

THE SCOPE OF POST-CHACOAN COMMUNITY ORGANIZATION IN THE LOWER ZUNI RIVER REGION

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INTRODUCTION

This chapter addresses the scope of post-Chacoan community organization in the lower Zuni River region, and suggests a methodology for examining community organization elsewhere. The chapter is divided into several sections. The first discusses the problem and the archaeological context. The second outlines a methodology for exploring household interaction by tracing ceramic exchange among roomblocks. This is followed by detailed presentation of an extensive oxidation and chemical element analysis of ceramics designed to resolve questions about the scope of post-Chacoan communities in the lower Zuni River area. The analysis indicates that intraregional exchange can be effectively monitored, which permits testing of different community models and highlights aspects of local ceramic production. Results suggest that the scope of post-Chacoan communities in the Zuni area was broad-based, with activity focused on post-Chacoan great house settlements. A critical evaluation summarizes what was, and what was not, addressed in this study, and possible directions for additional action are outlined. The chapter concludes with a discussion of the need for incorporating dispersed roomblocks into models of aggregation, and an assessment of implications for community organization and post-Chacoan settlement studies in other regions of the Southwest.

ARCHAEOLOGICAL CONTEXT

Following the collapse of the Chacoan system, and sidestepping the issue of *what* it was, a shift in settlement pattern occurred in the Cibola area. Widely dispersed roomblocks were replaced by a pattern of more "clustered" settlements (Kintigh 1990a, LeBlanc 1978, 1989; Stone 1992a, 1992b; Watson et al., 1980:203, 205). However, dispersed roomblocks continued to be occupied, and how they articulated with clustered settlements remains unresolved.

To address the question of post-Chacoan social organization, I rely on data from the Ojo Bonito Archaeological Project (OBAP) directed by Keith Kintigh. The OBAP study area is located adjacent to the Zuni River at its intersection with the Arizona-New Mexico border (Figure 3.1), immediately south and west of the present Zuni Indian Reservation. Approximately 40 km² has been intensively surveyed during four seasons, and over 450 prehistoric and historic sites have been recorded. Survey coverage has focused on the Zuni River drainage and major tributaries on either side of a basalt-capped mesa (the gap in shading, Figure 3.1). Site density is high throughout the area, with extensive occupation beginning by A.D. 900. The area contains a number of contemporaneous, post-Chacoan roomblocks (Kintigh 1992, Kintigh et al., 1994) that occur in three different spatial configurations: clustered around a "great house," clustered, and dispersed.

Among these, the great house sites are the most intriguing (Fowler et al., 1987, Kintigh 1988a, 1988b, 1990a, 1994; Kintigh et al., 1994). The Hinkson site represents the only post-Chacoan great house site in the OBAP study area (Figure 3.2). It contains a roomblock resembling Chaco-era "outliers" (see Powers et al., 1983), with detailed Chaco-style masonry, artificial surrounding berms, and a series of radiating paths or roads (Fowler et al., 1987:147-151, Kintigh 1988b, 1994; Kintigh et al., 1994). The key difference between post-Chacoan and Chaco-era "great house" sites is the presence of larger resident populations evident in the "compact and discrete" (LeBlanc 1989:354) settlement clusters found immediately surrounding post-Chacoan great houses (Kintigh et al., 1994, Stein 1987:92). The Hinkson site consists of 25 roomblocks containing about 440 rooms spread across a knoll (Fowler et al., 1987:147-151, Kintigh 1988b, 1994).

Unusually large great kivas also characterize many of these sites (Kintigh 1994, Stein 1987). The great kiva at Hinkson is about 34 m in diameter, and was apparently unroofed (Kintigh et al., 1994). A low

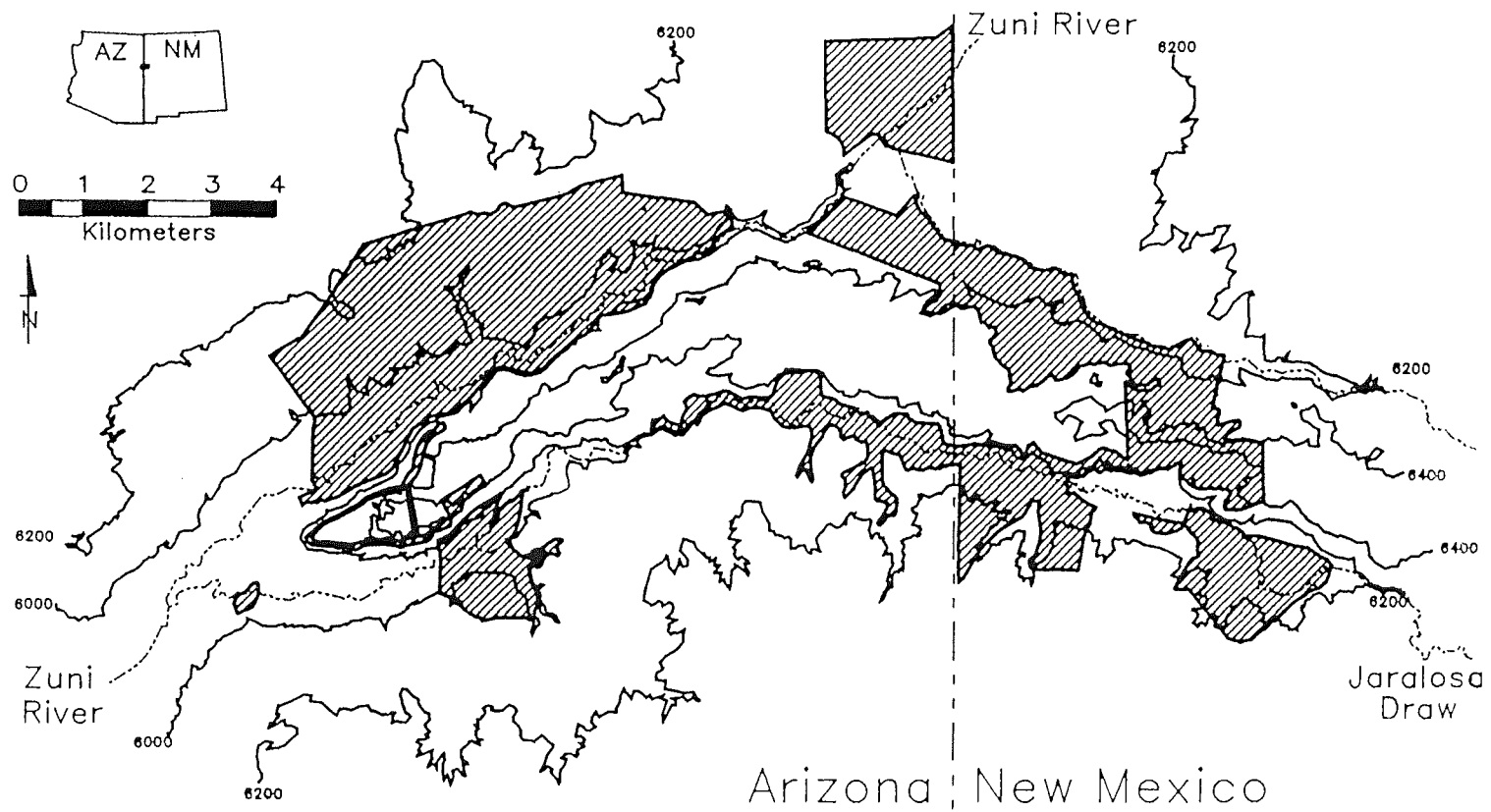


Figure 3.1 The Ojo Bonito Archaeological Project area; hatching indicates surveyed areas.

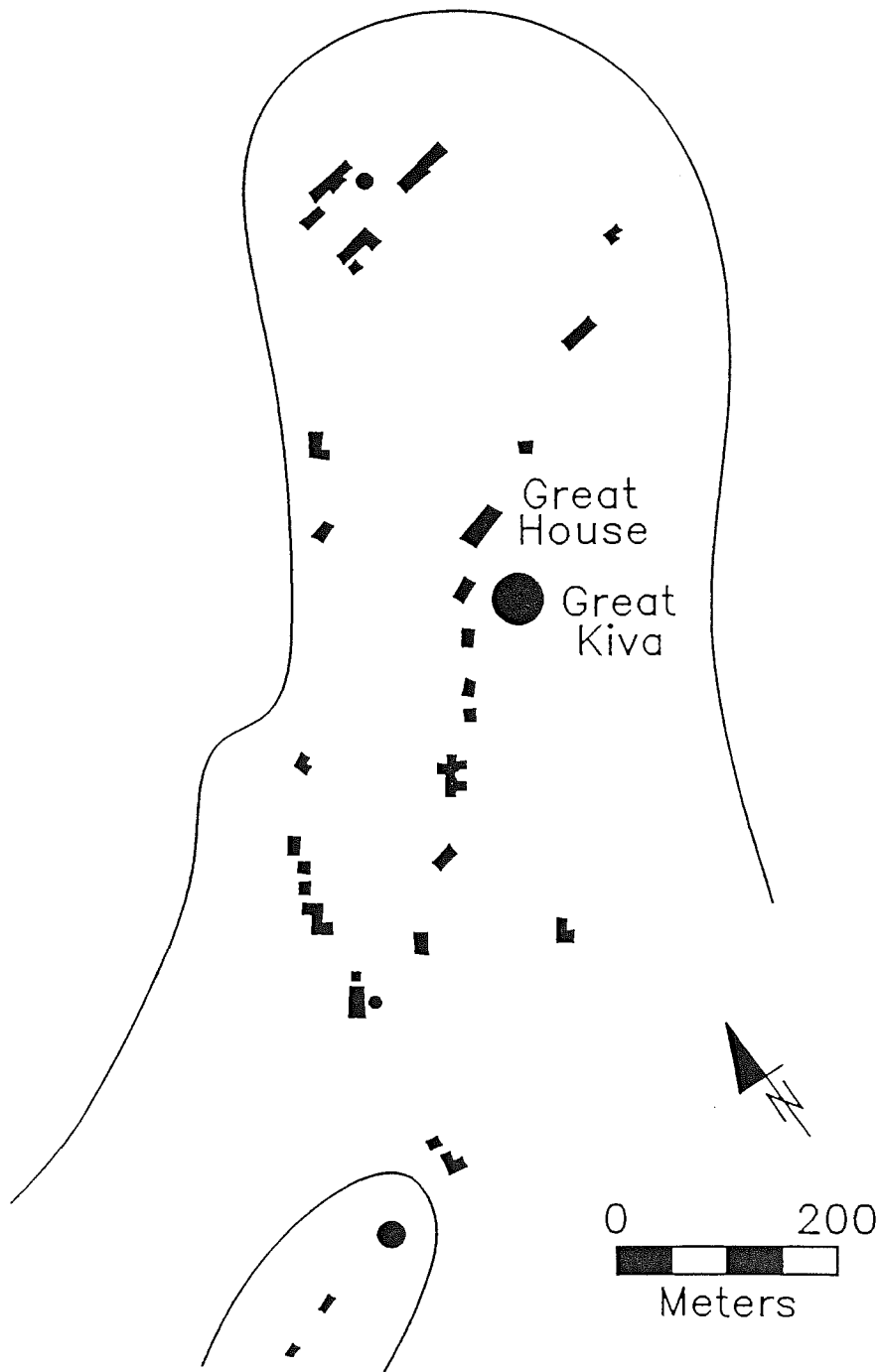


Figure 3.2 Plan of the Hinkson Ranch Complex (after Fowler et al., 1987:149).

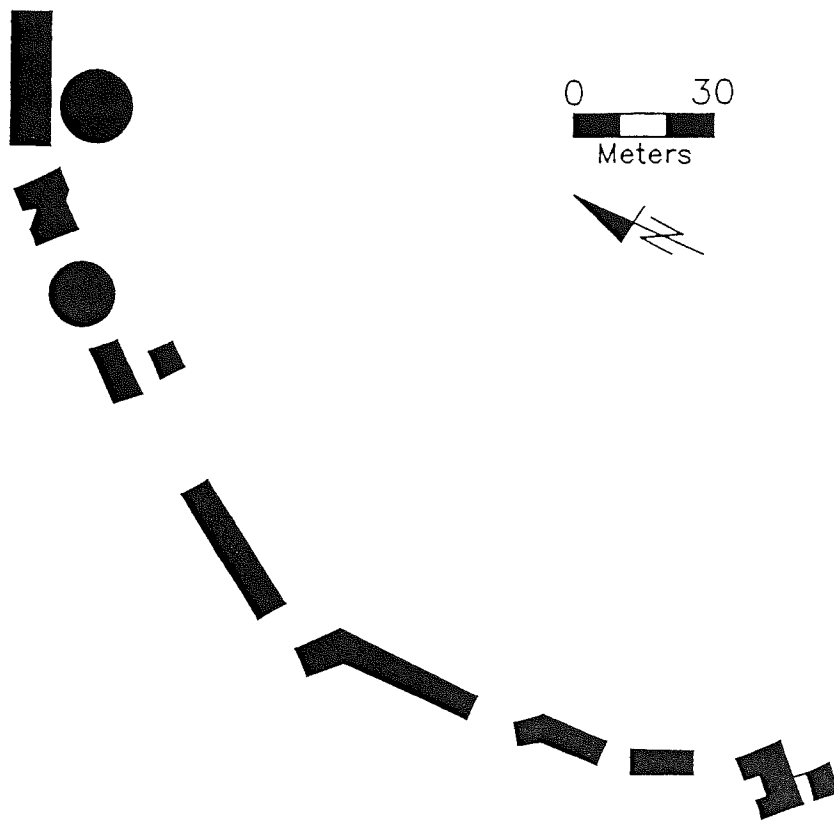


Figure 3.3 Plan of the Jaralosa Site (after Fowler et al., 1987:157).

interior bench, capable of accommodating a large group of people, rings the perimeter.

The second spatial configuration consists of clustered roomblocks without a great house. Generally, these contain fewer total rooms. The Jaralosa site (Figure 3.3) is an example of this configuration, with 9 roomblocks containing approximately 120 rooms (Fowler et al., 1987:156-158). It is the only clustered roomblock settlement without a great house in the study area. Two large kiva depressions, 10 to 15 m in diameter, are present.

Contemporaneous dispersed roomblocks are located to the north of the Hinkson and Jaralosa sites (Figure 3.4). These range from four to 40 rooms, with most in the 10 to 20 room range. These roomblocks are distributed on either side of a basalt mesa containing extensive terraced and gridded fields, which presumably were in use at this time. The nature of the interrelationships among dispersed and clustered roomblocks remains a key question in the study of

social and community dynamics following the Chacoan period.

THE PROBLEM

Prehistoric community studies are often plagued by poor temporal resolution and lack a clear definition of "community." Meaningful archaeological correlates are equally elusive. The term community commonly describes an arrangement of habitation structures, within some specified distance, thought to interact on a regular basis (Doyel et al., 1984:37, LeBlanc 1989, Stone 1992a:111-118, Upham et al., 1981, Watson et al., 1980). Spatial association is the most common criterion used to define communities in the Southwest. Although proximity has some behavioral correlates, using a set distance creates an artificial and untested "community" boundary. I argue that distance-based community definitions require empirical demonstration in a comparable archaeological context *prior* to their use. A

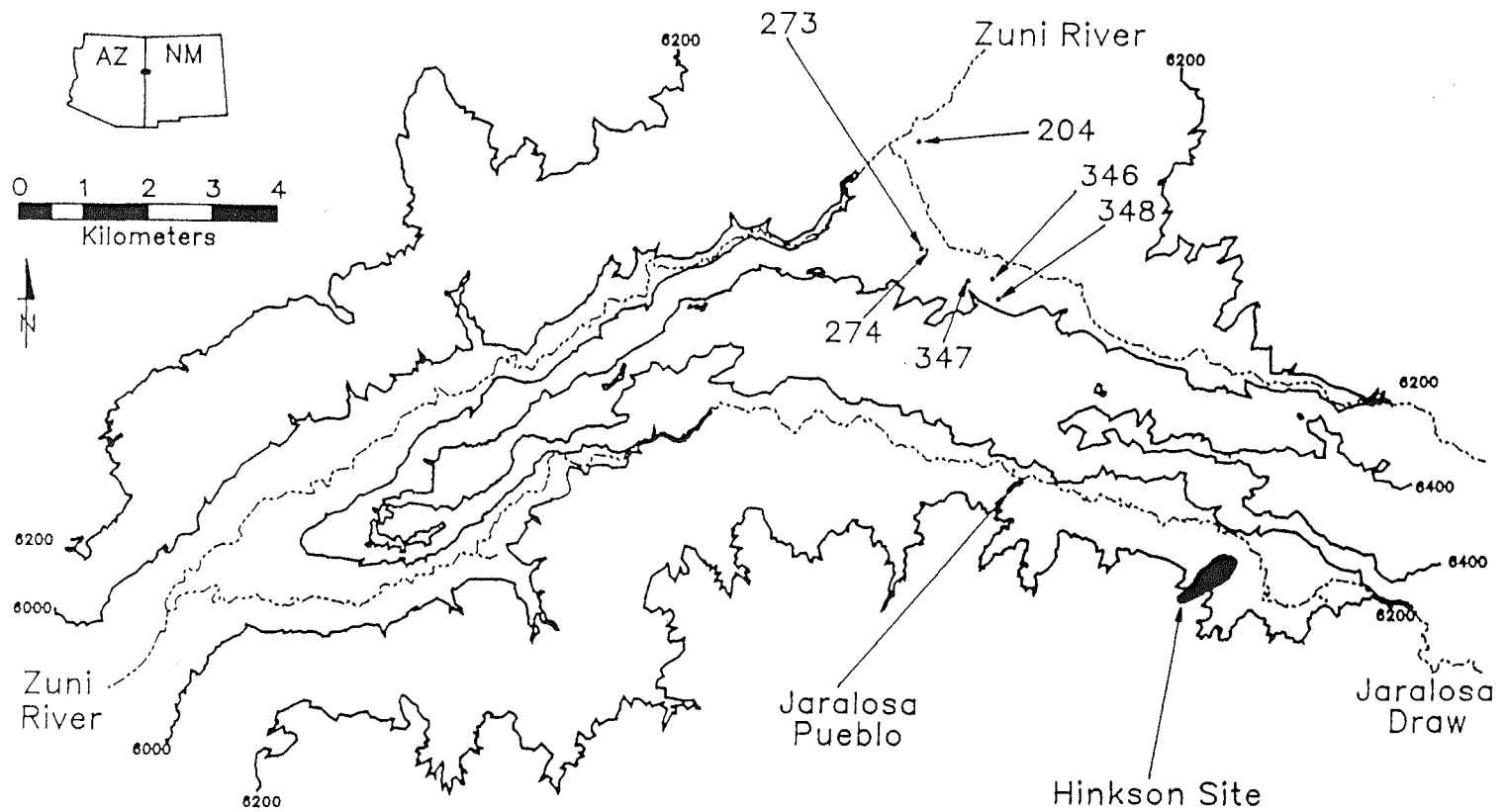


Figure 3.4 Location of post-chacoan settlements sampled for the ceramic analysis.

definition used by Doyel and others defining community as "a group of spatially related but noncontiguous contemporary settlements integrated on the local level (1984:37)" seems particularly practical, as it is able to accommodate different spatial scales.

Most spatial definitions would consider both types of clustered roomblock sites present in the OBAP study area as "communities," excluding the more distant single roomblocks. Alternatively, the single roomblocks might be considered together as a "community." To what extent did occupants of these three settlement types interact? Did they view themselves as part of the same community? What were the relationships among these contemporaneous roomblocks located a few kilometers apart? Does limiting "community" to roomblocks that are spatially clustered accurately describe the relationships among these roomblocks? Or, does this artificially restrict our interpretations? To address these questions, empirical demonstration of the relationships, or lack thereof, among roomblocks can suggest which scale is most appropriate for examining post-Chacoan communities.

THE STRATEGY

Models of economic interaction frequently use ceramics to monitor exchange between groups based on stylistic attributes and identification of production locations through compositional analysis (e.g., Hantman and Plog 1982). This is usually applied to a region, such as the area of the protohistoric Zuni villages (Mills and Vint 1991). I propose to conduct what has been termed "microvenience analysis" (Rice 1981:219, 1984:45), which is the study of production within a local area. A "microvenience" approach can be successfully applied to a small area (in this study, spanning less than 10 kilometers) where topography exposes different geological formations over short distances and clay resources differ in their availability and geological origin.

In this study, interaction is approached by analyzing exchange of two ceramic types found throughout the Zuni region. The first is indented gray corrugated, a presumed utilitarian ware that usually comprises approximately 50% of ceramic assemblages. Gray corrugated is assumed to have been produced by households for domestic use and occurs predominantly in jar forms.

The second type analyzed is St. Johns Polychrome. This chronologically diagnostic redware is found over a large portion of the Southwest, but is

thought to have been produced primarily in the Zuni Region (Carlson 1970:37, 39, Figure 14). St. Johns Polychrome vessels are red slipped bowls with black design on the interior and white designs on the exterior (Carlson 1970:31-41). The technology, form, decoration, "expense" (in terms of production steps, Feinman et al., 1981), and widespread distribution of this type suggest it had a different function than corrugated pottery (even if used for utilitarian purposes), and possibly a different mode of production and distribution. Some have suggested that St. Johns Polychrome was an elite ware within more complex political structures (Cordell and Plog 1979:420, Upham 1982, Upham et al., 1981:829). Although I disagree with this assessment, it is worth concentrating on St. Johns Polychrome to determine how it circulated among settlements.

I examine household interaction by examining the exchange of vessels between roomblocks. A common sense assumption with ethnographic support suggests that small scale exchange between individuals with social or kinship ties can be monitored through the movement of utilitarian wares (Bohannon 1955, David and Hennig 1972, Graves 1991:120-121, Sahlins 1972, Stark 1991:66-68). Abbott (1992) has successfully employed this concept to Hohokam interaction in the Phoenix Basin. By isolating ceramic production locations within the study area, and then tracing vessel exchange among different roomblocks, it becomes possible to reconstruct a "map" of social relations and to evaluate models of post-Chacoan community organization.

MODELLING COMMUNITY ORGANIZATION

To determine the degree to which the three settlement types interacted, three models are proposed. Each model relates dispersed roomblocks, the clustered roomblock Jaralosa site, and the Hinkson site, and is characterized by different expected ceramic distributions. These expectations provide a framework for evaluating community scope in the study area.

The first model posits that all roomblocks in the area, regardless of location, were equally integrated into a single economic and social network. In this model, the great house and the great kiva at Hinkson are thought to represent communal structures. Exchange was conducted to maintain social ties. Interaction among roomblocks could have been frequent or sporadic, corresponding to the degree of integration.

Household production of both plainware and decorated pottery is expected. The distribution of ceramics should reflect a pattern that does not correspond to immediately available clays. That is, ceramics were produced by each roomblock from clays located nearby, and exchanged among households within the area. Sherds from several clay sources should be present at any one roomblock.

The second model suggests that the Hinkson and Jaralosa sites represent discrete, compact communities. This implies that interpreting clusters as communities is appropriate, and that social interaction was concentrated within them. The great house and great kiva at Hinkson are not thought to have served all roomblocks. Instead, each community is expected to have its own ceremonial structure(s) and activities. This model predicts household production of both wares with infrequent exchange beyond community boundaries. Clays used for ceramic production should be located close to the clustered roomblocks, with apparent source homogeneity within clustered sites attributable to nearby clay sources. Dispersed roomblocks located a few kilometers distant may have been associated with a clustered roomblock community, and clay sources present at dispersed roomblocks would indicate the degree of their participation in the community. Conversely, a group of dispersed roomblocks may have constituted a separate community, with interaction concentrated among several dispersed settlements.

The third model suggests a more complex social arrangement. This model posits that all roomblocks within the area form a community, similar to the first model, but that internal differentiation was present. Ceremonial functions associated with the Hinkson site, the location of the great house and unroofed great kiva, integrated the area, but a differential relationship existed between the Hinkson site, the Jaralosa site, and dispersed roomblocks. Differentiation is reflected in exchange patterns with the Hinkson site the focus of directional exchange. Utilitarian ware production by all roomblocks is expected, while St. Johns Polychrome may not have been produced by all. This model predicts more complex patterning in the ceramic data in which St. Johns Polychrome should not mirror the corrugated pattern. The Hinkson site should show the greatest diversity of apparent corrugated and St. Johns Polychrome sources, reflecting local production and exchange from other roomblocks within and outside the area. Socially this model could, but need not, incorporate differential access to goods and political differentiation. However, this model is equally

consonant with aspects of social complexity not characterized by marked economic differences.

These idealized models are designed to highlight possible organizational extremes. Their purpose is to provide referents against which the scale of local interaction can be evaluated. Only after this has been determined can alterations, refinements, and additions to the most appropriate model be forwarded: we need to understand the scale of community to conduct effective community studies.

OPERATIONALIZING THE IDEA

I turn now to resolving the question of community scope. This section articulates the goals outlined above with a body of ceramic theory that provides a basis for identifying local interaction. Ceramic ecology, as articulated by Matson (1965) and Arnold (1985), provides the theoretical framework from which ceramic production locations and exchange are identified.

Ceramic Ecology

Matson (1965:203) has argued that it is important to incorporate raw material availability in ceramic analyses, and specifically, that environmental constraints (parameters) on pottery production must be addressed. The local context of clay availability relative to settlement location becomes a prerequisite for understanding ceramic production and exchange.

Arnold (1985) has elaborated on Matson's ideas in constructing a generalized model of ceramic production focusing on resource availability. Of particular interest is how far people travel to obtain clay. In examining 111 ethnographic cases where distance to potting clays could be determined, Arnold found that 33% obtained clay from within a 1 km radius of their homes, and that 84% of all cases fell within a 7 km radius (1985:38, 50, Table 2.1). Arnold argues that these are the preferred and maximum distance ranges, respectively, for clay exploitation (1985:38, 50).

Given Arnold's exploitation thresholds, determination of different production loci between areas located more than 14 km apart (twice the maximum exploitation range) is theoretically sound (Arnold 1985:58). However, determination of production locations among a group of sites with overlapping maximum exploitation ranges requires both the demonstration of clay utilization at less than the

maximum threshold, and the use of detectably different sources.

The Bridge

The separation of roomblocks relative to geology at OBAP supports the potential for utilization of different resources. In order for corrugated pottery to work as an adequate measure of interaction, I need to: (1) distinguish differences in clays used to produce corrugated pots, (2) associate these with differences in locally available clays, (3) demonstrate spatial association among roomblocks and available clays, and (4) evaluate how vessels made from different clays were exchanged between households. Corrugated pottery is used for this determination because corrugated vessels were probably produced at each settlement. If the four conditions outlined above can be met for corrugated vessels, we will have an idea of where clays with a specific compositional structure originate. This provides a basis for evaluating which clays, and inferred production locations, contributed to St. Johns Polychrome production. This eliminates the need for assumptions regarding St. Johns Polychrome production, a necessary step for objectively examining the conditions of its distribution.

What follows is a presentation of refiring and chemical element analyses and discussion of the geological setting in which these settlements were located. This section is both methodological and substantive, presenting the analytical procedures employed and an evaluation of their significance. Placing potters in the spatial context of raw material availability and the social context of interaction allows for new insights into post-Chacoan community organization. Here, I first relate ceramic properties to specific geological formations, then relate roomblocks to these same formations, and suggest production locations. By knowing where particular ceramics were produced, it becomes possible to assess distribution by analyzing where they were deposited.

Refiring Methodology

A total of 368 sherds were refired for this analysis. The samples consist of surface ceramics collected from multiple locations at the Hinkson and Jaralosa sites, and from six dispersed roomblocks. In addition, some excavated samples from the great house were used. The number of samples from each site is

presented in Table 3.1. The Hinkson and Jaralosa sites are treated, heuristically, as single entities.

Ceramic refiring, or oxidation, experiments are a low cost method of analyzing clays used in pottery (Rice 1987, Rye 1981, Shepard 1980). Pottery at a site is likely to have been subjected to a variety of firing conditions and temperatures. In order to evaluate differences in the materials used for vessels, control for firing variation is necessary, and refiring is a simple way to achieve this. A piece of each sherd was refired in an electric kiln in an oxidizing atmosphere to 900 degrees C., a temperature higher than most prehistoric firings (Rice 1987:20, Rye 1981, Shepard 1980, also Mills 1992). This has the effect of eliminating the variable conditions to which each vessel (sherd) was originally fired. After refiring, differences in physical properties may indicate different materials used to make the vessels.

Apparent porosity and Munsell color were measured for all sherds in the sample. These two properties are useful in identifying different clay sources (Bishop et al., 1982, Rice 1987, Rye 1981, Shepard 1980). Discussions of apparent porosity and the procedure for its calculation are presented in Rice (1987:352) and Shepard (1980:127). The Munsell color chart was used to separate sherds into color groups. If oxidized color of refired sherds is similar, the vessels may have been made from the same clay; conversely, if they differ greatly, the source clays were probably different.

Several researchers have conducted refiring experiments in the Anasazi Southwest (e.g., Mills 1987, Windes 1977), and in the Zuni region in particular (Crown 1981, Fowler 1991, Mills 1992, Mills and Vint 1991). A series of color categories have been used in these studies. Long ago, Smith (1962) noted the utility of refiring experiments for identifying variations in clay pastes, especially those that differ in iron content. These color groups aggregate Munsell chips into seven groups of color similarity, forming a continuum from white to buff to red (Fowler 1991:Table 4, Mills 1992, Mills and Vint 1991). In one sense, these groups measure relative amounts of iron. For the purposes of this analysis, I aggregated these seven categories into three color groups: buff, yellowish-red, and red. The Munsell color values assigned to each group are presented in Table 3.2. The provenience, apparent porosity and color group of each refired sample are presented elsewhere (Duff 1993:Appendix B).

Table 3.1 Number of Samples Refired from Each Site.

Site	Corrugated	Polychrome	Total
LZ 204	7	8	15
LZ 273	19	6	25
LZ 274	24	8	32
LZ 346	26	1	27
LZ 347	17	6	23
LZ 348	22	8	30
Jaralosa	44	17	61
Hinkson	111	44	155
Total	270	98	368

Table 3.2 Munsell Color Ranges Present in the Refired Color Groups.

Color Group	Munsell Color Range
1 Red	2.5 YR 4/6, 5/6, 6/6
2 Yellowish-Red	5 YR 5/6, 6/6, 7/6; 7.5 YR 7/4, 7/6
3 Buff	5 YR 8/2, 8/3; 7.5 YR 8/4; 10 YR 8/2, 8/3, 8/4

The primary goal of the refiring study is to determine if a number of different clay sources are represented in the OBAP ceramic assemblage. A secondary aim is to interpret the refired data in light of previous experiments conducted in the region. The refiring analysis suggests that the OBAP ceramic assemblage was produced utilizing clays from at least two distinct sources, and that all roomblocks appear to have been exchanging ceramics. This interaction suggests a broad-based communal organization, eliminating the second model which suggested clustered settlements functioned as "closed" communities.

Refiring Results

Boxplots of refired apparent porosity for all of the OBAP sherds separated by color group (Figure 3.5) indicates a clear separation between the red and buff color categories. This suggests that at least two different clays are represented. The yellowish-red group, as its name implies, overlaps both and contains the greatest

number of sherds. Apparent porosity values vary consistently with the color divisions, supporting the idea that these color groupings represent different clays. Overall, the red group has generally lower apparent porosity values than the buff group. This could relate to the chemical content of the sources with the red group containing more iron which acts as a flux, generally reducing porosity through increased vitrification when compared to equivalently fired samples containing less iron (Rice 1987:94).

The distribution of sherds among color groups by ware suggests intriguing differences (Table 3.3). Additionally, it appears that polychrome vessels are rarely made from clays that refire to red, while about one-third of the corrugated sample is derived from the lower porosity red group.

Geology

Mills and Vint (1991) and Fowler (1991:136-140, Table 5) associate red and yellowish-red firing

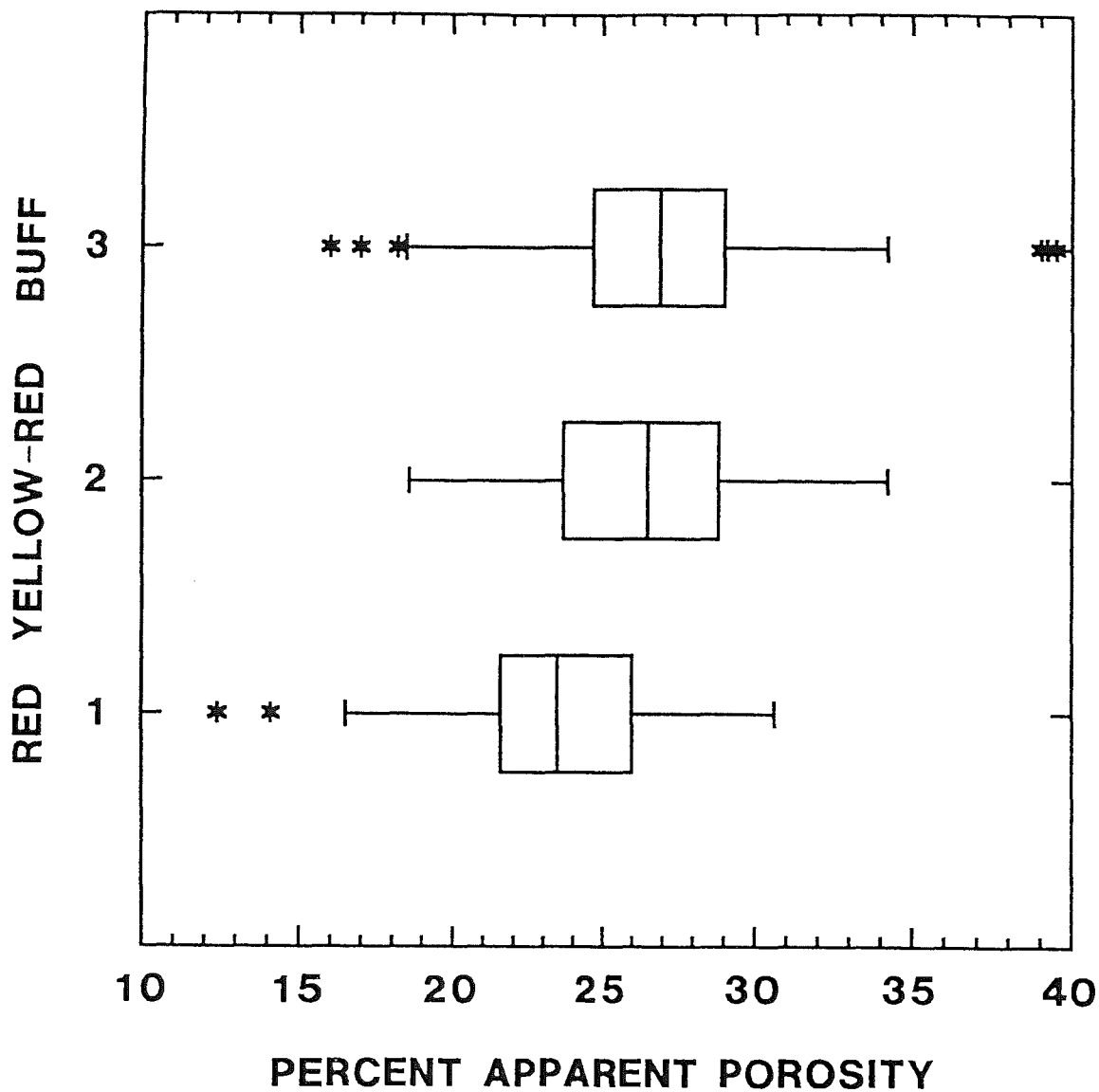


Figure 3.5 Boxplots of apparent porosity by refired color group using the entire refired sample.

Table 3.3 Comparison of Refired Color Group Classification with Ware

Ware	Buff	Yellowish-Red	Red	n
Corrugated	24%	41%	35%	270
Polychrome	44%	54%	2%	98

clays to the Chinle Formation, and buff firing clays to Dakota Sandstone. These two formations, and Mancos Shale, are present in the study area, and are likely clay sources (Figure 3.6).

The Chinle Formation is exposed along Jaralosa Draw nearest to the Jaralosa site. There are no exposures of the Chinle Formation in the vicinity of the dispersed roomblocks or the Hinkson site (see below for distances). Dakota Sandstone exposures line both edges of Jaralosa Draw and the southern Zuni River drainage, exposed on the lower slopes of a basalt mesa separating the dispersed and clustered sites. The Hinkson site is the only settlement not located near Dakota Sandstone exposures (ca. 2.4 km away). The Hinkson site rests on Mancos Shale, which is also exposed near several of the dispersed roomblocks. Currently, little is known of the properties of Mancos Shale-derived clays in the Zuni area.

To identify production areas, we need to relate sherds to local geology based on information about the chemical constitution of particular geological formations. Next, we examine the spatial distribution of sites relative to the exposure of these geological formations to determine which sites would have had reasonable access to particular formations, guided by Arnold's (1985) procurement ranges.

After determining which roomblocks would have had access to a geological formation based on proximity, two possible strategies can be applied. First, if a geological formation is only exposed near a limited number of sites, we can build an argument for production loci based strictly on proximity. The Chinle Formation is such a resource in the OBAP area, and data suggest specialized exploitation and production of corrugated ceramics from a Chinle Formation source by the residents of Jaralosa. A second approach requires discrimination of variability within similar clays, and is best accomplished through chemical analysis (discussed below). In instances where a number of roomblocks would have had access to a similar resource, refiring probably will not be able to discern specific production loci. However, it may suggest a reduced suite of potential production locations.

Returning to the refired data, if the red refiring group originated from the Chinle Formation (after Fowler [1991] and Mills and Vint [1991]), extensive interaction among all roomblocks is evident. Of the sampled sites, only Jaralosa is located near exposures of the Chinle Formation. Combining this with Arnold's (1985) preferred clay exploitation ranges suggests Jaralosa as the likely production location for the red

group sherds because it is quite unlikely that residents from the other roomblocks would have travelled to the Chinle Formation to obtain raw clays.

Table 3.4 indicates the shortest ("crow's flight"), one way distance between each settlement and the nearest exposure of the Chinle Formation. The Jaralosa site is the only settlement within Arnold's (1985) 1 km preferred exploitation range. The distances from all other settlements to the Chinle Formation fall between Arnold's (1985) preferred and maximum procurement ranges. However, the time or energy ("pheric distance") required to obtain a material "cannot be excessive (Arnold 1985:32)," and "straight line distance could give an unrealistic measure of the costs involved (Arnold 1985:38)." A measure of pheric distance is also provided in Table 3.4. It is the number of 50 foot vertical changes in elevation residents of all roomblocks would have to make to reach the Chinle Formation (cf. Alden 1981). Some of these vertical changes could be avoided in a procurement trip, but only at the expense of increasing the distance travelled. When the topographic relief is considered, it becomes apparent that considerably more energy would have had to be expended to obtain raw Chinle Formation clays by all but the Jaralosa residents. I argue that other potters opted to use sources that were both suitable and closer (in terms of absolute and pheric distances). Suitable Dakota Sandstone, and possibly Mancos Shale, clays were located near all sites. Thus, it appears that Jaralosa residents were responsible for production of the red refiring group.

More interesting, however, is the distribution of red group corrugated ceramics found at all settlement types (Table 3.5). One-third of the corrugated assemblage at dispersed roomblocks and 37% of corrugated sherds at Hinkson probably originated from Jaralosa.

The buff color group is associated with Dakota Sandstone. The dispersed roomblocks and the Jaralosa site are located within 1 km of Dakota Sandstone, making these sites the likely production locations of buff group sherds. If this association is valid, when polychrome is considered (Table 3.5), the Hinkson site appears to have received a sizable percentage of its ceramic inventory from the Jaralosa and dispersed settlements. Hinkson is about 2.4 km from the nearest exposure of Dakota Sandstone, and its residents could have procured clays from this source. However, the relatively low percentage of buff firing corrugated sherds at Hinkson suggests they exploited Mancos Shale derived clays that may refire to colors falling into

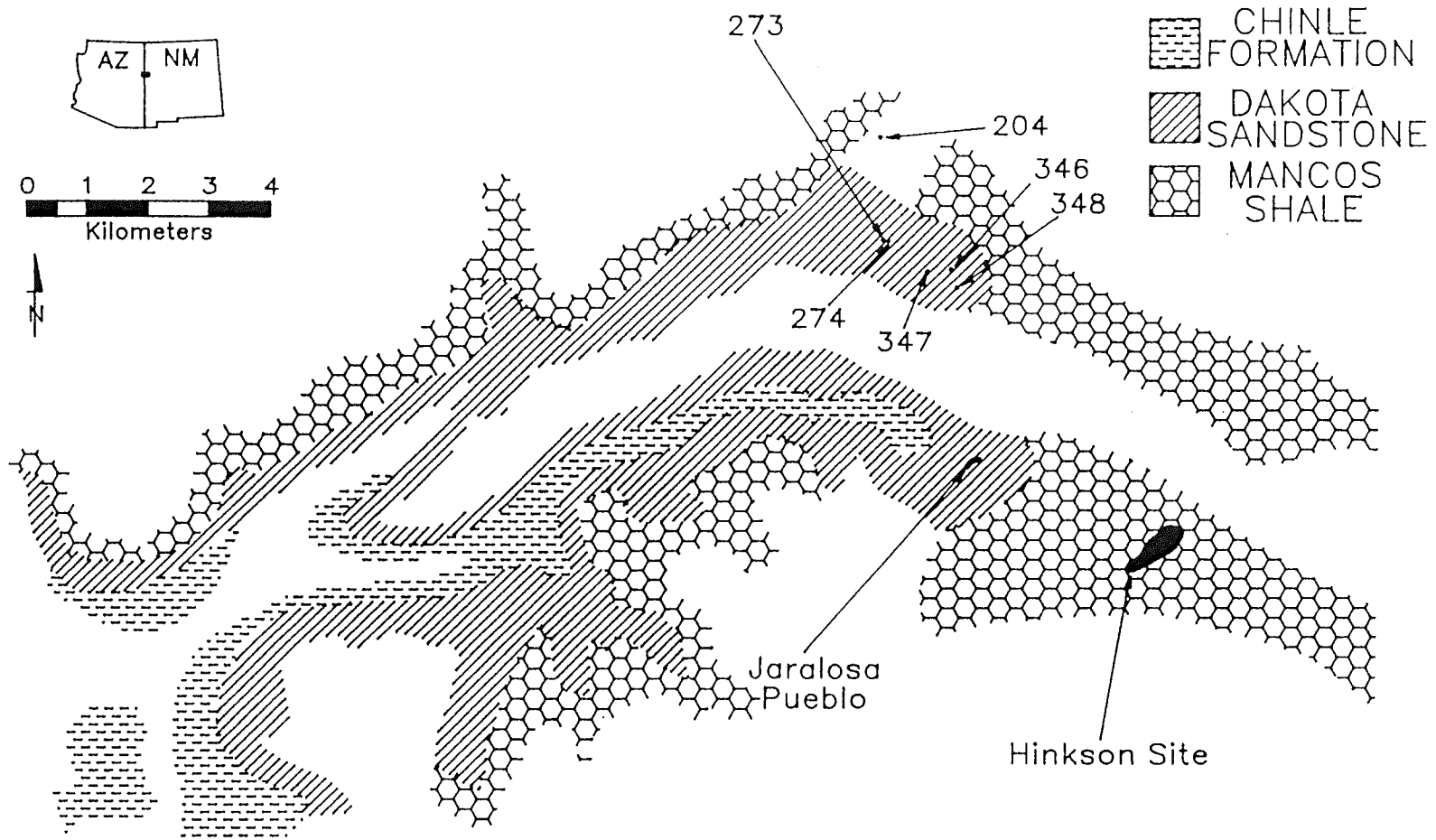


Figure 3.6 Geologic map of the OBAP study area with site locations.

Table 3.4 Absolute and Pheric One-Way Distances to the Nearest Chinle Formation Exposure.

Site	Distance (km)	Number of 50 foot Elevation Changes
LZ 204	4.3	17
LZ 273	2.7	15
LZ 274	2.7	15
LZ 346	2.3	14
LZ 347	2.2	14
LZ 348	2.0	14
Jaralosa	0.7	1
Hinkson	3.9	2

Table 3.5 Comparison of Color Groups to Settlement Types, Separated by Ceramic Ware.

Site	Buff	Yellowish-Red	Red	n
Corrugated Ceramics				
Dispersed	37%	30%	33%	115
Jaralosa	16%	55%	29%	44
Hinkson	16%	47%	37%	111
Polychrome Ceramics				
Dispersed	59%	38%	3%	38
Jaralosa	53%	47%	0%	17
Hinkson	47%	51%	2%	43

the yellowish-red color group. Alternatively, the yellowish-red group could represent Chinle, Mancos and Dakota derived samples. At present, not enough is known to interpret the yellowish-red color group.

Despite uncertainty about the role of the yellowish-red color group and Mancos Shale clays, the refiring analysis has suggested production locations and exchange relationships. The interaction suggested by the refiring analysis indicates that all three settlement types participated as a single community. Ceramic vessels were apparently exchanged between all settlement types, suggesting that interaction was not confined to settlement clusters.

The refiring data indicate differences in the utilization of clay resources and the potential of making behavioral interpretations from these differences. The

resolution of the refiring data is not precise enough to determine which of the remaining community models best reflects the data. To make finer distinctions within color categories, an extensive compositional analysis was also conducted.

Compositional Analysis

A sample of 197 indented gray corrugated and St. Johns Polychrome sherds was analyzed utilizing the weak acid-extraction ICP technique developed by Burton (Burton and Simon 1993). This sample consists of a subsample of the refired sherds stratified by type, on the basis of refired color group. For example, at Hinkson 16% (6 of 39) of the corrugated samples compositionally analyzed were drawn from the buff

Table 3.6 Number of Samples Analyzed from Each Site.

Site	Corrugated	Polychrome	Total
LZ 204	10	8	18
LZ 273	10	6	16
LZ 274	9	8	17
LZ 347	10	6	16
LZ 348	10	8	18
Jaralosa	30	20	50
Hinkson	39	23	62
Total	118	79	197

color group, while 47% (11 of 23) analyzed were drawn from the buff refiring Polychrome samples. LZ 346 was not sampled due to its proximity to other sampled sites. Table 3.6 indicates the compositional analysis sample sizes by site.

I argue that three ceramic production areas can be demonstrated in the OBAP study area when the compositional data are considered, and briefly outline how the data set was partitioned and how production locations were determined. The compositional data were first transformed by common (base 10) logarithm. Groupings based on similarities and differences in 12 element concentrations analyzed by acid-extraction ICP (Burton and Simon 1993) were defined through *k*-means cluster analysis. Raw element concentrations in parts-per-million for all samples are presented elsewhere (Duff 1993:Appendix C).

K-means cluster analysis groups cases based on overall similarity and the number of clusters it was instructed to create, reconfiguring cluster assignments in a non-hierarchical manner (Doran and Hodson 1975:180-184, Kintigh and Ammerman 1982). Clusters represent the chemically defined groups alluded to above.

To reiterate, production locations can be determined either by exclusive access to a particular source, or based on access to a proximate source. However, the precision of compositional data (relative to refiring) may permit further refinement. In instances where several sites had access to a particular formation based on proximity, cluster membership is evaluated using the percentage of a sites' total sample in a cluster as a guide. I have assumed that the site or sites with the

greatest percentage of its total sample present in a cluster is responsible for the production of all sherds in that cluster. This is a variation on the "criterion of abundance." Samples that are part of a chemically defined group (cluster), but found at other proveniences, are interpreted as having been exchanged. In cases where no single site emerges as a likely production location, two or more sites may be combined to create a production "zone."

This analysis proceeds in a fashion similar to the refiring analysis. Corrugated percentages are used to determine production locations. Compositional analysis confirms the association between the Chinle Formation and Jaralosa site corrugated ceramic production. It also allows for considerable refinement in associating production loci to the remainder of the sample.

The Jaralosa Corrugated Source

Based on previous refiring studies (Mills and Vint 1991, Fowler 1991, Mills 1992) and chemical element analysis (Walker 1992), some chemical properties of the Chinle Formation and the Dakota Sandstone are known. Of primary interest is Walker's (1992) study which employed several chemical characterization techniques to clay samples collected from Chinle Formation and Dakota Sandstone clay sources near the Pueblo of Zuni. He noted that "manganese provided the greatest contribution to partitioning clays by source, followed by chromium, then cobalt, and finally iron" (Walker 1992:50). Neither chromium nor cobalt are characterized by Burton's weak acid-extraction process (Burton and Simon 1993),

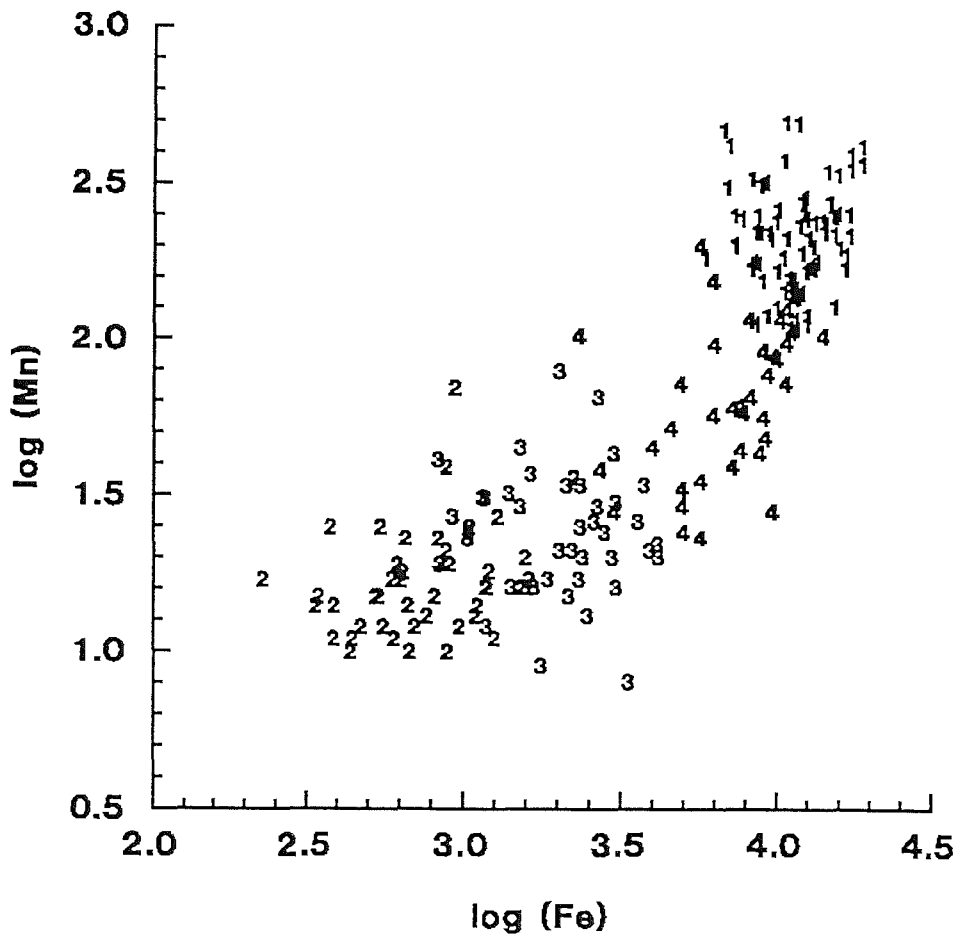


Figure 3.7 Bivariate element plot labelled with the four cluster solution using all compositional data.

but iron and manganese are. The Chinle Formation is characterized by consistently high concentrations of these two elements, while the Dakota Sandstone has consistently lower concentrations (Walker 1992: Appendix C). Additional confirmation comes from Sarrine (1958) who noted that rhodochrosite (high in manganese) is found throughout the Chinle Formation, and that weathered slopes of the Chinle have concentrated rhodochrosite into "a prolific manganese bearing bed (1958:43)." These studies provide a framework for the interpretation of the compositional data.

Figure 3.7 presents a bivariate plot of iron and manganese, elements noted by Walker (1992) as useful in discriminating between Chinle and Dakota sources. Data points have been labelled with the *k*-means cluster assignment based on the four cluster solution.

Combining all of the OBAP compositional samples, *k*-means analysis reveals one particularly distinctive chemical group. The cohesion of this cluster (up to the *k*-means ten cluster solution) strongly suggests a single source. This cluster is composed almost exclusively (73 of 75 cases) of corrugated samples. Principal components analysis divides these data in a similar fashion.

The high iron and manganese concentrations expected of Chinle Formation clay (Walker 1992) suggest that Cluster 1 can be assigned a Chinle Formation origin. Again, I argue for Jaralosa site production of these vessels. The Jaralosa-produced corrugated ceramics account for between 60% and 70% of the corrugated sample at all sites. Thus, it appears that many of the sherds that refired to the yellowish-red color group originate from the Chinle formation when

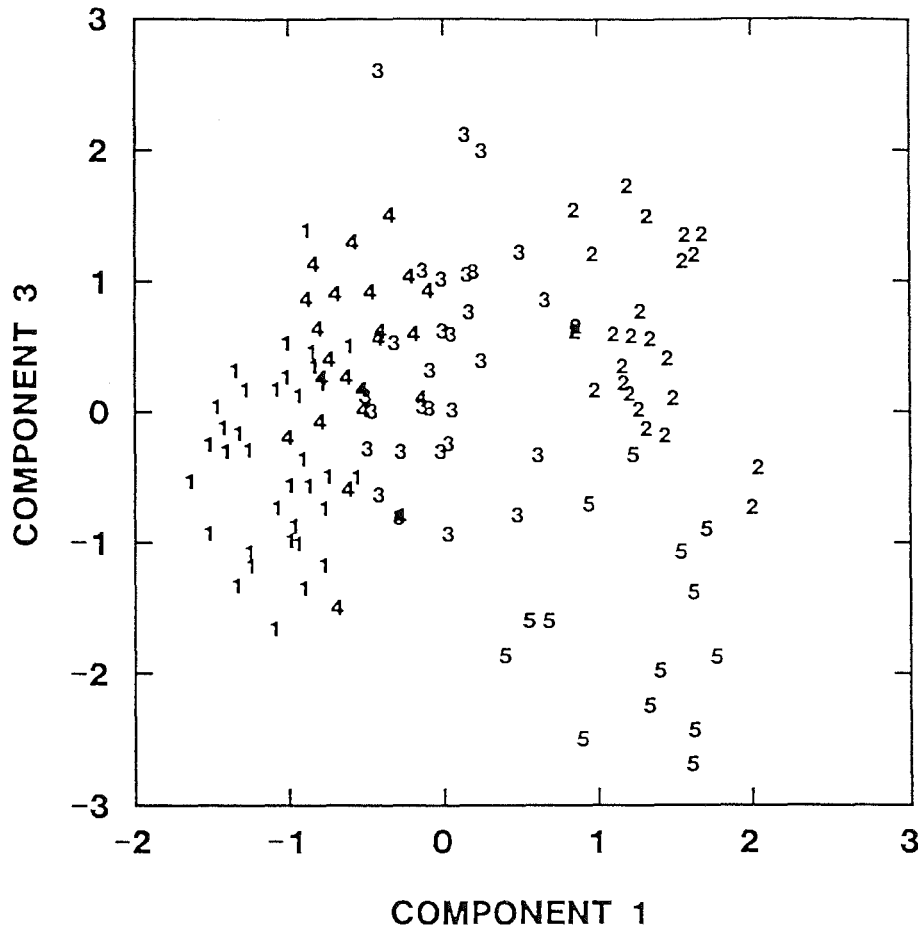


Figure 3.8 Bivariate plot of Component 1 and Component 3 from the principal components analysis.

compositionally analyzed. I now turn to the remaining portion of the compositional sample.

The Remaining OBAP Sample

In order to examine remaining samples in greater detail, the 76 sherds assigned a Jaralosa (Chinle Formation) production locus were removed. This results in a sample of 121 sherds (44 corrugated, 77 polychrome) representing all of the sampled sites. *K*-means analysis was performed, and the five cluster solution was deemed interpretively meaningful. Solutions with more than five clusters contain groups with only one or two sherds.

I begin by attempting to relate the chemical signatures of each of these clusters to what is known of the composition of the local geological formations, and then move to determining which sites were responsible

for the production of each cluster. Principal components analysis best illustrates the variability (Figure 3.8), here plotted with the first and third components. The first component accounts for 68% of the total variance, while the second and third account for 8% and 7% respectively. The third component most effectively separates Clusters 2 and 5.

Relating these five groups to geological formations requires that we once again turn to a bivariate element plot of iron and manganese (Figure 3.9). Beginning with an expectation of low concentrations of iron and manganese (after Walker 1992) as the chemical signature of Dakota Sandstone, we note that Clusters 1, 3 and 4 (lower left) generally fall into this range. Clusters 2 and 5 contain intermediate concentrations nearing those expected for the Chinle Formation, but may indicate a Mancos Shale source.

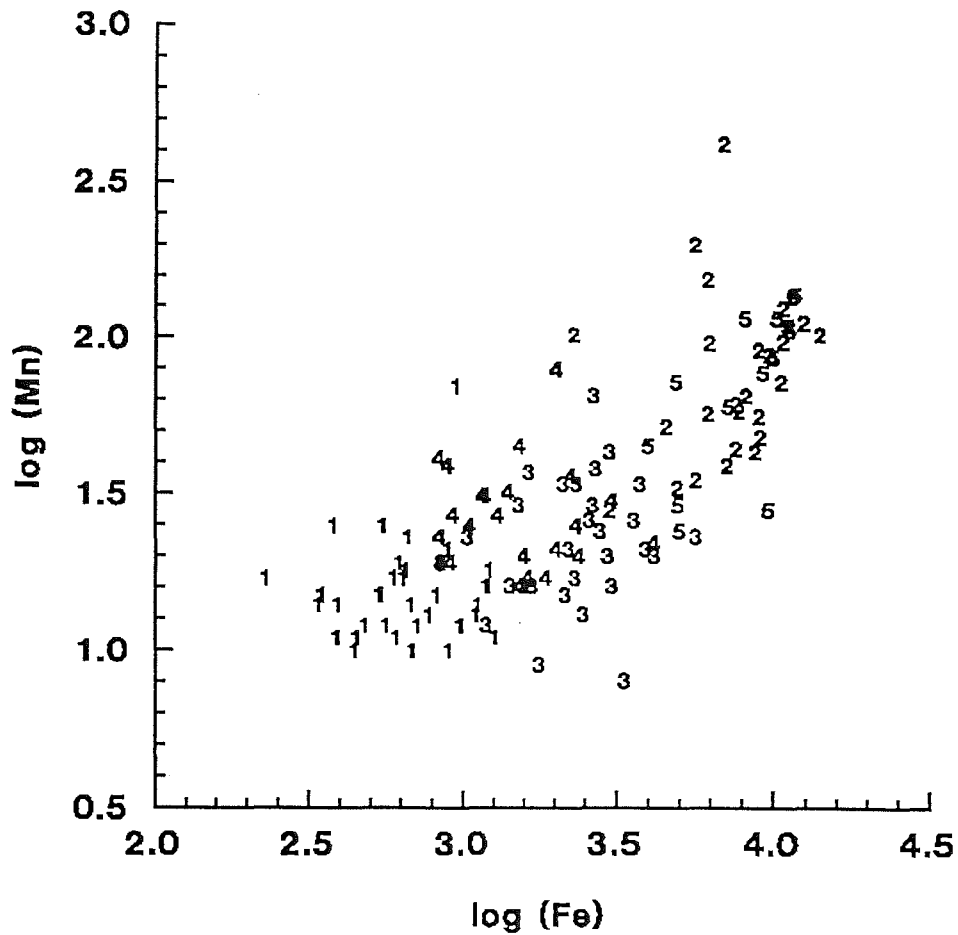


Figure 3.9 Bivariate element plot of iron and manganese labelled with the five cluster solution using all compositional data.

Reference to the spatial association of the sites relative to local geology (Figure 3.6) indicates that we might, at best, be able to detect three different production locations based on access to different suites of locally available sources. These consist of a production "zone" combining the dispersed sites, another at Jaralosa, and one at Hinkson.

Table 3.7 presents information on the *k*-means five cluster solution. Each of the five clusters are tabulated by the number of samples, and by ware for each of the sampled sites. The values for the dispersed sites are combined. Column six reports the number of sherds from each location assigned a Chinle Formation-Jaralosa site production location. Column seven indicates the total sample size for each settlement type, again with the dispersed sites combined. The remaining samples are presented by cluster in columns one

through five. For each of these, the number of samples in each cluster is converted to a percentage of the non-Chinle sample from each provenience present within each cluster. Thus, for Jaralosa, 30 corrugated sherds were sampled, 20 of which were produced at Jaralosa from Chinle Formation clays (Column 6), while one corrugated sample representing 10% of the non-Chinle corrugated sample from Jaralosa is present in Cluster 1. Row four notes the production location I have inferred for each cluster.

The Hinkson site most likely exploited Mancos Shale, the only formation exposed within approximately a 2.4 km radius of the site. Cluster 5 ceramics appear to have been produced at Hinkson based on the high percentage (62%) of Hinkson samples in this cluster, and the relative lack of other sites represented. Jaralosa site residents probably exploited both Chinle Formation

Table 3.7 Compositional Analysis Sample Distribution and Production Location Assignments.

Site	Cluster													
	1		2		3		4		5		Chinle Formation		Sample Totals	
	Corr	Poly	Corr	Poly	Corr	Poly	Corr	Poly	Corr	Poly	Corr	Poly	Corr	Poly
Jaralosa	N 1	10	5	2	1	2	1	6	2	0	20	0	30	20
	% 10%	50%	50%	10%	10%	10%	30%	20%	-	66%	-			
Hinkson	N 1	6	4	2	0	5	0	6	8	2	26	2	39	23
	% 8%	29%	31%	10%	-	24%	-	23%	62%	10%	67%	9%		
Combined Dispersed Sites	N 7	10	5	4	7	13	2	8	0	1	28	0	49	36
	% 33%	28%	24%	11%	33%	36%	10%	22%	-	3%	57%	-		
Assigned Production Location	Dispersed Sites		Jaralosa		Dispersed Sites		Dispersed Sites		Hinkson Ranch		Jaralosa		118	79

and Dakota Sandstone sources, and was responsible for the Cluster 2 group. The proximity of the dispersed sites to Dakota Sandstone and Mancos Shale suggest these as exploited sources, and percentages of corrugated suggest that they were responsible for the production of Clusters 1 and 3. The percentages for Cluster 4 indicate that either Jaralosa or the dispersed sites produced this group. I have attributed Cluster 4 to the dispersed sites because it falls between the Cluster 1 and 3 samples on both the Principal Components (Figure 3.8) and the bivariate element plots (Figure 3.9). Attributing this group to the Jaralosa site would not alter the interpretations presented below.

EVALUATING DISTRIBUTION

Having assigned each sample a production location, we can now proceed with interpretation of post-Chacoan exchange behavior at OBAP. What follows is a description and an exploration of the behavioral implications of the distribution of ceramics from the three production zones. This reveals the directional nature of polychrome exchange and demonstrates that the differentiated community model, indicated by directional exchange, best characterizes organization at OBAP.

Information from the corrugated sherds suggests that Jaralosa and the dispersed roomblocks appear to have been interacting intensively. Limited quantities of Jaralosa-produced polychrome were found at dispersed roomblocks, but an average of 57% of the corrugated sherds at the dispersed sites was produced

by Jaralosa. Conversely, Jaralosa received significant quantities of both wares (especially polychrome) from the dispersed sites. The exchange of corrugated vessels indicates some informal interaction on a household basis, but the quantity of polychrome vessels appears too great to be accounted for by informal exchange alone. It is possible that Polychrome may have been exchanged to Jaralosa from dispersed roomblocks for Chinle Formation corrugated vessels or another commodity transported in vessels. However, exchange between Jaralosa and the dispersed sites seems to have been, on some level, reciprocal.

The pattern of corrugated vessels found at the Hinkson site differs. The Hinkson residents received a many of their corrugated vessels from Jaralosa, while Jaralosa received 20% of their corrugated assemblage from Hinkson. Polychrome exchange between these two sites is limited to a few vessels from Jaralosa found at Hinkson. This suggests that, in contrast to the Jaralosa-dispersed sites interaction, Jaralosa residents did not receive Hinkson-produced polychrome ceramics in exchange for corrugated vessels.

The pattern of polychrome exchange differs dramatically from that of corrugated. Interaction among dispersed roomblocks cannot be measured due to their proximity and common access to sources, but their interaction with clustered roomblocks indicates a substantial percentage of dispersed site-produced polychromes are found at both of the clustered roomblock sites. Given the two wares sampled, Hinkson appears not to reciprocate interaction with ceramic exchange. Jaralosa, on the other hand, does reciprocate

with Chinle Formation corrugated vessels.

The intensive ceramic exchange among the sampled sites confirms some degree of common organization that incorporated all roomblocks within this local area. The differentiation in exchange between the two types indicates that polychrome may be consistently associated with more formalized distribution practices. The directional movement of polychrome vessels from dispersed sites to the Jaralosa site is not as surprising if we take the amount of corrugated ware produced at Jaralosa found at dispersed sites into account. Alternatively, the directional exchange of polychrome to Jaralosa may relate to activities at the two great kivas present there.

Reciprocal interaction from Hinkson may have taken another form. The directional movement of polychrome vessels to the Hinkson site implies that this may be a focus of activity or interaction, a reasonable assumption given the formal architecture, public space, and overall size of the site. The precise nature of this focus remains uncertain, but is certainly communal. It should again be noted that ceramic samples from Hinkson derive from collections at several of the roomblocks, and cannot be associated specifically to the great house.

Given the samples analyzed, there is little indication of Hinkson-produced ceramics found in quantity elsewhere. They appear to produce corrugated ceramics, however, these are not exchanged to other sites. It may be that Mancos Shale in the OBAP study area is a poor clay source that was routinely under-exploited. It may also be that another common type, such as Tularosa Black-on-White, was made from this clay and exchanged. Because this analysis sampled only corrugated and St. Johns Polychrome types, such an activity may have been overlooked. However, it seems more likely that a non-ceramic commodity or function accounts for the pattern observed at Hinkson.

DISCUSSION

The preceding analysis is intriguing and suggestive. If this analysis is theoretically and methodologically defensible, which I contend it is, these results have definite implications for other studies of aggregation-period community organization. The scope of community appears to be quite broad in the post-Chacoan period, with roomblocks located up to 8 km from one another interacting intensively. Minor productive specialization utilizing a preferred or desired resource is also suggested. However, prior to additional

interpretation, it is important to critically evaluate the results.

The ability to detect different production locations within the study area is central to any interpretation of these data. It has clearly not been demonstrated that residents of any particular roomblock did not travel to clay resources that were further than the closest exposure. Rather, an inferential argument based on the topographic and geological setting of the study area, as well as the ethnographic research of Arnold (1985), suggests that potters probably opted to use suitable nearby clays. Access to specific clay resources was not uniform. Obtaining clays from the Chinle Formation would require substantial energy expenditure to reach its nearest exposure, and it may have been somewhat more distant to suitable clay sources within it.

The semi-specialized production of corrugated vessels by the residents of Jaralosa Pueblo was an unexpected outcome. By semi-specialized, I mean that residents of Jaralosa regularly produced more Chinle Formation vessels than they required for household use, and exchanged these vessels (and/or their contents) to other households in the area, possibly for another good or service. I do not mean to imply they produced vessels as their sole productive means, but it seems they were distributing these on more than a casual basis. The magnitude of Jaralosa corrugated vessels found at other sites is somewhat diminished if we consider that this likely occurred over decades. The residents of all roomblocks appear to have produced utilitarian pottery, and it probably would not require excessive production for this volume of vessels to accumulate. Perhaps, "consistent over-production" might be a better term, similar to a much-reduced version of the community specialization noted by Stark (1991).

Another confounding variable needs to be addressed. I have assumed contemporaneity among roomblocks based on similar ceramic assemblages (Kintigh 1985a), and sherd samples were almost exclusively collected from survey. Similar ceramic frequencies may not correlate with absolute site contemporaneity. Excavation at these sites might establish contemporaneity if absolute dates could be obtained, but this is difficult even among completely excavated structures. Until we can effectively determine occupation duration, I see no way around this assumption.

The association of sherds with geological formations appears reasonable based on other studies that included clay samples. The chemical analysis of

Walker (1992) provides a guide to the interpretation of compositional data, but the associations articulated here could be considerably clarified by directly comparable analysis of raw clays gathered from the proposed source locations within the study area.

The methodology relies heavily on the presence of different clay sources within a study area. This condition is fulfilled at OBAP, but the approach would be of relatively little utility in areas of homogeneous resource distribution or access. In fact, another study using data from a similar suite of post-Chacoan roomblock configurations near Heshot uła on the Zuni Reservation revealed little about ceramic production or the scope of community (Duff 1993:139-159).

This highlights an important aspect of this research. Based on topography and geology, the potential for discerning local differences in resource exploitation was present for both the OBAP and Heshot uła study areas. Similar conditions can be found over much of the Plateau Southwest. An extensive refiring program was employed in both studies. This low cost, relatively simple process provided initial data on the likelihood of detecting meaningful differences in source clays. However, refiring analysis of the Heshot uła area samples indicated little variation. The compositional analysis performed (N=135) confirmed this homogeneity, and was essentially useless for addressing questions of community scope. The lesson being that a preliminary oxidation analysis may suggest whether the variability apparent from the topographic and/or geological setting of an area is represented in clay procurement practices. I would encourage others to employ refiring prior to selecting or sending samples to be analyzed by "high-tech" procedures (also, Graves 1991). In this case, it led to a refined series of questions, and a basis for stratifying the compositional sample.

The use of corrugated pottery as a monitor of interaction constitutes another critical aspect of this study. While there is ethnographic support indicating this is a realistic approach, the problem of multiple exchanges of the same vessel is beyond detection. Implicitly, I have assumed a vessel was exchanged only once. If vessels were repeatedly exchanged without concern for their production origin, the patterning noted could be spurious. However, if a tributary/redistribution network was in place, the original production location patterning might be accurate, but the resulting inferences based on distribution (deposition) would be fundamentally altered. That ceramics were the important good in exchange is an implicit theme in this analysis.

It was probably the combination of vessels *and* their contents that was important, but the *vessels* are what is archaeologically detectable.

CONCLUSIONS

I have suggested that local production and exchange can be effectively monitored through a combination of oxidation and compositional analyses. Utilizing three models of possible roomblock interaction thought to reflect differing scales of community, an extensive community model emerged as the most appropriate selection.

This research was specifically designed to address the problem of community scope. I have argued that our perceptions of community may be built on untested assumptions, and suggested a method for correcting this by analyzing exchange patterns among roomblocks. This study has suggested that viewing communities after Doyel and others, as "a group of spatially related but noncontiguous contemporary settlements of various types integrated on the local level into a functioning sociocultural entity (1984:37)" is a more appropriate strategy than employing definitions based on distance measures. Though distance clearly plays a significant role in interaction, an expanded view of community seems worthy of analysis. Exploration of archaeological questions within artificially constructed boundaries is likely to result in misleading interpretation of patterning. Restricting definitions of community to limited distance measures appears to be a case in point. We must explore processes at a scale greater than they are expected to encompass in order to effectively identify and understand them.

The need to incorporate dispersed roomblocks into discussions of post-Chacoan community organization has been demonstrated. The role of dispersed roomblocks in Chacoan communities should be similarly investigated. Insights into the operation of the "Chacoan system" could be profitably explored with an expanded view of community and this methodology.

The approach I have outlined has many potential applications, especially with heightened recognition of post-Chacoan settlement dynamics. Similar post-Chacoan settlement types appear to be a common pattern within the Zuni Region. Similarities with areas on the Zuni Indian Reservation and the El Morro Valley are evident, and may be relevant to other regions following the collapse of Chaco.

The importance of clustered settlements appears to have been, in part, related to the presence of

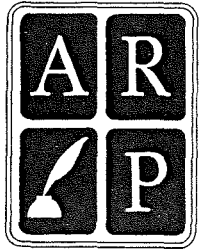
dispersed settlements. The extent and direction of ceramic exchange was shown to vary by settlement type. The production and exchange of St. Johns Polychrome suggests it was not an elite ware. All settlements possessed St. Johns Polychrome, and it was probably an important part of communal activity associated with the Hinkson site. However, I have not suggested the basis for community organization. Equally compelling arguments for this having had a social, economic or political basis could be made, the point being that this research has provided a baseline from which more detailed models of post-Chacoan community can now be built.

The time period under consideration includes the initial aggregation of people into clustered living arrangements, followed by the founding of the first large-scale planned pueblos in the Zuni Region. The period of aggregation (A.D. 1175-1275), witnessed the development of a communal organization that made possible the subsequent shift to nucleated settlement. The Pueblo IV period may have involved the spatial

consolidation of a pre-existing communal organization, developed, in large part, during the post-Chacoan era.

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EXPLORING SOCIAL, POLITICAL AND ECONOMIC ORGANIZATION IN THE ZUNI REGION

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