range of seasonal migration patterns related to kinship based pastoral and agricultural production, it may be equally important to examine the degree of local resident participation in alternative income sources. Such production within the project area through time, and the participation of the historic occupants of the project area in non-local wage employment.

It may be worthwhile to consider the possible impact of out-migration by Navajos who moved to areas such as Farmington, Cortez and Albuquerque, where the possibility of wage labor employment existed. These out-migrations, which were probably significant, probably affected seasonal patterns of site utilization in the project area, as well as larger, regional seasonal patterns of movement.

Clearly these problem areas cannot be examined without multidisciplinary efforts which would include ethnographic, archaeological and ethnohistoric studies. In terms of the latter, archival research shows good potential, particularly the Human Dependency Survey of the late 1930s. These data show excellent promise of providing information concerning changes in land use within the project area.
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The Archaeological Society of New Mexico, the oldest of its type in the Southwest, was organized on September 14, 1900, as the Santa Fe Archaeological Society. By 1906, its interests had expanded, and it became a statewide organization.

In 1908, it cooperated with the Peabody Museum of Harvard and the Southwest Society (later Southwest Museum) in aiding the Archaeological Institute of America in its New Mexico expeditions. In November of the same year, the School of American Archaeology, an arm of the institute, accepted a tentative proposition of the society to locate in Santa Fe, provided that a need for a museum was met. On February 19, 1909, the legislature established the Museum of New Mexico. By 1913, the first publication for the society, El Palacio, appeared.

During the following years, the society's activities decreased until the reorganization of 1956, when the first annual meeting of all local societies convened in Santa Fe. The idea of a Bandelier Lecture was conceived at the time, and an Amateur Achievement Award was inaugurated the following year. Annual meetings since have been held throughout the state, sponsored by local societies. The lectures and awards have continued. Other programs initiated include scholarships, publication of Papers of the Archaeological Society of New Mexico, field schools, a statewide rock art survey, and a certification program. The society today has a number of affiliated societies, including two in Texas and one in Arizona.