INFERRING THE INTERACTION OF TWO CHACO-ERA COMMUNITIES THROUGH PAINTED CERAMIC DESIGN ANALYSES

By

LINDSEY RENEE CLARK

A thesis submitted in partial fulfillment of
the requirements for the degree of

MASTER OF ARTS IN ANTHROPOLOGY

WASHINGTON STATE UNIVERSITY
Department of Anthropology

MAY 2010

To the Faculty of Washington State University

The members of the Committee appointed to examine the thesis of LINDSEY RENEE CLARK find it satisfactory and recommend that it be accepted.

_____
Andrew Duff, Chair

_____
Timothy A. Kohler

_____
Colin Grier

INFERRING THE INTERACTION OF TWO CHACO-ERA COMMUNITIES

THROUGH PAINTED CERAMIC DESIGN ANALYSES

Abstract

by Lindsey Renee Clark, M.A.
Washington State University
May 2010

Chair: Andrew I. Duff

Artifacts constitute the majority of the archaeological record and are the largest contributor to our ability to understand extinct cultural systems. Of these material remains, ceramics are among the most abundant and the most informative, especially in terms of their variability, both functionally and stylistically (Binford 1964:430). Stylistic analysis of ceramics has been the foundation for ceramic seriation and much of the chronology in the American Southwest, and may also be utilized to understand behavior.

Design elements are the individual design units painted on the ceramics, which are analyzed and recorded for intra- and inter-site comparisons of Cox Ranch Pueblo and Cerro Pomo, two Pueblo II (A.D. 1050-1130) communities located 8 km apart in west-central New Mexico. Similarities and differences that result from various living and learning environments can lead to the identification of interaction both within and between contemporaneous sites. Based on the analysis of painted ceramics excavated from middens and Great House deposits at both sites, it is possible to infer behavioral trends and levels of interaction within and between these two communities. Through the analysis of painted designs on the sherds from Cox Ranch Pueblo and Cerro Pomo, I address the question: “Did people living and working in close proximity influence each other’s painted design choices on an intra-site and inter-site level?”

While this question will not be definitively answered in this study, evidence supporting learning and preference patterns based on residence proximity are presented indicating that those who lived near each other may have influenced the ceramic painted design choices of their neighbors. The data collection and analyses also indicate that Cerro Pomo and Cox Ranch Pueblo became more homogenous in their painted design element choices over time. Additionally, the Great Houses in these two communities appear to have been integrative and specialized use locations for the whole community, much like the role of the Great Houses in Chaco Canyon (Cameron and Toll 2001:12).

Acknowledgements

First and foremost I need to thank Dr. Andrew Duff for his endless encouragement, support, and time. Both his knowledge and kindness are astounding, and his patience is never ending. The Washington State University faculty and staff have made my graduate school experience both educational and enjoyable. Dr. Colin Grier and Dr. Tim Kohler deserve a special thank you for agreeing to be on my committee and their help with this thesis; I appreciate your time and your comments which helped this study to be something I am very proud of.

To my family, not a day goes by where I do not remember how lucky I am to have all of you. I love you all so much and could not have done this without you. My parents specifically, thank you for everything. You are ridiculously amazing parents and your support and guidance is truly what made this possible. Friends at home, without you guys in my life I wouldn't have made it through the tough times. Christina, our daily conversations and occasional game breaks were both therapeutic and necessary. Thank you to my friends here, specifically Amy and Nichole, for forcing a small social life out of me at least once a week. A special thank you to my thesis buddy Emily for countless hours of company, laughs, and commiseration. We were a good team and we did it!

To Dave, my fiancé, thank you for dealing with the difficulties of both my fragile thesis emotions and the cross country distance. You kept me focused on the real reasons I was here and helped me to get out of bed on multiple occasions. You are my rock, my motivation, my best friend, and my love.

Table of Contents

List of Tables

List of Figures

Introduction

Painted designs on ceramics can offer more to the archaeologist than a pretty picture; they provide insight into cultural and behavioral processes. Ceramic production and decoration is a learned craft that can be taught and learned either intentionally or unintentionally. Along with these teacher-student transmissions of production knowledge is also style, which includes preferences or habits that may be evident in the archaeological record. Design elements are the individual design units painted on the ceramics, which are analyzed and recorded for intra- and inter-site comparisons of Cox Ranch Pueblo and Cerro Pomo, two Pueblo II (A.D. 1050-1130) sites located 8 km apart in west-central New Mexico. Similarities and differences that result from various learning environments can lead to the identification of interaction units both within and between contemporaneous sites. Based on the analysis of painted ceramics excavated from middens associated with roomblocks and Great House deposits at both sites, it is possible to infer behavioral trends and levels of interaction within and between these two communities. Through the analysis of painted designs on the ceramic from Cox Ranch Pueblo and Cerro Pomo, I address the question: "Did people living and working in close proximity influence each other's painted design choices on an intra-site and inter-site level?"

History of Research

Archaeological ceramic analysis in the southwestern United States has an extensive history. Ceramics have been employed to answer a wide array of questions ranging from cultural affiliation and ethnicity to occupation and use periods. Utilizing ceramics to better understand the cultural and behavioral processes behind their production, and the resulting archaeological

record has also been the focus of much research over the years. For this reason it is necessary to review past work which is applicable to the research question at hand in this study.

Southwestern ceramics are beautifully crafted and often adorned with some form of decoration. Gray and brown unpainted wares were impressed, indented, and corrugated to add style to the vessel. White- and red-slipped wares were often painted, another expression of style. Specific design combinations define ceramic types and innovative designs are occasionally observed in the archaeological record. It is obvious that people were not born with the inherent knowledge of ceramic decoration styles or techniques indicating the presence of a learning environment where ceramics were being manufactured. Ethnographically these production and learning episodes occur close to the residential structure of the potter. Prehistorically, those who lived in close proximity likely interacted more frequently during activities such as ceramic production and this may have influenced their design choices. With this in mind, I will examine whether the location of potting activities had any noticeable influence on the resulting painted designs present on red and white wares in two Southwestern communities dating to the eleventh and twelfth centuries, and if interaction can be detected through the design choices on an intra- and inter-community level.

Many studies have investigated technological aspects of ceramics to better understand the cultural system of their makers (e.g., Gosselain 1994; Smith 2000; Stark 1991), including assessment of intergroup interaction and migration levels; however stylistic attributes are less frequently used to answer the same question. Stylistic attributes are considered by Binford to be "a by-product of the social context of the manufacturers of the vessel" that "may arise from a traditional way of doing things within a family or a larger social unit, or it may serve as a conscious expression of between-group solidarity" (1965:206). Stylistic behavior is just one

expression of information that is constantly being transmitted, with style and design uniformity thought to indicate high levels of communication.

The presence of learning and working groups of potters has been well documented in the ethnographic record. Studies investigating transmission of the ceramic production craft itself have "demonstrated that potters absorb influences from many sources and learn from many individuals" even in societies where ceramic production is a household-based activity (Sinopoli 1991:120). One example is DeBoer's (1990) study of the Shipibo-Conibo from the Ucayali Basin of the Amazon. His study focused on polychrome vessel decoration and design transmission, and DeBoer found that inter-village interaction can lead to the spread of innovation or stylistic fashions (1990:102). Even though stylistic transmission is known to occur freely within a specific culture, and individual artists also produce unique work, the overall style still reflects the cultural style of an interacting group of people with a shared sense of identity (DeBoer 1990:100). I expect this to reflect the transmission or exchange of information producing messages that can be seen in the archaeological record.

The idea of style as information exchange was codified by Wobst in 1977. Wobst equates "style with that part of the formal variability in material culture that can be related to the participation of artifacts in processes of information exchange" (1977:321). The exchange of information may relate to culture or ethnic identity and possibly family or individual preferences. Information can also be exchanged at multiple intra- or inter-community levels for various purposes. Social interaction theory is another explanation for the variability of style in the archaeological record. This theory assumes that style was communicated and learned through time and space (Whallon 1968:223-224) and "patterns of interaction either define, or are the result of, the social organization of the community or region" (Wobst 1977:321). The problem

with all archaeological stylistic analysis however lies in the fact that archaeologists "were never the intended receivers of the messages style may carry" (DeBoer 1990:82).

Messages containing specific information or patterns of interaction began in the production environments themselves, where production environments were often composed of "clusters of coresident women who shared the same learning contexts" (Sinopoli 1991:120). Washburn performed an ethnographic study of design symmetry preferences on cloth by comparing two different ethnic groups, Laotian refugees in New York who formerly wove cloth and/or used it as clothing or household decoration, and Bakuba weavers and embroiderers from Zaire (Washburn 1994:160-161, 167). The results showed that "the people in an ethnic group consistently prefer[ed] certain pattern structures" (Washburn 1994:171). Learning contexts and techniques were thus seen as influential for both design application and preference (Crown 2001:455).

The relationships behind these learning techniques range from parents or relatives to peers and employers; these relationships are reflected in the stylistic decisions potters make and are evident on or in the final product (Crown 2001; Shepard 1985:304; Sinopoli 1991:119). For this reason, ceramics are credited with affording insight into the psychology and life of a people along with the "tastes and concerns of both the simple craftsman and the artist" (Shepard 1985:256). This is assumed to be true in prehistoric cultures as well. As expressed by Binford:

> Sites and areas within sites vary functionally. Since sites are the result of cultural activities performed by social units within restricted spatial bounds, we would expect them to vary formally as a function of the activities of the social units represented. It is a known and demonstrable fact that socio-cultural systems vary in the degree to which social segments perform specialized tasks, as well as in the cyclical pattern of task performance at any given location. These differences have spatial correlates with regard to the loci of task performance; hence we expect sites to vary formally and spatially with regard to the nature of the tasks

> performed at each, and the social composition of the units performing the tasks [1964:432].

Stylistic attributes are integral to the identification of distribution patterns independent of, or in addition to functional attributes. The application of paint on ceramic vessels is one example of a stylistic attribute. Painted designs are composed of a combination of forms or shapes that create units. These units are frequently referred to as elements and this terminology will be retained throughout this study. The presence and frequency of these elements provides archaeologists with the opportunity to identify non-random distributions indicative of communication levels and/or social organization.

The use of design style distribution as "a tool for sociological interpretation in prehistory" (Longacre 1970:27) has a long archaeological pedigree. Pivotal studies by Cronin, Deetz, Longacre, and Hill "were extremely important in fostering the recognition that ceramics could be used to consider intra- and intersite social variation, that there could be more to ceramic analysis than defining regional culture areas or chronological sequences" (Sinopoli 1991:120). Cronin was not only the first to test artifacts as indicators of "intertype relationships," she was also the first to do so in the Southwest (1962:110). After the 1960 excavations of seven sites in eastern Arizona's Little Colorado drainage, she conducted a study focusing on Snowflake Black-on-white design elements. This pilot study was performed to better understand what about this type's designs allow archaeologists to "recognize any one pottery type as a distinctive entity and which set it off from all other pottery types" (Cronin 1962:105). She focused on the question of how and why new types developed and related her observations to the ideas of stylistic drift and similarities based on site location. Evidence was found supporting greater degrees of similarity between types at a single site rather than "between different time levels of one type," indicating

learning and production environments influence designs (Cronin 1962:109). She also showed that the methodology she employed was and is a valuable technique to trace relationships (Cronin 1962:110).

Deetz is responsible for another early work establishing this archaeological concept and applying it to an area outside the Southwest, demonstrating its universal capabilities. Deetz's research concerned the ceramics of the eighteenth century Arikara culture located along the Missouri River (1965:1, 6). Through analysis of 2,500 rim sherds, he identified stylistic change and the "articulation between the changes in social structure… and changes in ceramic design" (Deetz 1965:3). Attributes such as curves, angles, profiles, decoration, and surface treatment were documented and graphed by percentages (Deetz 1965:46-49). Design elements were identified and recorded for vessel handles, lips, collars, and necks (Deetz 1965:46-49). Of these elements, both design choice and application techniques revealed noticeable trends, though patterning was not observed for all recorded elements or attributes. According to Deetz, "the key factor in solving the problem of ceramic and social interrelationships is the residence pattern" (1965:91) and location. Residence patterning and descent were inferred to indicate twelve social structural types, four of which were attributed to the ceramic patterning of the Arikara (Deetz 1965:95). This study showed the "possibility of a functional and real connection between kinship change and pottery design" (Deetz 1965:98) and inspired the later studies using ceramic stylistic change to better understand past social structures.

While "studies have increased our understanding of the range of possible explanations of stylistic variation" (Plog 1990:61), successfully relating these explanations to the individuals and social groups surrounding their production is rare. The true potential of painted stylistic elements to inform us about past social interaction is demonstrated in two popular studies (Lipo et al.

2003:87). The classic reports of Longacre (1970) at Broken K Pueblo and Hill (1970) at Carter Ranch Pueblo linked nonrandom design element distributions to stable residential groups, suggesting that the clustering of element frequencies reflects social proximity. Both these sites are located in east-central Arizona and the ceramics are part of the same developmental trajectory as those found on the somewhat earlier sites of Cox Ranch Pueblo and Cerro Pomo situated to the east in New Mexico.

Longacre's (1970) work focused on Carter Ranch Pueblo, with an estimated occupation spanning A.D. 1100-1250. The Carter Ranch site is made up of "thirty-nine dwelling rooms built in the form of a hollow square around a plaza containing a big D-shaped kiva" along with another detached kiva (Longacre 1970:18). The material culture reflected the fact that "culturally and spatially, the area lies between the classic Anasazi tradition of the Colorado Plateau and the Mogollon tradition of the mountain valleys" (1970:14). Longacre's hypothesis was based on the fact that "[s]ocial demography and social organization are reflected in the material system" (1970:28). As a result he expected "the smaller and more closely tied the social aggregate, the more details of design would be shared" (1970:28). His design element analysis utilized 6,415 black-on-white sherds depicting at least one complete design element from the Carter Ranch Site and site LS-211's (a prehistoric site in the same valley) pueblo rooms, surface collections, and middens (Longacre 1970:28). The design list developed specifically for his study contained 175 discrete elements and element patterns. Longacre documented nonrandom distribution of elements indicating "a corporate nature for the residence units" (1970:51) allowing him to identify "three residence units practicing matrilocal post-marital residence patterns" (1970:46). He also determined that the ceramics from the middens associated with the roomblocks showed comparable similarity (Longacre 1970:46), a line of reasoning that influenced my strategy of

using midden samples. Although his case study was "admittedly incomplete and only suggestive" (1970:3), it was one of the first attempts to recognize intra-site social interaction through the distribution of stylistic attributes.

Hill's analysis of Broken K Pueblo (1970) developed from Longacre's study. Broken K Pueblo was located approximately 11 km north of Carter Ranch, with an occupation spanning A.D. 1150-1280, post-dating Carter Ranch. Broken K Pueblo included 95 rooms comprising four roomblocks, making Broken K Pueblo more than twice the size of Carter Ranch. Based on the size difference, Hill expected to find more social units, assuming that patterned design element distributions reflected the "loci of a particular function or activity" and/or "loci of a social segment (or segments)" (1970:16). If true, Hill felt it was "possible to propose that each localized area represents the locus of a discrete social unit, or residential unit" (1970:16). Hill chose to apply the same element list as Longacre based on the equivalent culture areas, but expanded his study sample to include black-on-white, black-on-red, and polychrome vessels (1970:25). In fact, Longacre actually coded the ceramic data used by Hill (1970:vii). Hill's study was strengthened by using additional lines of evidence including storage pits, varieties of fire pits, animal bone and lithic chopper types. Through these multiple lines of evidence, coupled with statistical testing, Hill (1970:107) identified five residence units which exhibited nonrandom distributions of ceramic design elements.

In the years following the publication of the two aforementioned studies, their methods, results, and assumptions were criticized (e.g., Allen and Richardson 1971; Schiffer 1972, 1989; Stanislawski 1973; Watson 1977). Stephen Plog (1980) published his own critique and study to better explain stylistic patterning in the archaeological record. Plog's review of stylistic patterning analyses noted that previous design analyses were oversimplifying the situation and a

much wider range of possible factors could be responsible for such patterning. According to Plog (1980:24), four factors beyond interaction must be considered: subsistence-settlement systems, vessel shape, ceramic exchange, and temporal change in design. Plog also emphasized the necessity of clearly defining an "element" along with the importance of comparing elements that are interchangeable (1980:42). In his opinion, only after these two criteria are met is it appropriate to proceed with a stylistic analysis.

Plog's critique of past stylistic analyses was accompanied by his own study using a collection of data and thirteen stylistic attributes from the Chevelon Canyon region of east-central Arizona, located just north of the previously mentioned Southwestern studies. Specifically the sites were located in the Purcell-Larson area which stylistically represented both the Mogollon and the Anasazi. Plog's results showed that seasonal movement was not causing the variation in his ceramic record (1980:81), while a majority of the statistically significant differences were accounted for by vessel form (1980:112) or ceramic exchange (1980:69). Plog's results accounted for differences seen in the distribution of ten of the thirteen recorded attributes; however the remaining three differences were not accounted for by the aforementioned additional factors.

While Longacre and Hill's methods, results, and conclusions may be incomplete or oversimplified according to some, the necessity for and prospects of painted element analysis should not be discredited. Prior to becoming familiar with Longacre and Hill's landmark studies, the potential of painted design analysis became the focus of my research, which reaffirms the continued potential of this direction of work in archaeology today and its ability to increase our understanding of past peoples.

The basis of this thesis research is a design analysis of painted ceramics from the Cox Ranch Pueblo and Cerro Pomo communities in New Mexico. Cox Ranch Pueblo and Cerro Pomo are neighboring communities and appear to have had contemporaneous occupations (Duff et al. 2008; Elkins 2007:48). This thesis will investigate whether the design elements on the painted ceramics recovered from both communities can help us to better understand behavior and interaction within and between these communities.

Site Descriptions

Cox Ranch Pueblo and Cerro Pomo are both Great House communities dating to the Chaco period. They are located at the southern edge of the Cibola region in west-central New Mexico (Figure 1) on the edge of two distinct cultures: Ancestral Puebloans and the Mogollon. The communities surrounding the Great Houses are made up of contemporaneous residences thought to be comprised of co-residing individuals from both cultures (Duff and Nauman 2010).

General Orientation

Excavation and survey at Cerro Pomo (LA 31803, BLM NM-02-191) and Cox Ranch Pueblo (LA 13681, BLM NM-02-185) has been conducted as part of the "Chaco Frontier Communities Project." This project has been initiated on Bureau of Land Management lands in Catron County, New Mexico in 2002 to generate new information that will help to better understand settlement pattern, community organization, and land use (Duff 2009:2). The occupation span of Cox Ranch, Cerro Pomo, and their residential communities is estimated at A.D. 1050-1130 (Wichlaz 2009:2).

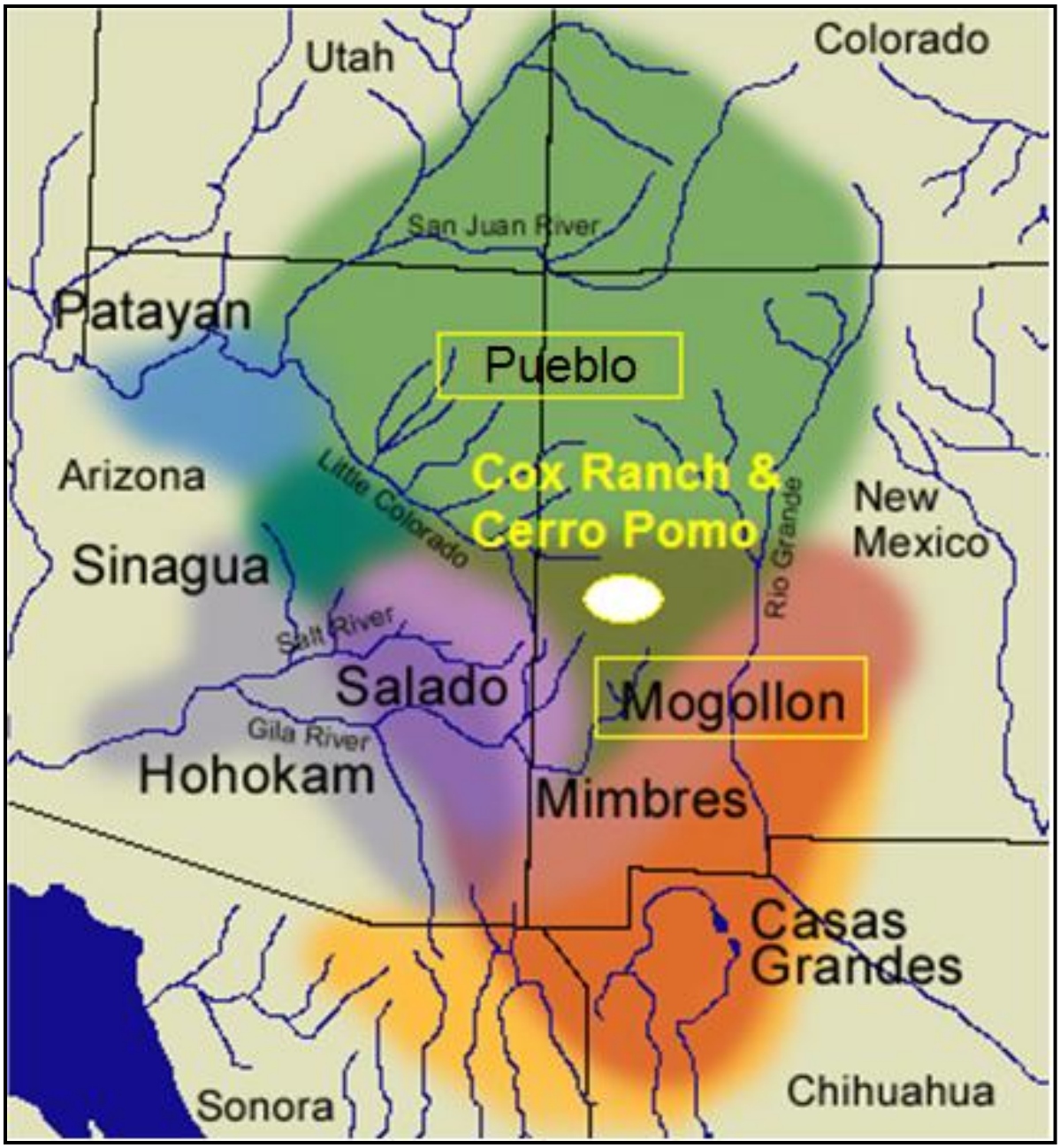

Figure 1. Mogollon and Ancestral Pueblo culture areas and the location of Cox Ranch and Cerro Pomo (modified from Elkins 2007: Figure 4; Base Map: http://www.beloit.edu).

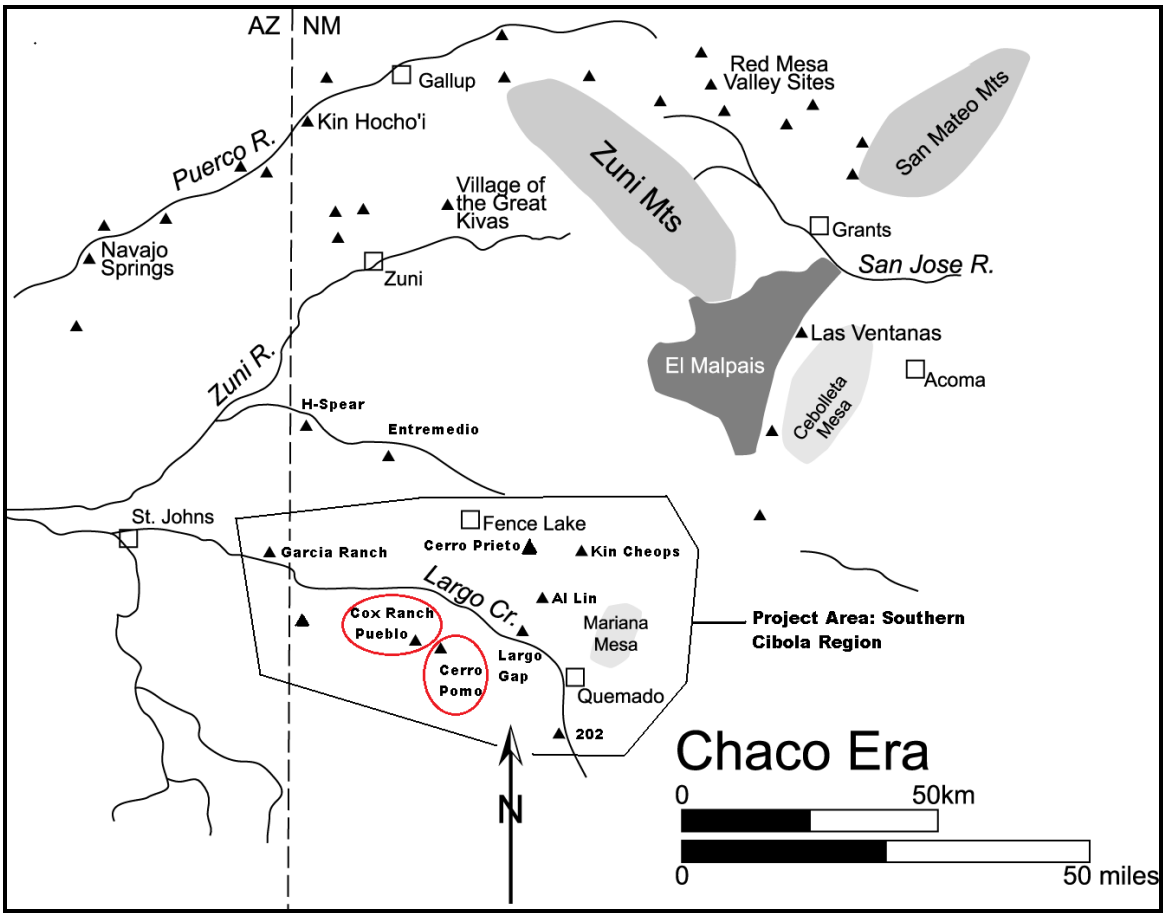

Figure 2. Location of Cox Ranch Pueblo and Cerro Pomo (Duff 2005: Figure 1); circles added.

These two communities are situated approximately 8 km apart in the Colorado Plateau's Southern Cibola region in west-central New Mexico (Figure 2). The geologic makeup of the region includes both sedimentary and volcanic deposits (Wichlaz 2009:7), and extensive alluvium (Huckleberry and Duff 2008). Their elevations are approximately 2000 m above sea level and the local climate is semi-arid with a "mean annual precipitation of 27.4 cm with 53 percent falling in July, August, and September" (Huckleberry and Duff 2008:109). Based on environmental reconstructions from El Malpais National Monument 80 km northeast of the study area, the environment during the period of occupation included above-average precipitation (VanBuskirk 2004:21). Significant drought affected the region around the time of abandonment

and precipitation levels continued to fluctuate during the remaining prehistoric and historic periods (VanBuskirk 2004:26).

"Cox Ranch and Cerro Pomo both have Chacoan architectural attributes with large Great House structures, possible subterranean ritual structures, and formal public space" (Elkins 2007:47), yet "they appear to have been less directly implicated during Chacoan times than might be expected" (Duff and Lekson 2006:317). Both sites have been determined to be contemporaneous "based on ceramic seriation and limited tree-ring dates" (Elkins 2007:48), dating to the late Pueblo II period (A.D. 1050-1130). These two sites are also linked through their view of the Cerro Pomo cinder cone, a prominent feature of the local landscape speculated to have additional meaning related to the solstices for the people occupying both sites (Duff et al. 2008:4-5).

Cox Ranch Pueblo and Cerro Pomo are communities thought to be centered on Great Houses which can be considered the "hallmark of Chacoan influence" (Duff and Lekson 2006:320), though what exactly these structures represent is uncertain. Interpretations include residential structures, community centers, storage facilities, locations of gatherings and ceremonial activities, or a combination of these uses (Kantner 2004:82). "Great Houses are usually characterized by being larger than all other buildings in the community, with extra-tall rooms, core-and-veneer walls, banded or Chaco-style masonry, blocked-in interior kivas, often with formal public space attached" (Duff 2005:6).

Both Cox Ranch Pueblo and Cerro Pomo's populations do not appear to be ancestral communities which "have significant time depth" (Doyel et al. 1984:38). These communities are located in an area with very little recorded Pueblo I or II period settlements, as well as all additional roomblocks within the area appear to have been contemporaneously occupied (Duff

2005:13; Elkins 2007:48). Cerro Pomo and Cox Ranch Pueblo are only two "of several sites and communities in the mid-1000s in an area with few local precursors and limited evidence for residential occupation during the A.D. 900s" (Duff 2005:2). They each represent focal Great House locations for the dispersed residential sites surrounding them which are thought to be part of the same sustaining community. These contemporaneous settlements surrounding Cox Ranch Pueblo and Cerro Pomo include both smaller residential sites and nearby field houses (Duff and Wichlacz 2009).

Cox Ranch Pueblo

Cox Ranch Pueblo (Figure 3) consists of a Great House with roughly 50 rooms, 18 room blocks, and 18 discrete midden areas (Elkins 2007:53). The northwest portion of the site has only received limited testing at this point consisting of salvage testing of Roomblocks 15 and 16 (Figure 3). "In addition to the Great House, there are two areas with some form of public architecture" including an unroofed Great Kiva appended to Roomblock 2 and a large depression likely representing a well (Duff 2005:5). Detailed surface mapping was conducted by Washington State University in 2002 followed by excavations at Cox Ranch Pueblo with associated field schools from 2003-2005, though initial reconnaissance was directed by the Peabody Museum's Upper Gila Expedition (Danson 1958; Wichlaz 2009:1).

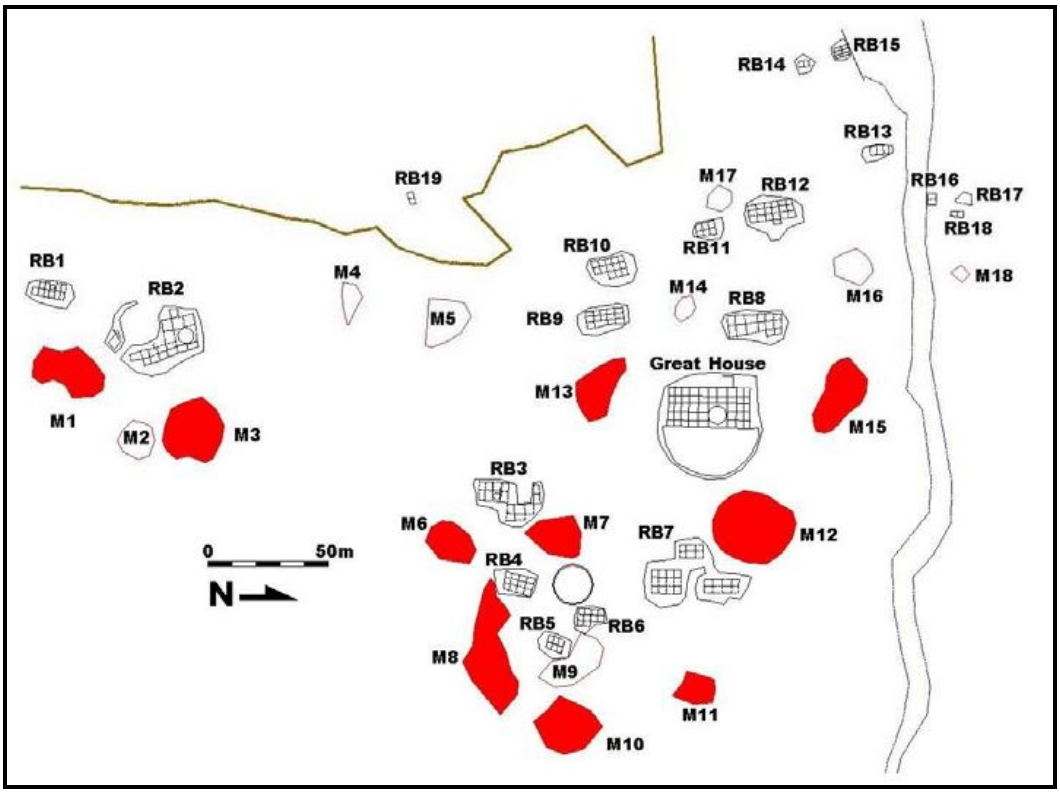

Figure 3. Cox Ranch Pueblo site plan with tested middens shaded red (Elkins 2007:55) shading original.

Midden areas are generally associated with nearby roomblocks and were a focus of excavation (Duff 2003). At Cox Ranch, middens were located east of their associated roomblock. This is different from the more traditional orientation during the Pueblo II period in the four corners region where "[t]he midden area usually lies south or southeast" of the roomblock and kiva (Lipe 2006:264). This 90 degree shift in roomblock and midden orientation observed at Cox Ranch Pueblo is also seen elsewhere in the Southwest such as the Early Coalition Bandelier-area sites in New Mexico, though the occurrence of this unexpected positioning is less common (Kohler and Root 2004:127-128). Excavation locations inside the middens were determined using a random sampling method and were then excavated as 1-x-1 m test units (Duff and Wichlacz 2009). Five units were excavated in Middens 1, 3, 6, 7, 8, and 15, and six in Middens 10, 11, and 12. Eighteen total units were excavated in the Great House. The locations of the

Great House test units are inside the Great House rooms, along the exterior of the back wall on the west side, the plaza, and inside the interior kiva (Duff and Wichlacz 2009). The roomblocks which were tested are not included in this study due to their insufficient sample size.

There are roughly 300 total rooms at Cox Ranch Pueblo which includes the Great House (Elkins 2007:53). An additional 15 recorded roomblocks are located within a 3 km radius, "suggesting approximately 100 additional contemporaneous rooms" (Duff and Wichlacz 2009). The 400 total rooms associated with Cox Ranch "divided by either two or three to account for issues of site use life and intra-period abandonment" limits contemporaneous occupation to a range of 135-200 rooms (Duff and Wichlacz 2009).

Cerro Pomo

Washington State University's excavations of Cerro Pomo began in the summer of 2005 and continued through the summer of 2008. Cerro Pomo is a dispersed community "typical of Pueblo II settlements in the area" (Wichlacz 2009:15). It is composed of a site named Cerro Pomo (Figure 4) and numerous residential sites located in the surrounding landscape. Excavations included 13 units within or adjacent to rooms in the Great House, five 1-x-1 m units in Midden 1, ten 1-x-1 m units in Midden 2, and a 1-x-3 m unit in the Great Kiva-like depression.

Survey has documented more than twenty residential settlements in the area surrounding Cerro Pomo; only four have been tested. The landscape surrounding Cerro Pomo contained a higher number of small roomblocks, compared to Cox Ranch Pueblo, which generally included 12 or fewer rooms (Duff and Wichlacz 2009). A few small roomblocks in the area of Cerro Pomo contribute the only evidence of earlier occupation (Duff 2009). Four additional roomblocks known as sites 961, 965, 967, and 969 have been surveyed (each containing 5-10

rooms) and their respective middens tested (Wichlacz 2009:15). Site 969 is located approximately 2.3 km northeast of Cerro Pomo, and sites 961, 965, and 967 are approximately 1.6 km east (Figure 5). Cerro Pomo's total occupancy including the Great House was approximately 300 rooms. The community residing in the Cerro Pomo vicinity at any one time is estimated over 100 people in 100-150 rooms (Duff and Wichlacz 2009).

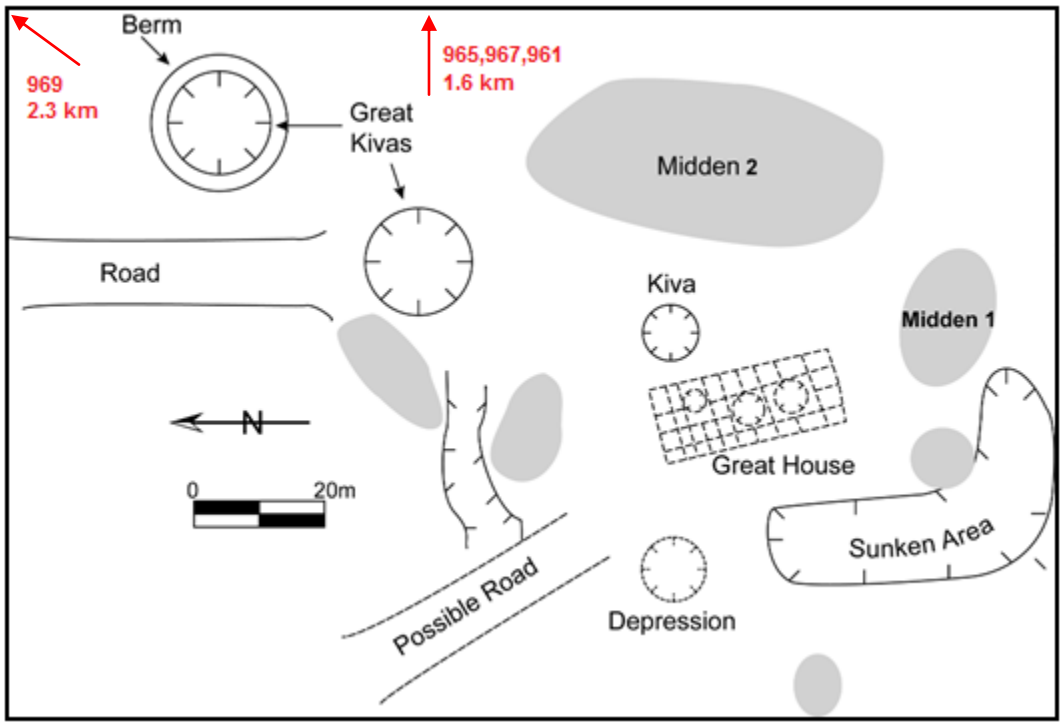

Figure 4. Cerro Pomo site plan (modified from Duff 2009:10).

Both communities built and utilized a Great House; however, the role of the Great House in each community will be discussed later. They also appear to both incorporate the Cerro Pomo cinder cone into their observances of the solstices (Duff et al. 2008). Cox Ranch Pueblo is a larger and more compact residential community, whereas Cerro Pomo is surrounded by more dispersed roomblocks (Figure 5). The degree to which these similarities and differences are seen in the painted ceramic assemblages will be addressed in later sections. Before proceeding to

analysis and interpretations, the ceramics included in this study and the research methods are first discussed.

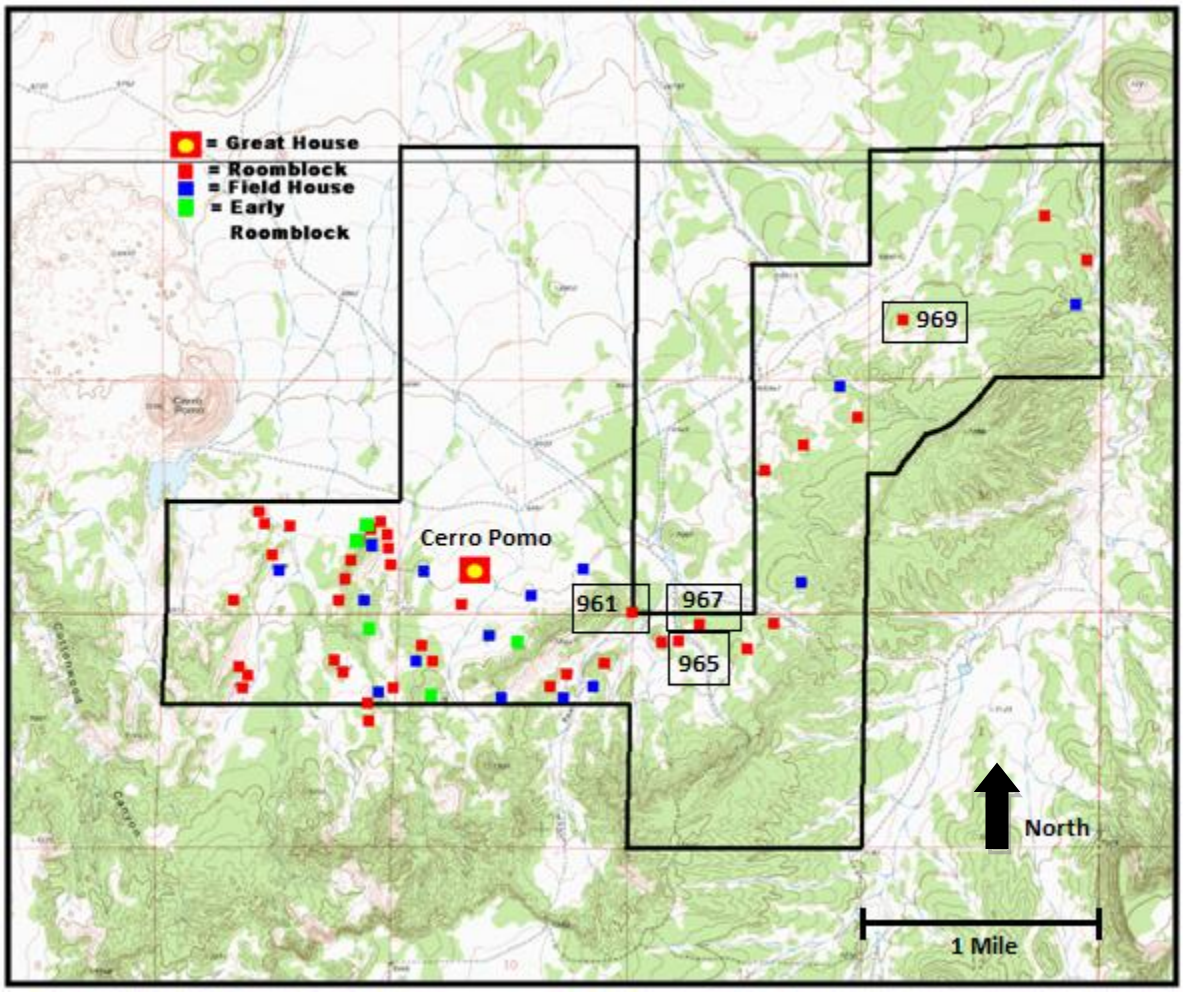

Figure 5. Location of Sites 961, 965, 967, and 969 (modified from Duff and Wichlacz 2009).

Ceramics and Methods

The Southwest is home to many different varieties of painted ceramic types defined by slip color, painted element designs, and the combinations of these painted elements. For this reason I first describe the painted wares present at Cox Ranch Pueblo and Cerro Pomo which make up the data set included in this research. The methods used to generate data are also discussed.

Description of Painted Ceramic Types

Ceramics present at these two sites include Mogollon Brown Ware, Cibola Gray Ware, Cibola White Ware, and White Mountain Red Ware. The white ware types present are Kiatuthlana, Red Mesa, Gallup, Escavada, Puerco, and Reserve black-on-white (Table 1). Kiatuthlana Black-on-white, the earliest type present at both Cox Ranch Pueblo and Cerro Pomo, is defined by the presence of black-on-white motifs consisting of "fine line chevrons; small solid triangles, often with a saw tooth edge and occasionally elaborations, such as pendent dots and cross-ticking" (Hays-Gilpin and van Hartesveldt 1998:64). These vessels also always contain a solid line at the rim and finer lines than the subsequent type, Red Mesa. Red Mesa Black-on-white also includes chevrons and solid triangles, but incorporates curved designs, hatching, and checkerboard patterning (Hays-Gilpin and van Hartesveldt 1998:67). The next three types chronologically, Gallup, Escavada, and Puerco, are all varieties of the Puerco Black-on-white type and (by the definition of Puerco Black-on-white given by the Cibola White Ware Conference of 1958), and should all be included as Puerco Black-on-white (Nauman 2007:71). They are still recognized as different Puerco varieties based on distinct characteristics and slightly different use dates (Table 1).

Gallup Black-on-white is conventionally identified through designs consisting of primarily hatchure that is often closely spaced (Hays-Gilpin and van Hartesveldt 1998:71). Gallup also includes some minor isolated solid elements that do not interlock with hatched designs (Hays-Gilpin and van Hartesveldt 1998:71). Escavada Black-on-white is characterized by bold solid designs with no line elaborations or hatching (Hays-Gilpin and van Hartesveldt 1998:74). The lines are broad and parallel and "often form nested chevrons, running bands of pendant triangles and elaborate arrangements of interlocking triangles (Hays-Gilpin and van

Hartesveldt 1998:74). Puerco Black-on-white includes: "Negative lightning, dot filled squares, and bold triangles" (Hays-Gilpin and van Hartesveldt 1998:77). This style also differs from the other black-on-white types with the use of panel dividers such as parallel lines and checkerboard designs, which are bolder than Red Mesa's, implemented "to separate areas of solid elements" (Hays-Gilpin and van Hartesveldt 1998:77). Reserve Black-on-white is the latest black-on-white type found in the study sites. It consists of more diagonally hatched elements than solid elements that are opposed earlier in its use and interlocking in the later production period (Hays-Gilpin and van Hartesveldt 1998:81).

Table 1. Production Dates of Painted Ceramics*

Type	Dates (A.D.)
Cibola White Ware	
Kiatuthlana Black-on-white	850-959
Red Mesa Black-on-white	900-1050
Gallup Black-on-white	1030-1125/50
Escavada Black-on-white	1000/30-1130
Puerco Black-on-white	1030-1150/1175
Reserve Black-on-white	1030-1175/1200
White Mountain Red Ware	
Puerco Black-on-red	1000-1175
Wingate Black-on-red	1050-1200
Wingate Polychrome	1125-1225

* Dates established through the combination of Hays-Gilpin and van Hartesveldt (1998) and Nauman (2007).

The black-on-red wares include Puerco, Wingate, and Wingate Polychrome (Table 1). Puerco Black-on-red is identical to Puerco Black-on-white except it is painted on a red slip. Wingate Black-on-red portrays the same design rules and patterns at Reserve Black-on-white applied over a red slip. Wingate Polychrome designs "are usually identical to those on Reserve Black-on-white and Wingate Black-on-red" except "usually simple, rectilinear lines or frets" in white are also present on the vessel's exterior (Hays-Gilpin and van Hartesveldt 1998:166).

Coding methods

Inspired by Longacre's analysis at Carter Ranch and Hill's at Broken K Pueblo, I decided to follow their general methods for coding painted design elements. I began by scanning roughly 10 bags of ceramics recovered from various middens at Cox Ranch Pueblo to familiarize myself with the range of designs present on the painted ceramic vessels. Longacre's research encompassed ceramics that were similar to those of the present project, though his assemblage largely dated to subsequent periods. For this reason, I was able to include many of the designs he coded for in my attribute list. I combined a few simplified versions of Longacre's relevant elements, based on my working definition of an element, and additional elements I observed during my initial preview, which resulted in the attribute list employed for this study. During data collection, 12 additional elements were recognized (elements 53-64) and added resulting in a total of 64 elements (Figure 6). Metric data was measured and recorded for all elements when possible, including circle and dot diameter (elements 2, 3, 8, 9, 12, 13, 15, 45, 57, 64), element height (elements 1, 5, 6, 31, 39, 44, 51), angle (elements 8-12), line width and spacing (elements 1, 7, 31, 32, 33, 39, 44, 48, 52, 53, 54).

All sherds from the tested middens (except Cox Ranch Midden 13, which was unavailable for analysis), the Cerro Pomo Great House, and Cox Ranch Pueblo's Great House

test units were incorporated in this study, including sherds of indeterminate type and those less than ½" as long as an identifiable element was present. Often sherds less than a ½" are omitted from studies; however their inclusion along with non-typed sherds allowed the largest possible data set for element based analyses. Painted ceramic vessels in the Southwest are often composed of multiple element designs. This was not always apparent when solely dealing with sherds, however if multiple elements were identifiable, each element was recorded independently.

Trash-filled rooms as well as rooms containing abandonment assemblages represent discontinued use of both the room and the artifacts inside which is, in essence, a midden-type room use. The Cox Ranch Pueblo Great House contains many trash-filled rooms and a few rooms with intact cultural deposits (Nauman 2007:57). The ceramics from Cerro Pomo's Great House represent abandonment assemblages with some minor trash-infilling. The excavated roomblocks at Cox Ranch Pueblo are not trash-filled and produced an insufficient sample for this study. Longacre's work indicated a high degree of similarity between roomblocks and their associated midden's design elements. This supports my sampling strategy which focuses on middens, trash-filled rooms, and the Great Houses (Longacre 1970:46).

The variable size of sherds means that design elements are often incomplete, making them difficult to code. If sherds from the same context refit and the mended element was clear, that element was recorded only once. If an element was incomplete (Figure 7 a-d) or eroded (Figure 7 c) to the point of being unclassifiable, it was either omitted from the study or, if appropriate recorded as element 33 along with its metric attributes to compare line thickness and spacing among and between areas.

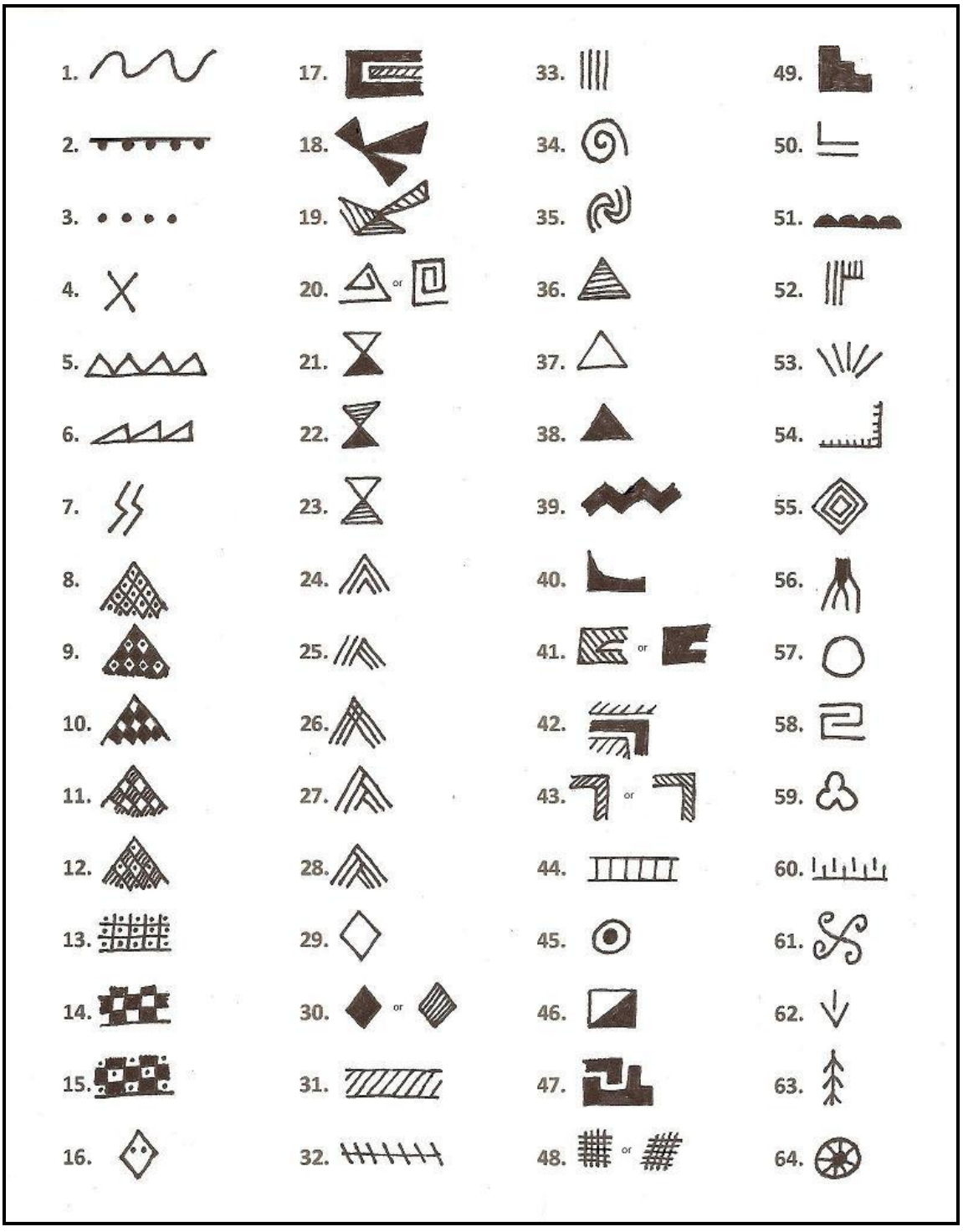

Figure 6. Element list with coding numbers.

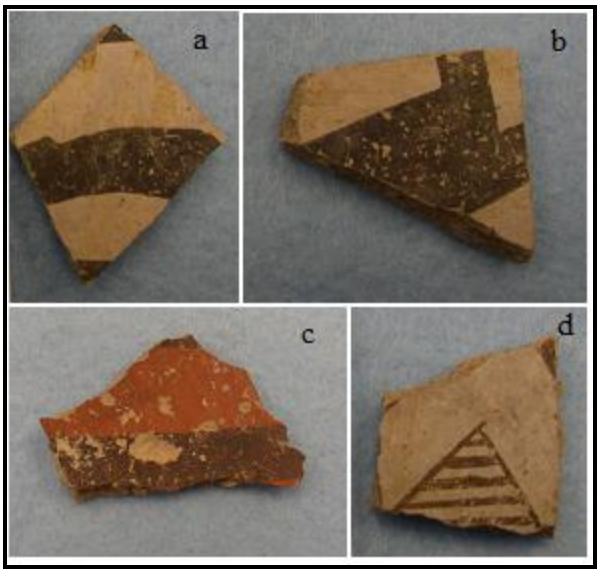

Figure 7. Examples of unrecorded and incomplete elements (Cox Ranch Midden 12 Unit 4 Level 3).

Elements were coded as present for each instance, and counts were recorded on data collection sheets with provenience information (e.g., their area, unit, level, ware, and vessel type; sample coding sheet is presented as Appendix A). Counts of each element were then entered into an Excel spreadsheet for further manipulation and for export to statistical packages. Unit and area data were collapsed into one count representing the entire unit or area without level differentiation. While this may mask some temporal signals, no difference was noticed in Nauman's (2007:96) study when midden units at Cox Ranch Pueblo were collapsed versus separated by depth to investigate temporal variation by area.

Statistical Analysis

All statistical analysis was conducted using STATA 9.2 and Statistica (Release 7). The majority of my data is nominal and kept as such for diversity tests of variation including richness, evenness, and heterogeneity, along with significance tests such as chi-square and Fisher's exact. Richness is the "number of classes present in a collection" (Kintigh 1989:26), and evenness measures "whether all species are equally abundant, or certain species are more

abundant than others" (Bobrowsky and Ball 1989:6). Diversity is a measure of "both richness and evenness under a single value" (Bobrowsky and Ball 1989:8) as expressed by the Shannon-Weaver Index (or Shannon-Weiner Index). Chi-square tests are performed using elements with counts greater than 5 in at least 75 percent of the cells included. To better understand the comparative results, cell contributions to the chi-square are assessed to determine which elements and areas contribute to the significant chi-square results. Raw counts and ware type are also utilized for correspondence analyses. The data are standardized by converting counts of elements to percentages when employing multivariate data agglomeration analyses, such as a Ward's cluster analysis. These methods were deemed valuable for this research and data type during a pilot study conducted during spring 2009.

Pilot Study

A pilot study was conducted to investigate patterning in painted element data collected from Cox Ranch Pueblo to assess initial trends. At the time of the pilot study, data from sherds from four tested middens at Cox Ranch Pueblo that were deemed "relatively contemporaneous" based on the presence and percentage of ceramic types were used (Nauman 2007:84). All excavated units from Middens 1 and 3, located in the southern portion of the site, and all units from Midden 15 and four of six units from Midden 12, both located in the north region of the site (refer to Figure 3), were analyzed, and yielded a total of 1,901 recorded elements. Both element counts and percentages, along with metric attributes were considered to determine if there were differences between areas of the site and if any differences were statistically significant.

The results from the pilot study were revealing. A Ward's cluster analysis based on Euclidean distances of element percentages aggregated by midden showed that Midden 3 and 12 clustered together with the highest level of similarity. I had anticipated that the middens would

cluster together by location (e.g., Midden 1 with 3, and 12 with 15); however the clustering of these two middens may represent something more than ceramic production groups. Midden 12 is associated with the Great House and Midden 3 with an unroofed Great Kiva-like structure appended to Roomblock 2. This suggested that the locations of ritual or social importance, and their higher levels of visibility, may have influenced the people creating the painted designs incorporated into these activities. This pattern is pursued further with data from all contexts at Cox Ranch Pueblo and with data from Cerro Pomo.

The results of chi-square tests performed on element counts by area indicated statistically significant differences between the northern (Middens 12 and 15) and southern middens (Middens 1 and 3) (refer to Figure 3 for map) at a 95 percent confidence level ($p \leq 0.05$). Seven elements were identified as significantly contributing to this result (elements 2, 6, 17, 24, 25, 42, and 44, see Figure 6), indicating that the northern and southern middens were distinct. The element distinctions suggested the people using those middens were possibly related to different learning groups or populations based on proximity. These results will be investigated further using the complete data set.

T-tests were then run on the recorded metric attributes of particular elements. These tests showed no significant statistical differences between areas. Based on their lack of patterning, and the fact that they were time consuming to record, these measurements are omitted from future data collection and analysis. Element 33 (Figure 8) represented parallel lines when no element was identifiable from the sherd and was solely incorporated into the metric analyses. For this reason, element 33 was also dropped from further data collection.

Figure 8. Example of element 33 (Cox Ranch Pueblo Midden 12, Unit 3, Level 4).

Another product of the pilot study was the identification of an element pattern present only in Middens 12 and 15. Patterns that were noted visually, but were not statistically testable due to limited occurrences, will continue to be investigated with the total data set. Based on the results of the pilot study, the statistical methods described above appeared suitable for this research and will be applied to the additional data collected and presented here.

The present study includes all available painted sherds from Cox Ranch middens and Great House (n=5442, Appendix B) and Cerro Pomo (n=1203, Appendix C). The total element counts of each site's different areas are presented below in Table 2.

Table 2. Total Element Counts by Site and Area

Cox Ranch		**Cerro Pomo**	
Midden 1	220	Site 961	52
Midden 3	244	Site 965	137
Midden 6	345	Site 967	68
Midden 7	175	Site 969	70
Midden 8	163	Great Kiva	3
Midden 10	94	Great House	398
Midden 11	188	Great House Midden 1	198
Midden 12	830	Great House Midden 2	277
Midden 15	396		
Great House	2787		

Elements 11, 22, and 23 were not present in the collections analyzed at either of the sites included in this study. Analysis of the total study data set follows.

Cox Ranch Pueblo

Cox Ranch Pueblo produced the majority of painted sherds included in this project. The data set analyzed from Cox Ranch Pueblo's middens and the Great House will be the focus of this section. Interpretations based on patterns observed in the record stem from the statistical and visual analyses presented here.

Analysis

Though occupation at Cox Ranch Pueblo is fairly contemporaneous based on limited tree ring and more extensive ceramic seriation dating, the occupation dates span almost 100 years suggesting that multiple generations inhabited Cox Ranch Pueblo. Based on the literature presented above and the behavior expected of people living in this environment, temporal and spatial differences may manifest in the painted design elements present on the ceramics.

The first calculations to determine anomalies and outliers in design elements are the diversity measures of richness and diversity (Table 3). Richness is determined by dividing the number of elements present by the total number of elements recorded at Cox Ranch. Diversity is measured using the Shannon-Weaver (or Shannon-Weiner) Index (henceforth referred to as $\bar{H}$) expressed by Kaufman (1998:76) as:

$$H = -\sum \frac{x_i}{N} \ln \frac{x_i}{N}$$

In this equation, *x* indicates the number of artifact classes, *N* indicates the total sample size, and $\bar{H}$ is the resulting diversity (Kaufman 1998:76).

Table 3. Cox Ranch Pueblo Richness and Diversity by Area

Cox Ranch Pueblo					
Area	Elements Present in Area	Total Present at Site	Richness	Total Analyzed	$\bar{H}$
M1	33	59	0.56	220	5.17
M3	33	59	0.56	244	5.34
M6	26	59	0.44	345	5.71
M7	23	59	0.39	175	5.02
M8	23	59	0.39	163	5.01
M10	17	59	0.29	94	4.45
M11	23	59	0.39	188	5.09
M12	46	59	0.78	830	6.56
M15	35	59	0.59	396	5.81
GH	50	59	0.85	2787	7.77

If Cox Ranch was self-contained or represents one population living contemporaneously experiencing the same social and cultural influences, I expect the richness and degree of diversity to be fairly even throughout the roomblock middens. If the Great House was solely for residential use or a location for storage, I expect the $\bar{H}$ values to be similar to the roomblock middens. Determining the richness of each area and the diversity will indicate if all areas were choosing the same number of design elements and, if not, which areas deviated from the norm.

A total of 59 discrete elements are present in the available ceramic data from Cox Ranch Pueblo. This total does not include elements 11, 21, 22, or 23 which are not present in the sampled areas of the site. A linear regression of area richness on sample size is graphed with a 95 percent confidence interval to identify areas with unexpected richness (Figure 9). As the population or number of elements recorded increases, the species richness is expected to increase until all possible species (elements) are included. The r^2-value of 0.62 ($p<0.01$) indicates that a linear relationship does exist. Figure 9 shows that Middens 10 and 12 were the furthest outliers; however the linear relationship seen in Figure 9 is likely the result of the Great House affecting

the regression line. Midden 10 contains a smaller variety of element types than expected for the total elements analyzed and Midden 12 possesses more. Midden 12's assemblage also includes unique elements (12, 55, and 56) and is associated with the Great House, which contains unique elements 16, 18, and 58-64. The multiple unique elements in these areas may be a result of the activities contributing to the Great House deposits. Midden 1 (element 46), and Midden 3 (element 50) also each contain one unique element.

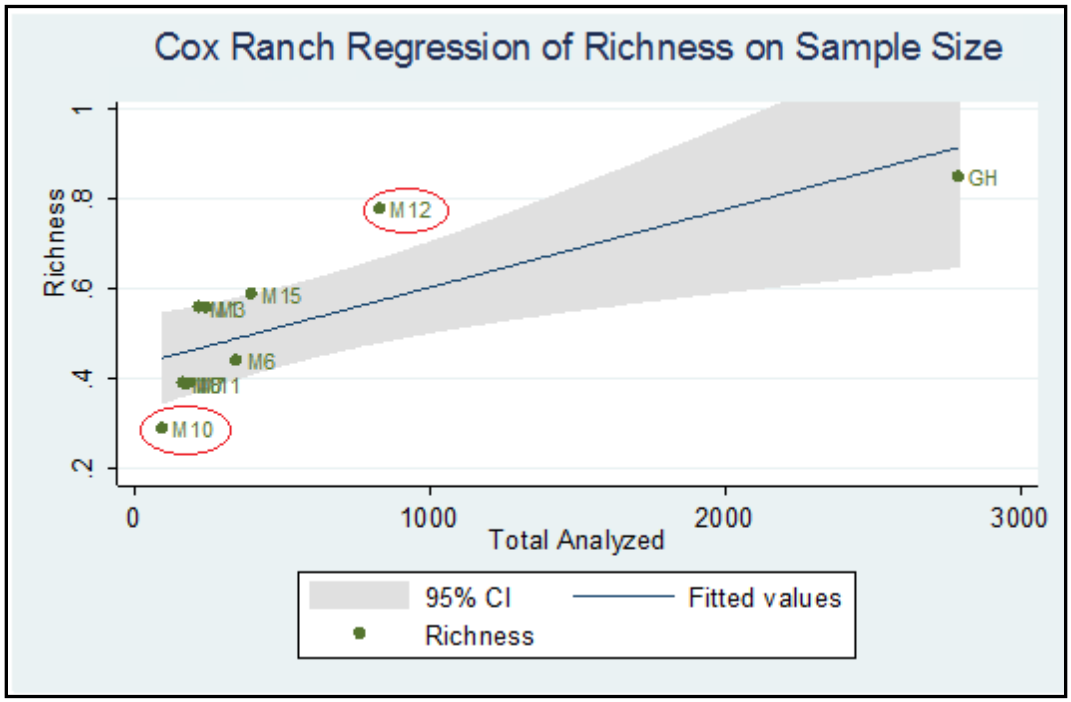

Figure 9. Cox Ranch Pueblo Area richness and r-squared line (r^2=0.62, p<0.01).

The residential middens cluster closely and the Great House is farther away indicating two different populations or activities are represented in the data. The Great House was probably a location that included more than everyday household activities when compared to those represented by the painted ceramics in roomblock middens. This variation in activity is likely the influencing factor resulting in additional and unique design elements applied to the ceramics found in trash-filled rooms of the Great House.

To determine diversity of the assemblages, the $\bar{H}$ was calculated for these same data (Table 3). The $\bar{H}$ measures heterogeneity incorporating both richness and evenness "to evaluate the effect of sample size" (Rothschild 1989:94). Most areas fall near the average diversity measure for the site. The average diversity for Cox Ranch Pueblo is $\bar{H}$=5.59. Only two areas are noticeably above the mean (Midden 12 and the Great House), however the Great House is the only real outlier. With a standard deviation of 0.95, it is 2.29 standard deviations above the mean. The Great House shows the highest degree of diversity followed by Midden 12 (Figure 10), the midden associated with the Great House, which itself is one standard deviation above the mean. These results further support the possibility of more public or specialized activities taking place at the Great House and its associated midden in the Cox Ranch Pueblo community, though the diversity is also likely a result of sample size.

Many of the Great House units are trash-filled (units 3, 4, 5, 6, 9, 12, 15, 16, and 17) and produce sample sizes roughly equivalent to the majority of the roomblock middens. The diversity of these individual units (Table 4) is calculated and graphed with linear regression of area $\bar{H}$ and Great House unit $\bar{H}$ on sample size with a 95 percent confidence interval (Figure 11). Aside from Midden 12, trash-filled Great House unit 16 shows the highest diversity in the community; though overall the diversity of the Great House units appears equivalent to the roomblock middens. This further confirms the use of the Great House as a location used by the whole community as well as the fact that the high diversity seen in the Great House assemblage is largely a result of sample size.

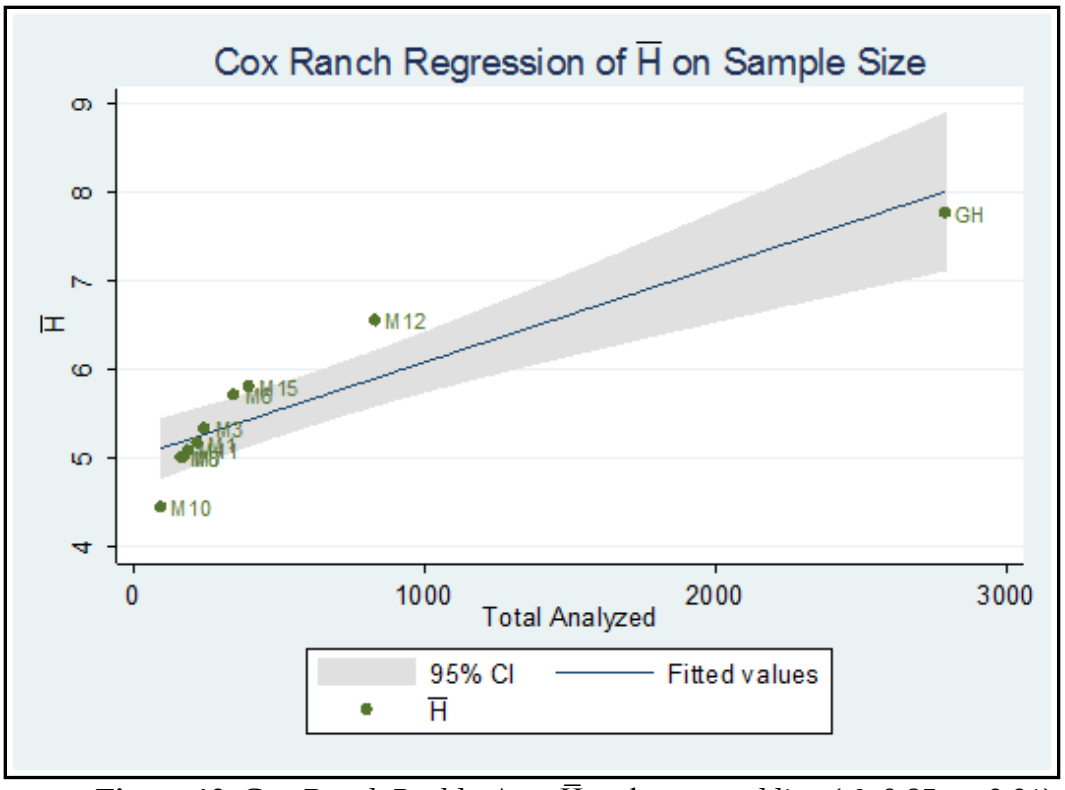

Figure 10. Cox Ranch Pueblo Area $\bar{H}$ and r-squared line (r^2=0.85, p<0.01).

Table 4. Cox Ranch Pueblo Great House Unit Diversity

Cox Ranch Pueblo		
Great House Unit	n=	$\bar{H}$=
3	87	4.20
4	259	5.42
5	230	5.32
6	281	5.51
7	124	4.61
8	188	5.09
9	179	5.04
10	88	4.39
11	51	3.84
12	155	4.85
13	215	5.22
14	27	3.16
15	309	5.57
16	429	5.84
17	165	4.95

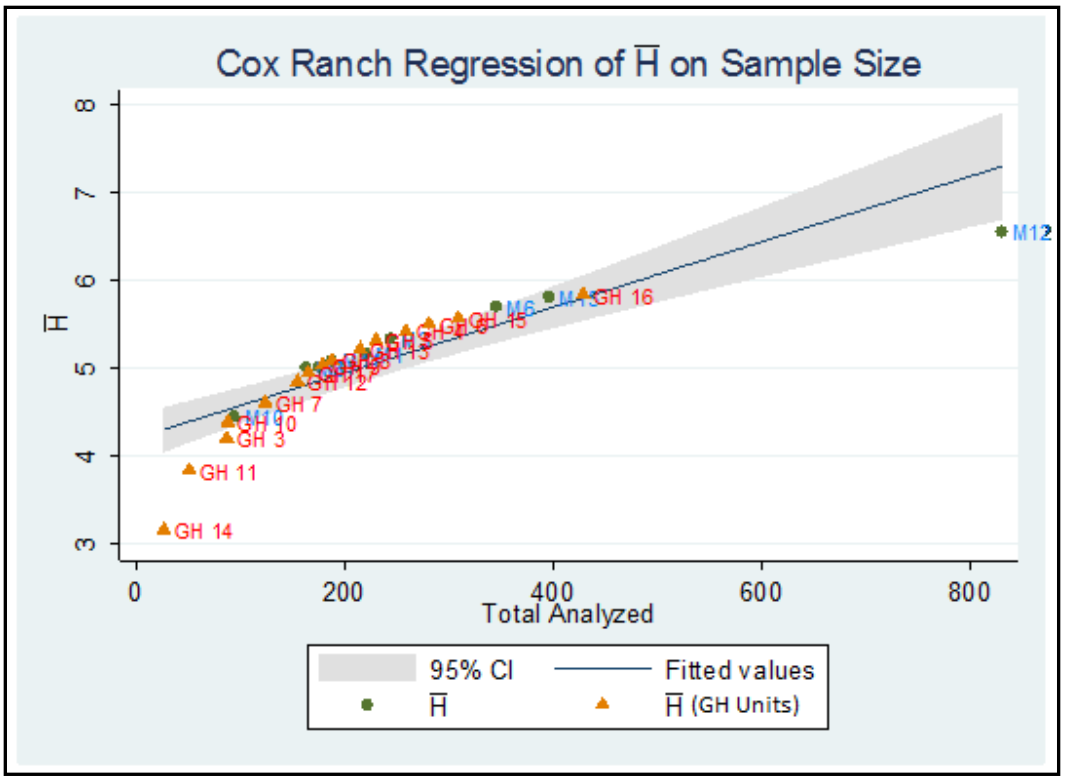

Figure 11. Cox Ranch Pueblo Area and Great House Unit $\bar{H}$ and r-squared line (r^2=0.74, p<0.01).

To test this hypothesis, another diversity test is conducted by combining all the residential middens and comparing their combined diversity to the diversity seen in the Great House to better equalize sample size. For this test, Middens 3 and 12 are excluded because the pilot study indicated possible differences of these contexts based on their association to public architecture. The residential middens combined produce a diversity value of $\bar{H}$=7.22, still lower than the Great House but comparable to the Great House diversity index of $\bar{H}$ =7.77 (the Great House $\bar{H}$ result is 7.772 with all Great House elements and 7.767 when elements unique to the Great House are omitted). I interpret this to mean that the Great House was used by the whole community and the painted ceramic assemblage is primarily a contribution of the entire Cox Ranch Pueblo community and possibly other roomblocks, middens, and/or sites not yet sampled.

The richness and diversity measures show that element choices are not uniform across the site of Cox Ranch Pueblo and are strongly influenced by sample size. Results of the diversity tests highlight the Great House's substantially higher level of element diversity which continues to be above the diversity level of all residential middens when they are combined. When these residential middens are combined however, the diversity level increases and becomes comparable to the Great House, indicating the Great House was used by the whole community. The trash-filled rooms in the Great House individually produce comparable scores to the roomblock middens supporting the interpretation that events producing these deposits inside the Great House were community-wide events. The fact that the Great House as a whole still contains a more diverse collection of elements than the combined roomblock middens also suggests some degree of conscious element choice pertaining to activities taking place in the Great House, even without the unique elements. Overall the diversity and richness measures indicate that the culture at Cox Ranch Pueblo does not strictly control element choice and that the Great House was an area of specialized use beyond a normal residential structure. This specialized use appears to have often involved the whole community. The finer inner workings of the tested areas and their relationships to each other are further clarified through multivariate cluster analyses.

Various cluster analysis algorithms (e.g., average-linkage, single-linkage, and Ward's) were applied to data aggregated by area of recovery and all results produced similar conclusions. I focus on Ward's cluster analysis based on a Euclidean distance matrix of element percentages to identify, discuss, and visually represent groupings. A cluster analysis that aggregates individual units is presented as Figure 12. This multivariate analysis produces three large groupings, which are separated by color. The red group consists of units primarily from Midden

10 and no units from M3, M6, M7, M12, or M15. The middle group indicated by green is a mixture of units from all Middens, but also has subgroupings of Great House units. The blue grouping contains most of Midden 1's units and another Great House cluster with no Midden 10 units.

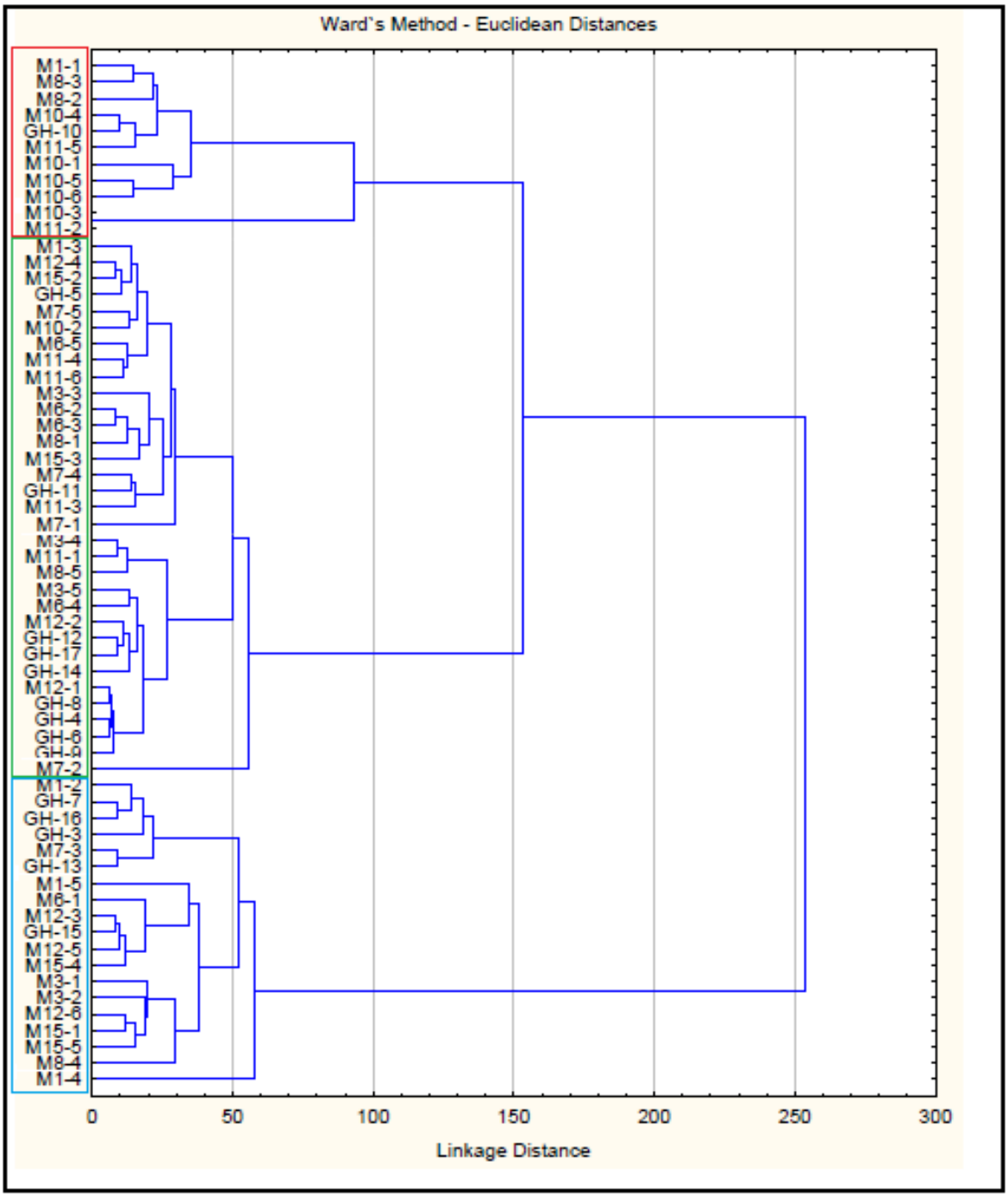

Figure 12. Cox Ranch Pueblo unit element percents.

These three major divisions may represent populations of potters which is observed through the tendency for units from a particular midden to cluster together. This indicates those who used the midden were an interacting population. These divisions may also indicate temporal signals of occupation representative of contemporaneity within the clusters. As will be discussed later, the red group is primarily early based on painted ceramic types, blue is late, and green is a mixture of the two. Since the Great House trash-filled rooms were a signal of later occupation and/or room abandonment, it makes sense that these collections are mostly represented by later wares and occupations.

Aggregating element totals by area (e.g., all of Midden 7, all of Midden 10, etc.), a clearer picture emerges regarding similarities between areas (Figure 13). Middens 8 and 10 were similar to each other but very different from the rest of Cox Ranch, as were Middens 6 and 11. Middens 1 and 15 did not pair with another individual area. Middens 3 and 12 cluster together and both represent the middens associated with public and possibly ritual architecture (Midden 12 with the Great House and Midden 3 with the possible Great Kiva).

The clusters and divisions may be explained through midden proximity as well as function. Middens 8 and 10 were located directly next to each other in the eastern portion of the site (Figure 14); Middens 6 and 11 were also located in the eastern region. It appears that people who were using Middens 8 and 10 interacted together, and people using Middens 6 and 11 also experienced a higher degree of interaction with each other, though less interaction existed between these midden pairs based on the results seen in Figure 13. Midden 3 is associated with a possible Great Kiva attached to Roomblock 2, and Midden 12 is likely the location of the Great House's refuse disposal. Both areas may have been locations of public ritual events, potentially explaining the similarities in painted design refuse.

The reason Middens 1 and 15 did not pair with other middens may be explained by their location. Middens 1 and Midden 15 were both on the periphery of the tested areas. Those using Midden 1 were more isolated from the rest of the site and probably incurred less interaction with the other residents. Midden 15 may be similar to middens located to the west that have not yet been tested. Midden 7 clustered with the Great House's trash-filled rooms and appeared to be representative of similar populations. While Midden 7 is the most similar to the Great House deposits as a whole, it is unlikely that one area was responsible for all the trash filling of the Great House rooms.

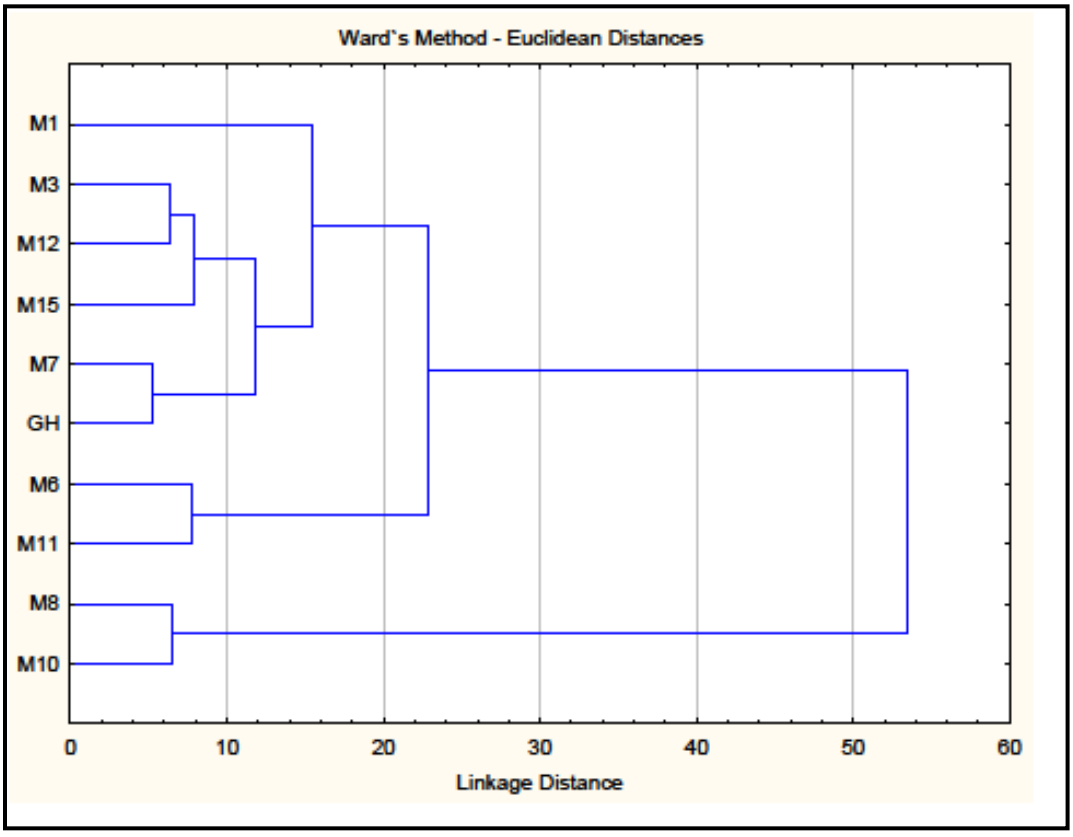

Figure 13. Cox Ranch Pueblo area element cluster analysis.

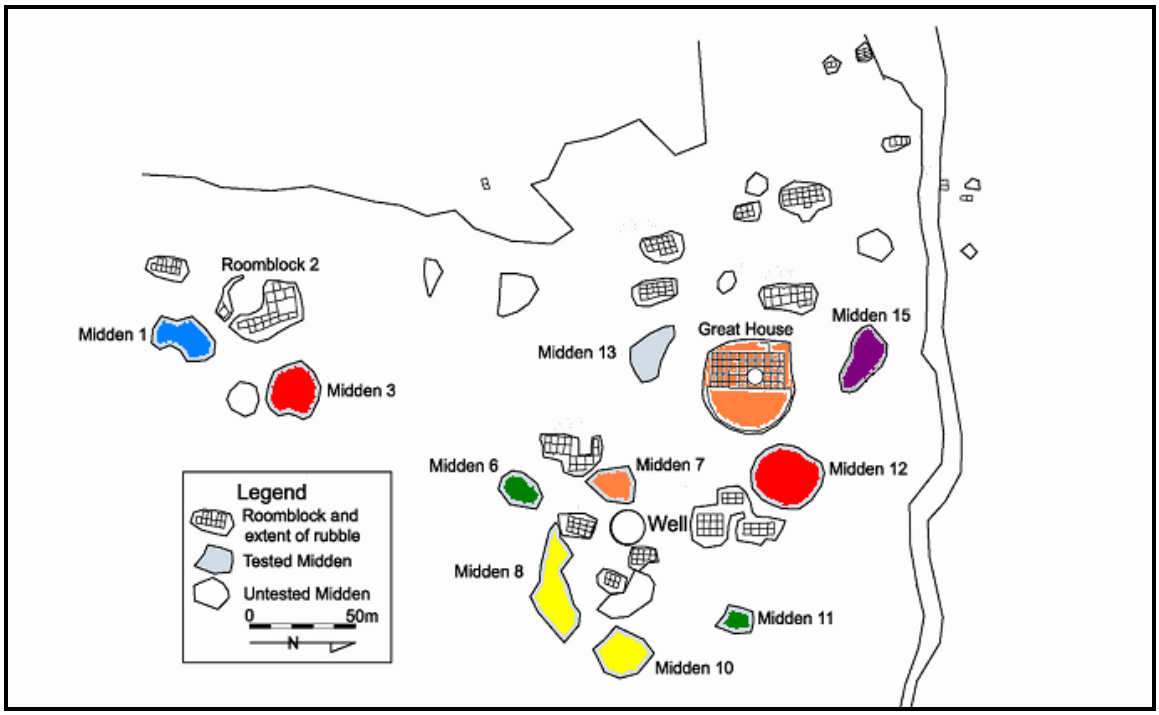

Figure 14. Cox Ranch Pueblo plan map with clusters indicated through color.

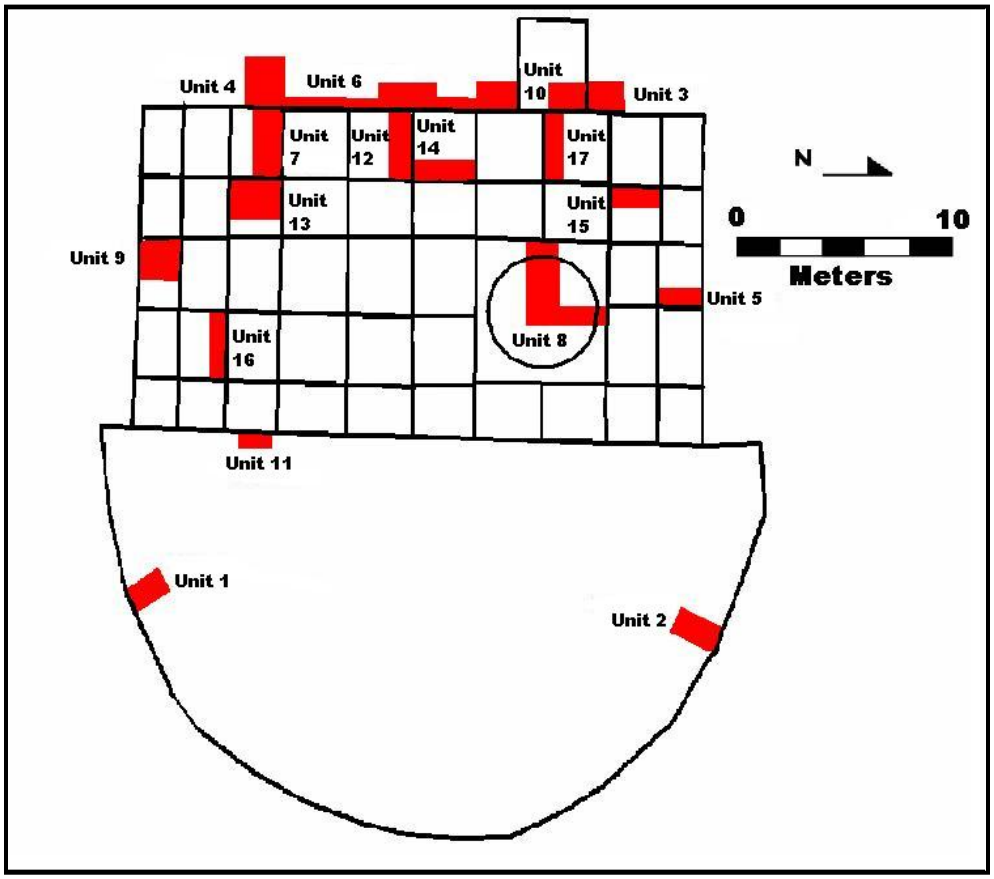

Figure 15. Plan of Cox Ranch Pueblo Great House, with excavation units shaded in red (Elkins 2007:55).

To determine which groups of people were disposing of trash inside the Great House (Figure 15), another cluster analysis was run using individual Great House units and aggregated midden data. I would not expect trash-filled rooms to only represent one area, especially if the Great House rooms contained refuse from public and/or ceremonial activities. This being said, four distinct clusters emerged, potentially indicating the areas clustering with the rooms were significant contributors to deposition in those rooms (Figure 16).

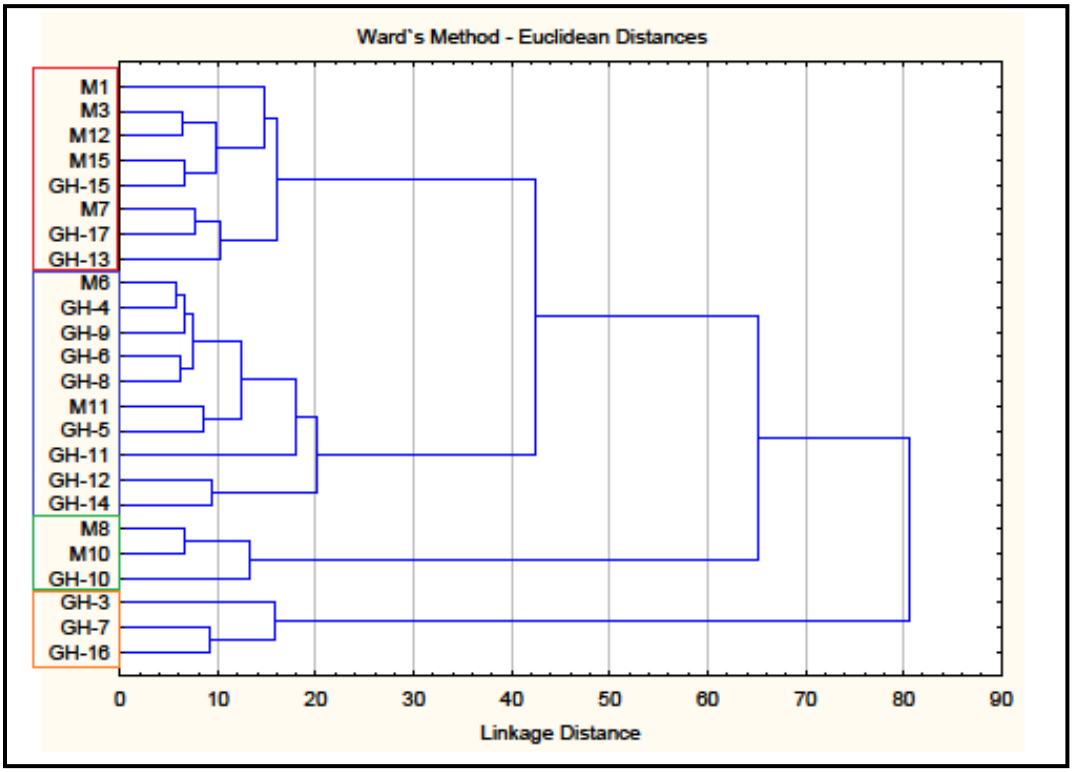

Figure 16. Cox Ranch Pueblo area element cluster analysis with Great House units.

The first group outlined in red contained Middens 1, 3, 7, 12, and 15 with Great House units 13, 15, and 17. Midden 15 is most similar to Great House unit 15 and Midden 7 to unit 17. The second group marked by blue contained Middens 6 and 11 with Great House units 4, 6, 8, 9, 11, 12, and 14. Midden 6 was extremely similar to Great House units 4, 9, 6, and 8. Midden 11

was most similar to Great House unit 5. The third green cluster was made up of Middens 8 and 10 along with Great House unit 10. These clusters may represent the families that hosted specific events and this may even represent who was important at Cox Ranch and when.

The fourth cluster was the most dissimilar and consists of three Great House units — unit 3 which was located on the back wall, 7 which was an open room, and a later trash-filled room16. Based on element percentages, these units appeared most similar because they contained the highest proportion of elements 6, 7, and 59.

Element 59 is one of the elements (elements 16, 18, 58-64) found only within the Great House. While unique elements occurred in a total of eight Great House units (units 3-9 and 12) in various excavated locations inside and adjacent to the Great House, they are rare. These elements did not occur enough times to be included in chi-square tests and are an example of visual analysis noting differences among the various areas. Another difference is seen in an element pattern previously mentioned and still only observed in Middens 12 and 15. This pattern involved element 25 or 27 flanked on either side by thicker solid chevrons (Figure 17). This pattern occurred four times in Midden 12 (Figure 17 top row) and three times in Midden 15 (Figure 17 bottom row). These two middens are located next to each other in the same area of the site and this pattern may have been transmitted through proximity-based interaction. Another explanation for this particular pattern's appearance in those two middens may be trade or Midden 15's population bringing vessels to the Great House.

Figure 17. Element pattern present in Cox Ranch Pueblo Middens 12 and 15.

Cox Ranch Pueblo Discussion

The analyses above exposed a few different trends seen at Cox Ranch Pueblo based solely on painted element designs. Midden 1 contained a distinct painted element assemblage and was also the area most detached from the rest of the site. The location of Midden 1 and those who disposed of refuse within it were likely more isolated from the rest of the population. The resulting lack of interaction during pottery production may account for this anomaly. Some areas within the site showed high degrees of similarity. These areas are also comparable in location and/or use. Middens 8 and 10 consistently grouped together and were located next to each other. This can be interpreted as a result of learning groups or proximity based interaction influencing design. Middens 6 and 11 were also very similar and, though not as close to each other, are located in the eastern portion of the site and associated with neighboring roomblocks. These similarities may represent related families or cooperative pottery production units. The fact that

Middens 3 and 12 were similar is interesting since these two middens were associated with forms of public architecture, the Great House and a possible Great Kiva, but are spatially separated.

Inside the Great House, individual rooms typically did not show higher diversity than roomblock middens, though when combined produced a slightly higher diversity than the whole of Cox Ranch. Deposits grouped with different populations (represented by site midden), which may be representative of shifting influences and authority or different populations hosting or sponsoring events inside the Great House. The Great House deposits also contained the highest proportion of unique elements, including element 16 — the only anthropomorphic design found in the samples included in this study (Figure 18). These rare and unique elements associated with the Great House suggest a deeper meaning than simply painted designs used for everyday functions by everyone throughout the site.

Figure 18. Anthropomorphic painted design from inside the Cox Ranch Pueblo Great House.

In sum, proximity-based interaction is not strongly represented or supported in the tested painted ceramics at Cox Ranch Pueblo. Some patterns in the ceramic data may be explained by this phenomenon, yet they cannot be attributed to it with any level of confidence at this time. A byproduct of this research involves the potential use of the Great House. The Great House seems to capture site-wide activities and some specialized element use, while the proximity-interaction hypothesis receives limited support. This is similar to Great House function as a location of periodic gatherings at Chaco Canyon with ceremonial and communal activities incorporating "special goods" (Cameron and Toll 2001:12),

Cerro Pomo

Cerro Pomo, the second community to be discussed, was fairly contemporaneous with Cox Ranch Pueblo, though it may have had a slightly earlier occupation based on the earlier ceramics found at various roomblocks throughout the area (Duff 2009). The sherd sample size was much smaller but, like Cox Ranch, it contained a Great House, Great House middens, residential sites, and their associated middens.

Analysis

The painted ceramics at Cerro Pomo and the four associated roomblock sites that have been tested incorporated 42 elements into their painted designs. Element 21 was the only element found at Cerro Pomo and not Cox Ranch Pueblo.

Area richness (Table 5) was converted into percent (n/42) and graphed as a regression on sample size with a 95 percent confidence interval excluding the Great Kiva (Figure 19). The Great Kiva sample is so small that it is excluded from all the subsequent analyses. All cases fall

within the confidence intervals suggesting a strong positive relationship between richness and sample size (r^2=0.83, p<0.01).

Table 5. Cerro Pomo Richness and Diversity by Area

Cerro Pomo					
Area	Elements Present in Area	Total Present at Site	Richness	Total Analyzed	$\bar{H}$
M 961	18	42	0.43	52	3.63
M 965	20	42	0.48	137	4.85
M 967	12	42	0.29	68	4.18
M 969	11	42	0.26	70	4.17
GH	37	42	0.88	398	5.85
M1	22	42	0.52	198	5.18
M2	22	42	0.52	277	5.54
GK	3	42	0.07	3	1.08

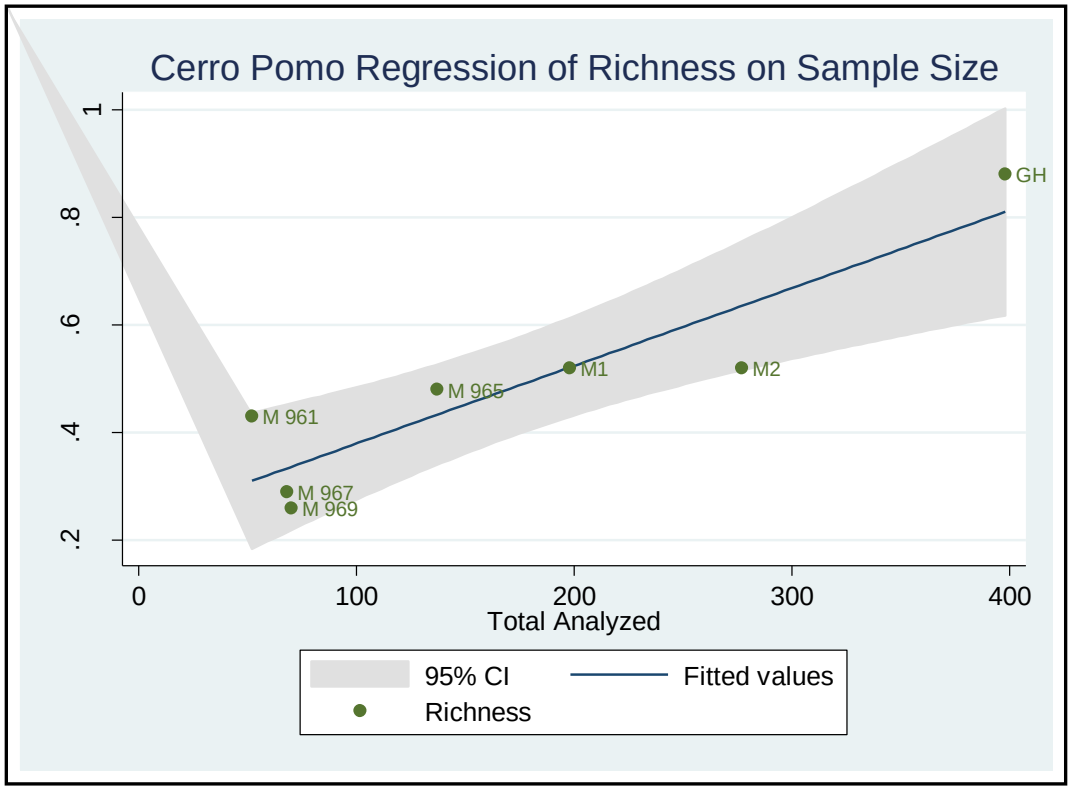

Figure 19. Cerro Pomo area richness and r-squared line without Great Kiva (r^2=0.83, p<0.01).

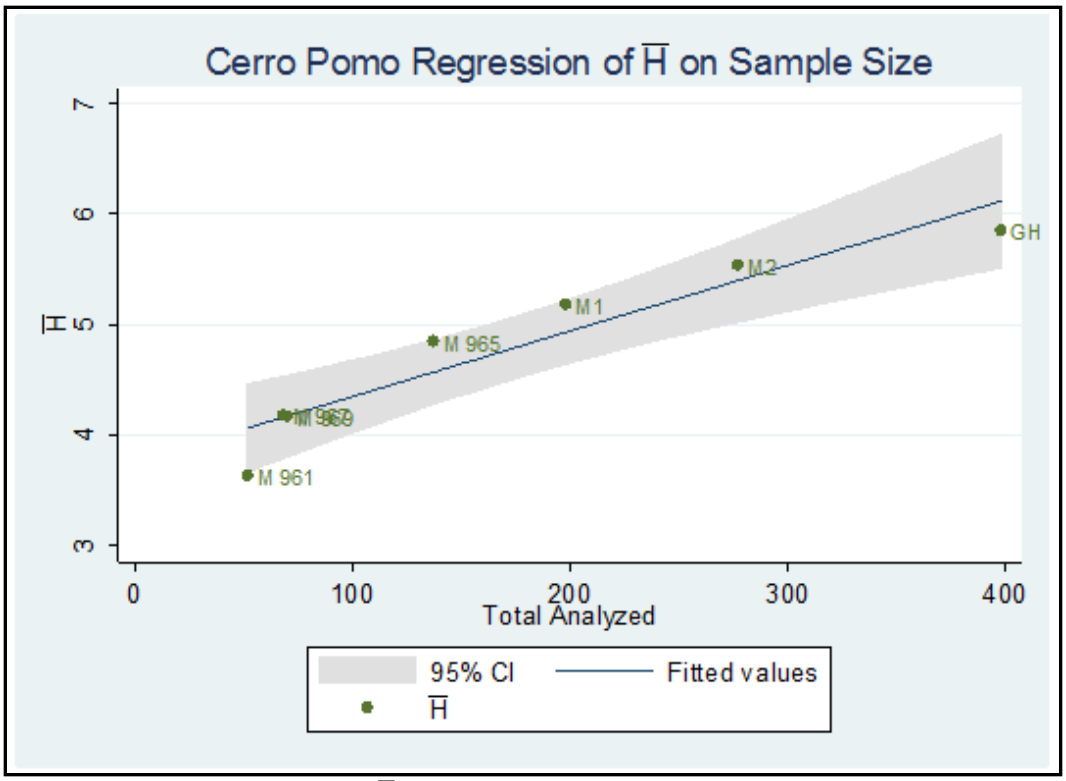

Figure 20. Cerro Pomo area $\bar{H}$ and r-squared line (r^2=0.89, p<0.01).

Cerro Pomo's average diversity is $\bar{H}$=4.77. Again, the Great House and its associated middens had the highest degree of diversity as well as the largest sample size, even though none of the Great House rooms were trash filled (Figure 20, Table 5). The Great House was the only outlier with a diversity of $\bar{H}$=5.85, which is 1.33 standard deviations of 0.81 above the mean ($\bar{H}$=5.81 without elements unique to the Great House). The Great House and the site of Cerro Pomo appeared to serve a different function than the residential sites associated with it. Sites 961, 965, 967, and 969 middens combined resulted in an $\bar{H}$=5.69 (without Site 961, $\bar{H}$=5.55) which is very close to the $\bar{H}$ of Middens 1, Midden 2, and the Great House individually. All Cerro Pomo deposits combined including the Great Kiva had an $\bar{H}$=6.66 (Middens 1 and 2 alone, $\bar{H}$=6.07 both with and without unique elements). This indicates that the site of Cerro Pomo and its Great House, like Cox Ranch Pueblo, was probably a location of gatherings for the

surrounding residential community and the majority of the ceramics found at Cerro Pomo were contributions from the whole Cerro Pomo community. With the addition of more tested residential sites in the future, the combined residential $\bar{H}$ may further increase this result and better support this interpretation.

While none of the Great House rooms were trash filled at Cerro Pomo, the Great House sample size was still larger than any midden, residential or not, which was likely influencing both the richness and diversity results. Individually (Table 6) the Great House rooms were less diverse than Site 965, Midden 1, and Midden 2 (Figure 21). This again confirms that the higher level of both richness and diversity calculated for the Great House was largely a result of sample size. Middens 1 and 2 had the highest richness and diversity of all the middens, and like Midden 12 at Cox Ranch, were associated with Great House use and activities, supporting the likelihood of some deeper meaning behind ceramic designs chosen for such activities.

Table 6. Cerro Pomo Great House Unit Diversity

Cerro Pomo		
Great House Unit	n=	$\bar{H}$=
1	38	3.52
2	64	4.05
3	20	2.85
4	19	2.84
5	14	2.54
6	21	2.94
8	8	1.99
9	38	3.51
10	49	3.75
11	6	1.78
12	23	2.95
13	98	4.42

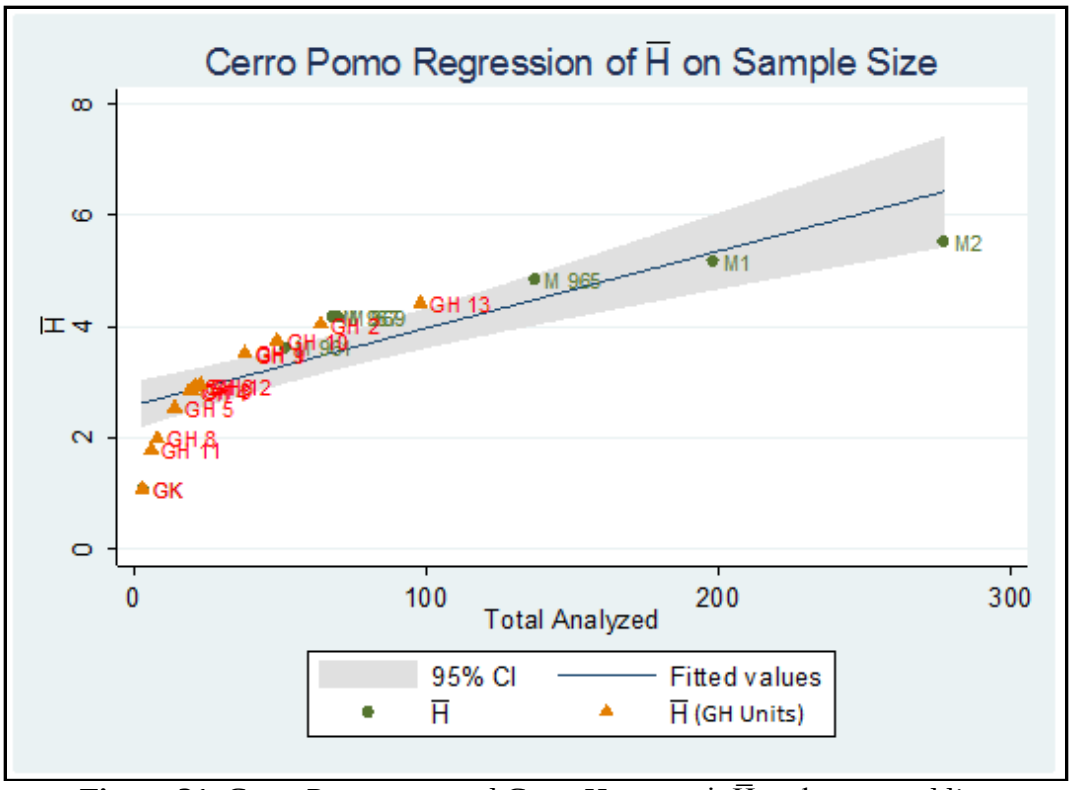

Figure 21. Cerro Pomo area and Great House unit $\bar{H}$ and r-squared line (r^2=0.73, p<0.01).

Before continuing on to compare areas based on their total elements, a cluster analysis of individual unit element percents was run to identify clustering. The results showed that units from the same area (e.g., midden) often clustered together, indicating that these areas and middens were probably representative of individual populations.

The dendrogram presented in Figure 22 shows a strong division into two groupings which are separated by color. The cluster outlined in purple contained most of the Great House units and all of Site 961. The orange cluster consisted of all Midden 2 and Site 967 units, as well as most of Midden 1 and Site 969 units. Site 965 is evenly divided between the two. These divisions may be a temporal signal showing that the Great House was still in use while Sites 967 and 969 were occupied. The people who used Middens 1 and 2 were either the same people as those living at these two sites, or a different population representing the same culture and

occupation dates. Site 965 may have had a later occupation which also coincided with the abandonment of the Great House. The Great House rooms cluster together, indicating that the abandonment assemblage was likely from the same population.

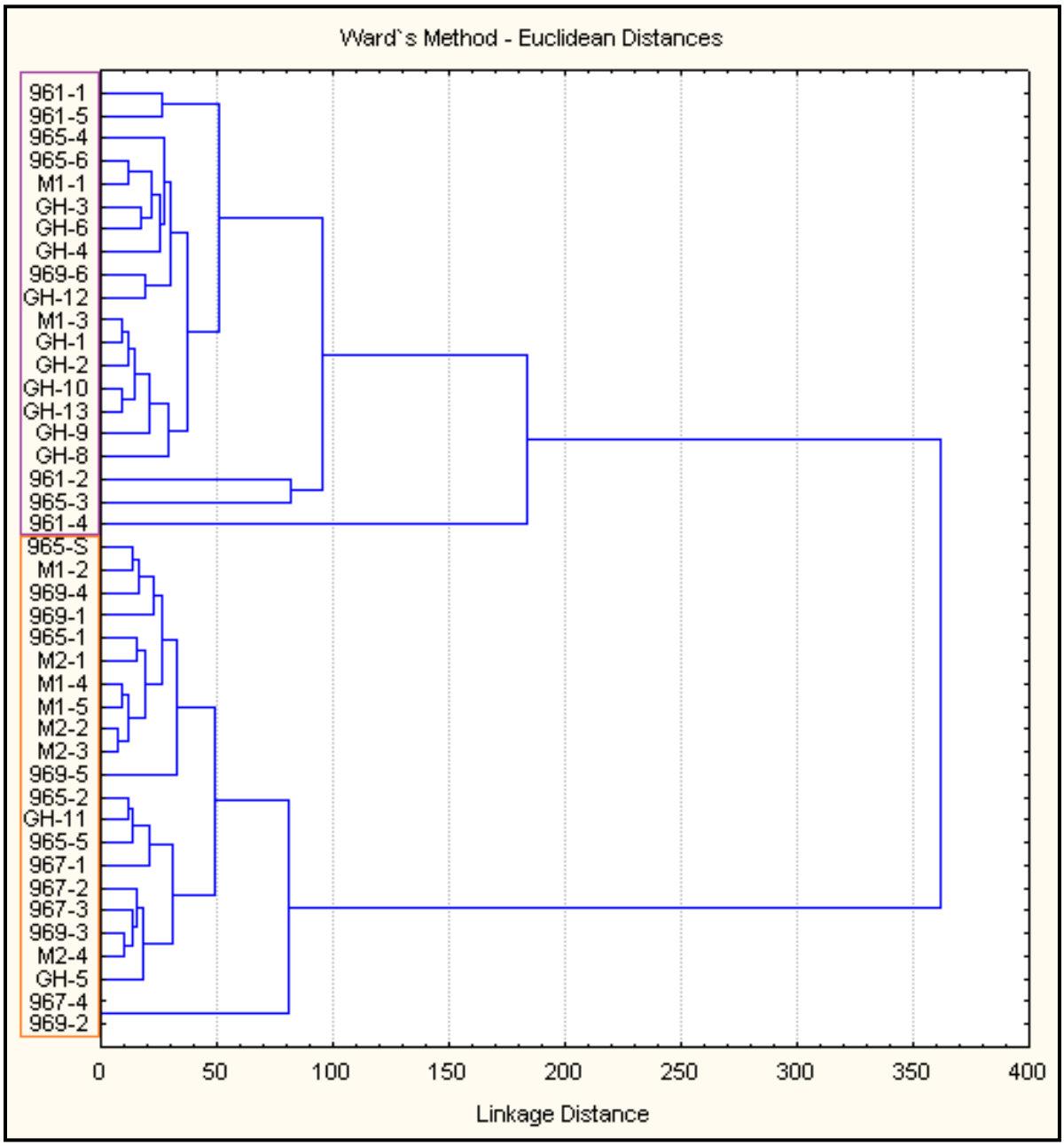

Figure 22. Cerro Pomo unit cluster analysis.

The tendency for the Great House rooms to cluster strongly together was also seen at Cox Ranch Pueblo. Another similarity among these contemporaneous Great Houses is the presence of unique elements and an anthropomorphic or realistic design element. One sherd from Cerro Pomo's Great House displayed a painted element that was reminiscent of the sun or a flower (Figure 23). The elements unique to Cerro Pomo's Great House are 19, 21, 28, 29, 30, 36, 37, 55, 57, and 58. The Great House middens also each contained one unique element; Midden 1 had element 60, and Midden 2 included element 54.

While the number of unique elements found within the Great House may be a result of sample size, this trend is seen in both Cox Ranch Pueblo and Cerro Pomo's Great Houses, suggesting a meaningful pattern rather than a coincidence or a result of sample size. Site 967 included one unique element, element 15. The presence of unique elements in various areas may occur from innovation or adoption from interaction with a different community, such as with Cox Ranch Pueblo. The high proportion of unique elements found inside the Great House suggests that this assemblage and its deposit location are distinct.

Figure 23. Unique painted design from inside the Cerro Pomo Great House.

A Ward's cluster analysis based on Euclidean distances using element percents aggregated by site for Cerro Pomo and the tested roomblock sites provides a general sense of similarity. The Great Kiva, the Great House, Middens 1 and 2 were combined for this test. While other cluster analyses were performed (e.g., single-linkage and average-linkage) the clustering results did not change. Results showed Sites 965 and 969 clustering together with the lowest level of dissimilarity followed by Site 967 and then grouping with all of the Cerro Pomo contexts. Sites 965 and 967 are located within 100 meters of each other, which may have contributed to the similarity of design choices. Site 961 was the most dissimilar, likely a result of occupation dates discussed further below.

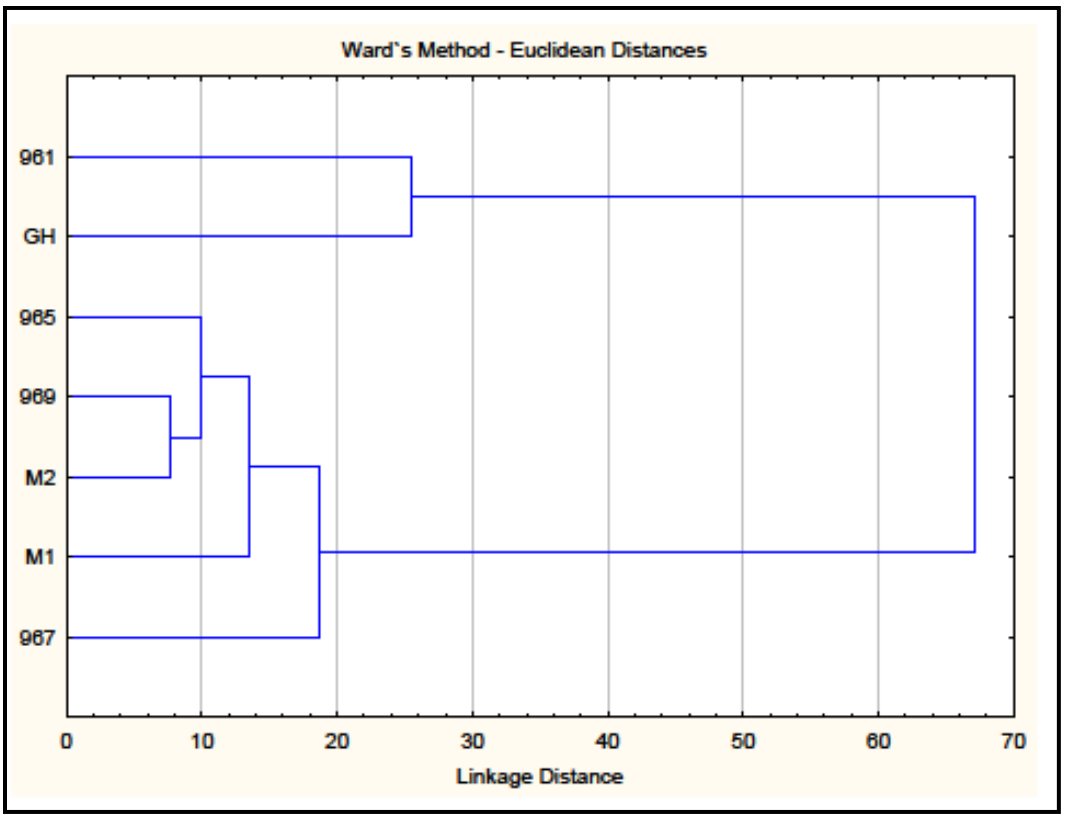

Figure 24. Cerro Pomo area element cluster analysis (no Great kiva).

Another cluster analysis with Cerro Pomo contexts separated revealed two groupings. In one of the groupings, the Great House elements were most similar to site 961 (Figure 24) though this may be a result of both areas individuality more than similarity to one another. Besides Site 961, the Great House was very different from the other areas and sites of Cerro Pomo as seen in Figure 24. The Great House had high proportions of elements 6, 7, 25, and 35. Cerro Pomo Great House Middens 1and 2 differ substantially from the Great House assemblage. Sites 965, 967, and 969 appear to be among the populations filling the Great House middens with ceramics similar to those used at these residential sites, while the Great House abandonment assemblage designs differ. This may indicate the Great House's earlier use was more of a residential location or a gathering place for those from Sites 965, 967, and 969. This also shows that the Cerro Pomo community extended to at least site 969, which was the tested roomblock site furthest from the site of Cerro Pomo. The abandonment assemblage may have accumulated over years of revisiting the area for ceremonial activities associated with the Cerro Pomo cinder cone after the residential sites were abandoned or it may also represent a special assemblage left behind to mark the closing of the Great House either inside or on the roof, which later collapsed.

Cerro Pomo Discussion

The site 965, 967, and 969 assemblages indicated generally similar painted design choices. Middens from these sites are also very similar to the Great House Middens from Cerro Pomo, suggesting that the people using or residing at the Great House and the people living at Sites 965, 967, and 969 were an integrated population, even though site 969 was located some distance from the rest. This suggests either high degrees of interaction among these areas, co-use of the Great House with resulting deposition, or an open Great House used largely by the peoples

of Sites 965, 967, and 969. The last theory is best supported by the $\bar{H}$ when the residential middens are combined and compared to the site of Cerro Pomo.

Midden 1 was most similar to Site 969 and Midden 2 to Site 967. These results may indicate residential areas primarily using specific middens or temporal change when coupled with precise site occupation dates. However, the patterning of other community sites located elsewhere is unknown at this time as they have not been sampled.

The Great House itself contained a painted ceramic assemblage strongly representative of a single population as well as the highest proportion of unique elements found at Cerro Pomo, indicating a more specialized use and/or abandonment assemblage. The sherds recovered from the Great House cluster closest to Site 961, however its contribution to the Great House abandonment assemblage is unlikely when coupled with temporal data. It is possible that Site 961 was occupied by a different population at a different time, which is supported by seriation-based temporal inferences which will be further discussed below.

Results from the above analyses show patterning of painted design choices in the Cerro Pomo archaeological record. While this study did not confirm interaction-based element choices, it did not disprove the presence of potting groups influencing design choices. The results produced data allowing further insight into prehistoric occupation, behavior, and social organization. The site of Cerro Pomo and the residential sites on its periphery may not have been perfectly contemporaneous or locations of continuous occupation during the approximate dates associated with these sites. The variations in elements within the Great House suggest an intended social function behind their use, especially inside the Great House near the time of abandonment. This potential use of the Great Houses as locations of specialized activities in these two communities was strengthened through the unique elements also found inside the Cox

Ranch Pueblo Great House. To gain a better understanding of these two communities painted design similarities and differences, as well as their degree of interaction with one another, they will next be compared.

Cox Ranch and Cerro Pomo

The Cox Ranch Pueblo and Cerro Pomo assemblages each possessed patterning in the painted design elements that can be interpreted as a result of interaction. The overall contemporaneity of occupation at the two sites combined with their location, similarities in architecture, and importance of the Cerro Pomo cinder cone in relation to the solstices for both sites suggests the sites were more than just neighbors. Interaction between these two sites is a strong possibility seeing as they are nearest neighbors, and neither alone was likely a demographically viable entity. Whether the interaction is manifest in the archaeological record, specifically the painted wares, is what will now be investigated.

Inter-Site Analysis

A chi-square test of design element totals for both Cox Ranch Pueblo and Cerro Pomo produced results indicating that they are statistically dissimilar (x^2=128.91; df=39; $p<0.01$) implying these two sites are not one population, though many cells with a count less than 5 were included which may influence the results (elements and counts in Appendix F, 23.8 percent of cells under 5). Cerro Pomo Site 961 has proven itself very different from the others, however even when it is removed from the chi-square analysis (Appendix G) the populations are still statistically distinct (x^2=124.56; df=39; $p<0.01$). While these two populations are different, the multivariate analysis depicted in Figure 25 shows some areas between the communities cluster together.

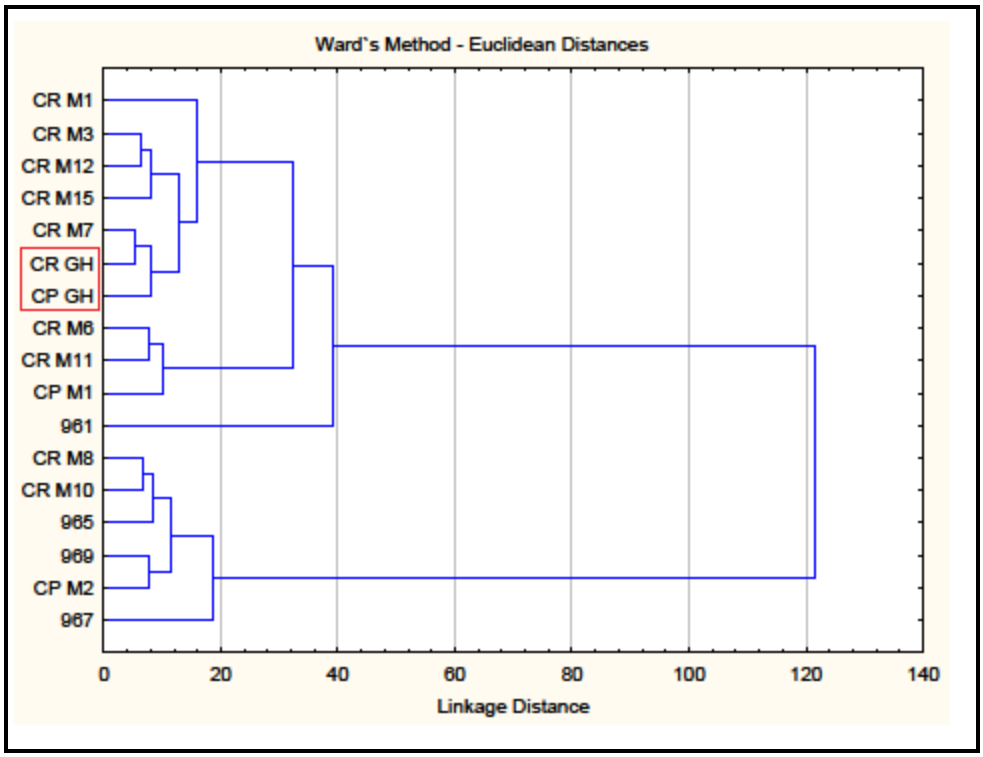

Figure 25. Cluster analysis of Cox Ranch Pueblo and Cerro Pomo area element percents.

The Great Houses are similar and outlined in red indicating that both Great Houses were used and viewed in a similar way and the ceramics deposited in these contexts represent similar activities and choices. Unique elements were present in different areas within the sites, but the Great Houses contained substantially more than any other area. Cox Ranch's Great House had a total of 9 unique elements and Cerro Pomo's had 10. The only element unique to both Great Houses was element 58. Many of the elements unique to Cerro Pomo's Great House were found in multiple areas of Cox Ranch Pueblo. Elements 19, 28, 29, 30, 36, and 57 were found in roomblock middens at Cox Ranch, but only inside the Great House at Cerro Pomo. This may represent incidents of trade or social interaction between the two sites. The Cox Ranch population might have brought over vessels with these designs to a gathering at Cerro Pomo's Great House or Cerro Pomo's population may have seen the design at Cox Ranch Pueblo and incorporated it into their design repertoire. A similar explanation might be true for elements 15

and 54, which were again unique to a specific area at Cerro Pomo, but were present in multiple areas at Cox Ranch Pueblo.

Unique elements and examples of innovation are often omitted from analyses because of their rarity and inability to be included in some statistical testing. These isolated events however tell us more about the behavior and thought processes of the people than common or abundant events. These sites represented similar cultures and the greater the cultural pressure to conform, the less likely innovation was to occur. To determine if and when cultural pressure was acting on these communities throughout the century or so of occupation, it is important to look closer at trends over time.

Based on years of research in the Southwest, ceramic types have been accurately dated enabling inter- and intra-site temporal comparisons of ceramic types and elements. For the following tests early types include Kiatuthlana Black-on-white, Red Mesa Black-on-white, Gallup Black-on-white, Escavada Black-on-white, Puerco Black-on-white, and Puerco Black-on-red. Late types are Reserve Black-on-white, Wingate Black-on-red, and Wingate Polychrome. Elements included in this research project that were unable to be assigned a specific type were excluded from this portion of the study. The results are expressed in Table 7 below.

The design element sample suggests that many areas were equally represented by early and late types, while a few areas were dominated by earlier or the later types, indicating varying use and occupation periods. The Cox Ranch Great House, Midden 6, Midden 7, and Midden 8 contain a high proportion of later types. The same may also be said for Midden 11. Cerro Pomo's Great House along with the Great House Middens 1 and 2 also reveal later use. Cerro Pomo Midden 2 contains a higher percentage of later types which suggests it may have been a secondary refuse location after Midden 1 was exhausted. Site 969 contains a higher proportion of

late wares though not as drastic as the other areas. Site 961 contained considerably more early wares than later types; this is likely the reason it was so different compared to all other areas of Cerro Pomo and Cox Ranch in some of the previous analyses. The fact that Cox Ranch Midden 1 was not significantly earlier or later than other areas of Cox Ranch strengthens the argument that its peculiarity was a result of location and level of interaction, not its occupation period.

Table 7. Early and Late Wares by Area

CR	% early	% late	CP	% early	% late
GH	28.03	71.97	**961**	**95.45**	**4.55**
M1	41.67	58.33	965	50.00	50.00
M10	56.90	43.10	967	57.89	42.11
M11	36.36	63.64	969	38.89	61.11
M12	55.52	44.48	GH	32.08	67.92
M15	42.09	57.91	GK	66.67	33.33
M3	42.46	57.54	M1	37.76	62.24
M6	23.76	76.24	M2	21.05	78.95
M7	13.76	86.24			
M8	25.00	75.00			

Since a majority of the areas at both Cox Ranch and Cerro Pomo appear to produce later designs on painted ceramics, one would think that the later wares would account for the lack of statistical similarity between the two populations. A correspondence analysis of areas and elements using the early/late delineation however showed this was not the case (Appendices D and E). In fact it appears that earlier painted wares (Kiatuthlana Black-on-white, Red Mesa Black-on-white, Gallup Black-on-white, Escavada Black-on-white, Puerco Black-on-white, and Puerco Black-on-red) were very different and later wares (Reserve Black-on-white, Wingate Black-on-red, and Wingate Polychrome) were very similar based on element frequency (Figure 26). These later ceramics clustered tightly with specific elements and the earlier were more

widely distributed when the site element totals were collapsed into early and late by site. In this correspondence analysis, dimensions 1 and 2 explain 97.89% of Inertia (Dimension 1=90.67%, Dimension 2=7.218%).

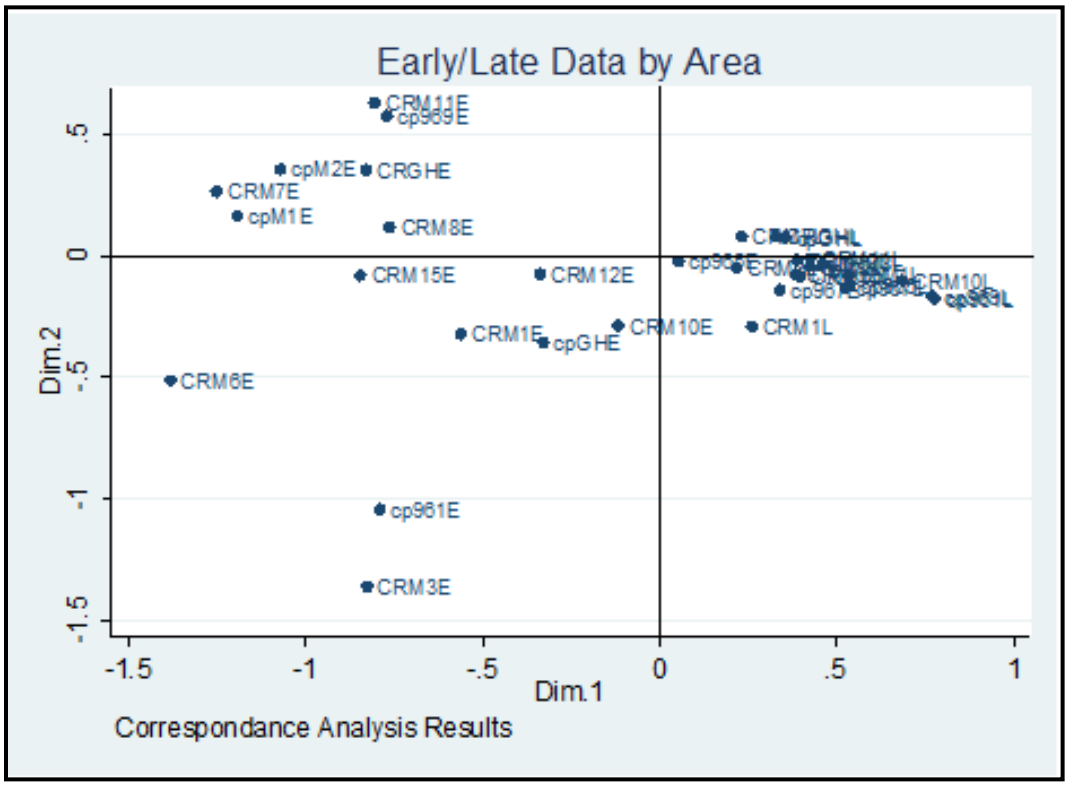

Figure 26. Correspondence Analysis of early and late wares by element and area.
(Key: CR = Cox Ranch, CP= Cerro Pomo, E= early, L=Late;
e.g, CRM7E= Cox Ranch Midden 7 early, cpGHL= Cerro Pomo Great House late)

Cox Ranch and Cerro Pomo's later painted designs showed increased similarity over time, clustering closely with elements 25, 31, and 43 (Figure 27). These elements were very common in the later wares though not exclusive to them. For example, Gallup frequently included both elements 25 and 31. The fact that designs became incredibly standardized later in these sites' occupations indicates greater regional homogeneity, which could result from two possible influences. This pattern may be a result of increased interaction during later occupation dates. Increased interaction has been known to influence those involved, and an abrupt shift to

such standardized or similar designs would be one visible result. Another possibility is the presence of an outside force acting upon both populations pressuring them to produce more formalized and homogenous painted designs on these later wares.

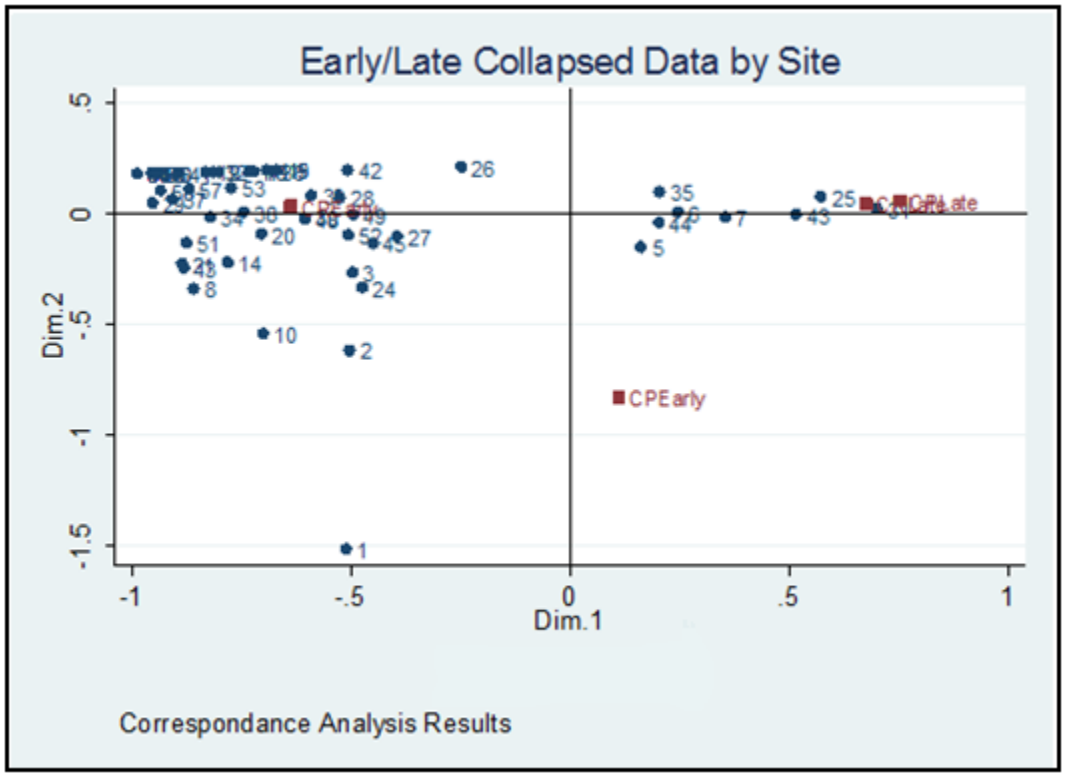

Figure 27. Correspondence Analysis of early and late areas and elements.

Inter-Site Analysis Discussion

Cox Ranch and Cerro Pomo were not one single population occupying the contemporaneous sites separated by 8 km. The Great Houses in both areas suggest similarities in use, something also evident based on the number of unique element types present in each. The unique elements were likely a reflection of specialized intra- and possible inter-community activities taking place in those structures. Many of these unique elements were present on the earlier ceramic wares. Elements 60, 61, 63, and 64 were unique Great House elements at Cox

Ranch painted on early wares before ceramic design became more standardized. The lack of unique elements on Reserve and Wingate ceramic designs may be due to the homogenization of painted designs later in occupation.

A few elements appeared early at one site and later at the other (based on ceramic type), which is another piece of evidence supporting interaction-based stylistic influence. Element 15 was present on early Cox Ranch vessels and later in both Cox Ranch and Cerro Pomo vessels. The same is true for elements 19 and 36. Element 55 was present on early Cox Ranch painted ceramics and made its appearance at Cerro Pomo on a later type. Element 58 showed the stylistic influence worked both ways through its presence on an early Cerro Pomo ceramic and a later Cox Ranch painted ceramic.

Interaction did appear to considerably increase during later periods of occupation based on the observed standardization of painted designs on later types. Most areas within these sites appeared to represent both early and late, or primarily late occupations. Site 961 of the Cerro Pomo community was the major exception, as it contained almost exclusively earlier types. The earlier occupation of Site 961 was likely the controlling factor in its vast dissimilarity to the other areas of both Cox Ranch and Cerro Pomo.

In conclusion, Cox Ranch and Cerro Pomo were two different populations that changed over time. Painted designs applied to the earlier ceramics favored different elements. As time went on, something changed and their later painted designs became extremely similar. The cause for this change is only speculative at this time; however it may be credited to increased interaction or an increased pressure to conform. This pressure may relate to a stronger macro-regional identity and possibly transmission of messages of identity linked to Chaco Canyon during the later occupation periods.

Discussion

Cox Ranch Pueblo and Cerro Pomo consisted of different populations based on settlement pattern as seen through their painted design elements. These populations appear to have been most similar to other populations in the same community, and at times in the same general area of that community. The multiple populations and population groupings may represent occupation periods or production/learning groups. Exceptions to this trend are middens and assemblages associated with public architecture or areas with recognizably different occupation periods.

Within Cox Ranch Pueblo, each excavated midden included in this study appears to represent one population, likely an extended family over time. Middens in the eastern portion of the site cluster together based on element percents, indicating that those living in close proximity may have in fact influenced each other's design choices. The proximity or general area of Middens 8 and 10 along with their roomblocks supports the proximity-based interaction hypothesis of this research. Middens 3 and 12 at Cox Ranch Pueblo are similar, but are not located near each other. These two middens are associated with public architecture and the assemblages from these public activities are similar. Midden 1 and Midden 15 do not cluster with any other midden or area within Cox Ranch. Their occupation and use period based on ceramic types does not explain their difference, indicating that their location is more likely a factor. Both middens are located on the periphery of the tested areas. However, Midden 15 appears to be similar to Midden 12, which is located close by to the southeast (see Figure 3 above). Both middens contain an element pattern not found definitively anywhere else in the site (see Figure 17). Their proximity to each other may have influenced their use of this element combination.

The Cox Ranch Pueblo Great House was not only unique in size and architecture, but also in use and designs found on discarded vessels. This implies a meaning behind their use, not

merely the vessel contents. The presence of multiple unique elements also strongly suggests the importance of these elements in the activities taking place within the Great House. Units within the Great House cluster together and may have resulted from isolated-event deposits or deposits from similar times. At Cox Ranch, specific Great House units are statistically similar to certain roomblock middens, which may have been the result of different populations hosting or bringing food to the activities at the Great House (refer to Figure 16). Specialized activities taking place in or around the Great House is also supported by the abundance of ritual faunal remains as compared to other areas of Cox Ranch Pueblo (Mueller 2006).

Ethnographically identified ritual fauna present at Cox Ranch Pueblo include various avian and mammalian species (Mueller 2006:128). Of these species, over 90 percent of the ritual avian fauna and over 85 percent of the ritual carnivore fauna were found in the Great House and Midden 12 (Mueller 2006:128). The combined Great House contexts were very different from the residential middens, which each only contained a single ritual fauna species (Mueller 2006:130). When these residential middens were aggregated, the species diversity considerably increased because "almost every single bone is from a separate species" (Mueller 2006:130). This is the same pattern observed through the painted design analysis of Cox Ranch Pueblo strengthening the interpretation of the Great House as an integrative community space.

The Cerro Pomo community produced many of the same trends observed at Cox Ranch Pueblo. Sites 965 and 967 are located in close proximity to each other and were likely the same or similar populations in terms of their element choices. Site 969 was spatially separated from the other sites though it also exhibits great similarity to Sites 965 and 967, showing the minimum spatial extent and influence of this community. Temporally, the sampled ceramics from Site 961 are much earlier which explains its vast difference in element choices.

Similar to Cox Ranch, the middens associated with the public architecture, specifically the Great House's Middens 1 and 2, are very similar to each other, but not necessarily with the deposits excavated from within the Great House itself. These middens were more similar to Sites 965, 967, and 969 indicating a strong possibility of their population's use of the Great House. Site 961 did not appear to have used any public area of Cerro Pomo and may have predated its construction and function as a gathering area. If the people who established and occupied Site 961 were part of the Cerro Pomo community, this may indicate that Cerro Pomo had an ancestral-type community, though not a significantly earlier one. This site and others recorded in the area could suggest slightly earlier founding dates for the Cerro Pomo community compared to Cox Ranch Pueblo (Duff and Wichlacz 2009). At the very least this site likely represents a local precursor of which there are very few recorded in this area and time. The Cerro Pomo Great House again contains the highest number of unique elements in the community, supporting the importance of these designs and the specialized use of the area. The diversity previously discussed also supports the use of Cerro Pomo's Great House as a gathering location for the whole community. The population that engaged in Great House activities and was responsible for the abandonment assemblages in the Great House is not similar to any other area's painted design assemblage, again indicating specialized use of elements in this area. Temporally the Cerro Pomo Great House was likely used and abandoned during the later occupation period.

Individual elements continue to support the idea of inter-community interaction-based design influence. Specific elements that appear on early wares in one community did not appear until later in the other community despite the ceramic types these designs were applied to, and their traditional style rules. This theorized inter-community interaction appears to radically increase later in the occupation of both communities.

Temporal data based on painted ceramic types and their percent of the assemblage established from the early/late type division discussed earlier also helps to determine if interaction was taking place between the Cerro Pomo and Cox Ranch communities, roughly when the interaction occurred, and if it can be seen in the painted elements. The Cerro Pomo and Cox Ranch Pueblo communities were very different in terms of their element use during the earlier portion of their occupation, and the early areas of both communities cluster with different elements in the correspondence analysis. The later occupations overlap in their element use, which supports an increased inter-community interaction through time, and this interaction influenced element choices which resulted in more homogenous or standardized designs. Cultural conformity pressure may also explain the increase in homogeneity relating to the development of a more cohesive ethnicity.

The blending of cultures is a strong possibility based on the location of these two communities in the southern Cibola region. This region "exhibits a blending of two main cultural influences: that of the Mogollon and of the Ancestral Pueblos" (Elkins 2007:42). The Mogollon traditionally occupied the Mogollon Rim's mountains while the Ancestral Puebloans primarily inhabited the Colorado Plateau (Elkins 2007:42). Cox Ranch and Cerro Pomo are located on the edge of these two culture areas and the influence of these different cultures is seen in the architecture and unpainted brown and gray wares found at both communities (Duff 2005; Duff and Nauman 2010; Elkins 2007; Nauman 2007). The earlier design element heterogeneity seen in both communities, followed by the cohesion between the communities' later design choices may represent the gradual development of a communal culture expressing "between-group solidarity" (Binford 1965:206) through the intra- or inter-community combination of both ethnic groups.

Conclusion

Both speculative interpretations about intra-site interaction and more confident statements of inter-community interaction and Great House function have resulted from this study. It has been shown that greater degrees of painted element similarities often exist between closely situated residential locations in both communities. This may be attributed to higher degrees of interaction among the residents living in those areas of the community and/or temporal signals of residence occupation. The painted designs in both communities also became much more homogeneous over time, which is strong indication of interaction between the residents of Cox Ranch Pueblo and Cerro Pomo communities. This is further supported when coupled with other similarities such as location, architecture, and the importance of the Cerro Pomo cinder cone. Another exciting result of the data analysis involves the role of the Great House at Cox Ranch Pueblo, and possibly also Cerro Pomo. These structures not only contained multiple unique elements, indicative of its specialized use, they also produced diversity comparable to that of the combination of residential middens. This, along with the Cox Ranch Pueblo faunal evidence (Mueller 2006), supports the conclusion that Great Houses were used for activities involving the whole community.

The idea of the Great House as a community gathering location which incorporates unique objects into its ceremonial contexts is also part of the "Chaco Phenomenon." Chaco Canyon was "a place where participants came, bringing goods, for participation in communal ceremonial events" (Cameron and Toll 2001:11) and other periodic gatherings. Along with goods brought from participants, Great Houses in Chaco Canyon also contain unique ceremonial objects which were produced in households, though not for their own use, which may represent household specialization (Cameron and Toll 2001:11-12).

Based on the results of this study, I believe that interaction can in fact influence design choices and did so at these two contemporaneous communities on an inter-community level. Intra-community similarities may represent interaction as well, but are more likely are the result of temporal trends. I also believe these design elements revealed other aspects of prehistoric behavior in these two Pueblo communities, such as the use of specific areas within the "contemporaneous" sites. Without abundant tree ring data throughout a site, painted design analysis can help to further differentiate occupation periods within a site and identify the areas of contemporaneous occupation, possible interaction, and specialized activities. This allows for a finer separation and clearer understanding of life in these Pueblo communities.

This research and these results also provide support for the potential of prehistoric ceramic design analysis as a means to recognize learning pathways and production groups. Often it is believed that whole vessels are necessary for an accurate study of painted designs, as well as an informative result from a design analysis study. No whole vessels were available for these sites and the results of this research show that whole vessels are not always essential to design element analyses. Painted sherds should not be overlooked as a tool or additional avenue for understanding the past.

Future Research

Additional work would strengthen these results including the addition of unpainted ceramics and further excavation within and around these sites. The inclusion of additional painted and unpainted ceramics will better define patterns and neither of these two areas has been archaeologically exhausted. Sites 961, 965, 967, and 969 around Cerro Pomo are only a few of the satellite residential sites surrounding the larger public architecture at the site of Cerro Pomo. At Cox Ranch it would be interesting to excavate middens west of the Great House and

Midden 15 to determine if Midden 15 was similar to other unexcavated middens in close proximity, and to what degree these other areas are adding to the Great House collection.

Future projects using the data collected and analyzed here should include further analysis of design elements, once temporally divided, coupled with vessel shape, and at least a third contemporaneous community located further away to determine if the trends attributed to proximity based inter-community interaction hold true. If so, work could continue to track interaction back to Chaco Canyon or identify other cultural centers to better understand the trade of information or actual ceramic vessels among Chaco-era sites. Also, according to Plog (1980), the incorporation of other ceramic production attributes and underrepresented factors, such as trade, firing environment, temper type, wall thickness, and ceramic construction, can add additional insight into the influence of production groups in interaction based learning within and between sites.

References Cited

Allen, William L., and James B. Richardson III

1971 The Reconstruction of Kinship from Archaeological Data: The Concepts, the Methods, and the Feasibility. *American Antiquity* 36(1):41-53.

Binford, Lewis R.

1964 A Consideration of Archaeological Research Design. *American Antiquity* 29(4):425-441.

1965 Archaeological Systematics and the Study of Culture Process. *American Antiquity* 31(2):203-210.

Bobrowsky, Peter T., and Bruce F. Ball

1989 The Theory and Mechanisms of Ecological Diversity in Archaeology. In *Quantifying Diversity in Archaeology*, edited by Robert D. Leonard and George T. Jones, pp. 4-12. Cambridge University Press, Cambridge.

Cameron, Catherine M., and H. Wolcott Toll

2001 Deciphering the Organization of Production in Chaco Canyon. *American Antiquity* 66(1):5-13.

DeBoer, Warren R.

1990 Interaction, Imitation, and Communication as Expressed in Style: The Ucayali Experience. In *The Uses of Style in Archaeology*, edited by Margaret Conkey and Christine Hastorf, pp. 82-104. Cambridge University Press, Cambridge.

Deetz, James

1965 *The Dynamics of Stylistic Change in Arikara Ceramics*. Illinois Studies in Anthropology No. 4. University of Illinois, Urbana.

Doyel, David E., Cory D. Breternitz, and Michael P. Marshall

1984 Chacoan Community Structure: Bis Sa'ani Pueblo and the Chaco Halo. In *Recent Research on Chaco Prehistory*, edited by W. James Judge and John D. Schelberg, pp. 37-54. Reports of the Chaco Center, Number 8, Division of Cultural Research, U.S. Department of the Interior National Park Servece, Albuquerque, New Mexico.

Duff, Andrew I.

2003 *A Research Design for Archaeological Testing at Cox Ranch Pueblo (LA 13681, BLM NM-02-185), Catron County, New Mexico*. Submitted to the Bureau of Land Management, Socorro Field Office, Socorro.

2005 *A Research Design for Archaeological Testing at Cerro Pomo (LA 31803, BLM NM-02-191), Catron County, New Mexico*. Submitted to the Bureau of Land Management, Socorro Field Office, Socorro.

2009 *A Research Design for Intensive Field Inventory of Lands in the Vicinity of Cox Ranch Pueblo, Catron County, New Mexico*. Submitted to Bureau of Land Management, Socorro Field Office, Permit No. 188-8152-04-F Addendum.

Duff, Andrew I., T.J. Ferguson, Susan Bruning, and Peter Whiteley

2008 Collaborative Research in a Living Landscape: Pueblo Land, Culture, and History in West-Central New Mexico. *Archaeology Southwest* 22(1):1-24.

Duff, Andrew I., and Stephen H. Lekson

2004 Notes from the South. In *The Archaeology of Chaco Canyon, An Eleventh-Century Pueblo Regional Center,* edited by S. H. Lekson, pp. 315-339. School of American Research Press, Santa Fe.

Duff, Andrew I., and Alissa L. Nauman

2005 *Preliminary Report on the Archaeological Testing of Cox Ranch Pueblo (LA 13681, BLM NM-02-185), Catron County, New Mexico, 2003 Season*. Submitted to Bureau of Land Management Socorro Research Area, Permit No. 188-8152-03-C.

2010 Engendering the Landscape: Resource Acquisition, Artifact Manufacture, and Household Organization in a Chacoan Great House Community. In *Engendering Households in the Prehistoric Southwest*, edited by Barbara Roth, pp. 12-33. University of Arizona Press, Tucson.

Duff, Andrew I., and Caitlin Wichlacz

2009 The Spatial and Temporal Dynamics of Chacoan Communities on the Southern Frontier. Poster presented at the 74th Annual Meeting of the Society for American Archaeology, Atlanta.

Elkins, Melissa Anne

2007 *Serving Up Ethnic Identity in Chacoan Frontier Communities: The Technology and Distribution of Mogollon and Puebloan Ceramic Wares in the Southern Cibola Region.* Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Gosselain, Olivier P.
1994 Skimming Through Potters' Agendas: An Ethnoarchaeological Study of Clay Selection Strategies in Cameroon. In *Society, Culture, and Technology in Africa*, edited by S. Terry Childs, pp. 99-107. MASCA Research Papers in Science and Archaeology, Supplement to Volume 11, Philadelphia.

Hays-Gilpin, Kelly, and Eric van Hartesveldt
1998 *Prehistoric Ceramics of the Puerco Valley.* Museum of Northern Arizona Ceramic Series No. 7. Museum of Northern Arizona, Flagstaff.

Hill, James N.
1970 *Broken K Pueblo: Prehistoric Social Organization in the American Southwest.* Anthropological Papers of the University of Arizona, No.18. University of Arizona Press, Tucson.

Huckleberry, Gary, and Andrew I. Duff
2008 Alluvial Cycles, Climate, and Puebloan Settlement Shifts near Zuni Salt Lake, New Mexico, USA. *Geoarchaeology* 23(1):107-130.

Kantner, John
2004 *Ancient Puebloan Southwest*. Cambridge University Press, Cambridge.

Kaufman, Daniel
1998 Measuring Archaeological Diversity: An Application of the Jackknife Technique. *American Antiquity* 63(1):73-85.

Kintigh, Keith W.
1989 Sample Size, Significance, and Measures of Diversity. In *Quantifying Diversity in Archaeology*, edited by Robert D. Leonard and George T. Jones, pp. 25-36. Cambridge University Press, Cambridge.

Kohler, Timothy A., and Matthew J. Root
2004 The First Hunters/Farmers in the Pajarito Plateau (A.D. 1375-1600). In *Archaeology of Bandelier National Monument*, edited by Timothy A Kohler, pp.215-264. University of New Mexico Press, Albuquerque.

Lipe, William D.
2006 Notes from the North. In *The Archaeology of Chaco Canyon: An Eleventh-Century Pueblo Regional Center*, edited by Stephen H. Lekson, pp.261-313, School of American Research Press, Santa Fe.

Lipo, C.P., M. Madsen, R.C. Dunnell, and T. Hunt
2003 Population Structure, Cultural Transmission, and Frequency Seriation. In *Style, Function, Transmission: Evolutionary Archaeological Perspectives,* edited by M.J. O'Brien and R.L. Lyman, pp. 79-104 . University of Utah Press, Salt Lake City.

Longacre, William A.
1970 *Archaeology as Anthropology: A Case Study.* Anthropological Papers of the University of Arizona, No.17. University of Arizona Press, Tucson.

Mueller, Jennifer L.
2006 *Ritual, Feasting and Trajectories to Social Power in a Southern Chacoan Great House.* Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Nauman, Alissa L. 2007
2007 *Learning Frameworks and Technological Traditions: Pottery Manufacture in a Chaco Period Great House Community on the Southern Colorado Plateau.* Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Plog, Stephen
1980 *Stylistic Variation in Prehistoric Ceramics: Design Analysis in the American Southwest.* Cambridge University Press, Cambridge.
1990 Sociopolitical Implications of Stylistic Variation in the American Southwest. In *The Uses of Style in Archaeology*, edited by Margaret Conkey and Christine Hastorf, pp. 61-72. Cambridge University Press, Cambridge.

Rothschild, Nan A
1989 The Effect of Urbanization on Faunal Diversity: A Comparison Between New York City and St Augustine, Florida, in the Sixteenth to Eighteenth Centuries. In *Quantifying Diversity in Archaeology,* edited by Robert D. Leonard and George T. Jones, pp. 92-99. Cambridge University Press, Cambridge

Schiffer, Michael B.
1972 Archaeological Context and Systematic Context. *American Antiquity* 37 (2):156-165.
1989 Formation Processes of Broken K Pueblo: Some Hypotheses. In *Quantifying Diversity in Archaeology,* edited by Robert D. Leonard and George T. Jones, pp. 37-58. Cambridge University Press, Cambridge.

Shepard, Anna O.
1985 [1956] *Ceramics for the Archaeologist*. Carnegie Institution of Washington, Washington, D.C.

Sinopoli, Carla M.
1991 *Approaches to Archaeological Ceramics*. Plenum Press, New York.

Smith, A. Livingstone
2000 Processing Clay for Pottery in Northern Cameroon: Social and Technical Requirements. *Archaeometry* 41(1):21-42.

Stanislawski, Michael B.
1973 Review of *Archaeology as Anthropology: A Case Study*, by William A. Longacre. *American Antiquity* 38(1):117-122.

Stark, Miriam T.
1991 Ceramic Production and Community Specialization: A Kalinga Ethnoarchaeological Study. *World Archaeology* 23(1):64-78.

VanBuskirk, Stephanie
2004 *Alluvial Stratigraphy and Soil Formation at Cox Ranch Pueblo, New Mexico*. Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Washburn, Dorothy K.
1994 The Property of Symmetry and the Concept of Ethnic Style. In *Archaeological Approaches to Cultural Identity*, edited by Stephen Shennan, pp. 158-173. Routledge, London.

Watson, Patty Jo
1977 Design Analysis of Painted Pottery. *American Antiquity* 42(3):381-393.

Whallon Jr., Robert
1968 Investigations of Late Prehistoric Social Organization in New York State. In *New Perspectives in Archaeology*, edited by Sally R. Binford and Lewis R. Binford, pp. 224-244. Aldine Publishing Company, Chicago.

Wichlacz, Caitlin Anne

2009 *Complementary Compositional Analyses of Ceramics from Two Great House Communities in West-Central New Mexico.* Unpublished Master's thesis, Department of Anthropology, Washington State University, Pullman.

Wobst, Martin

1977 Stylistic Behavior and Information Exchange. In *Papers for the Director: Research Essays in Honor of James B. Griffin*, edited by Charles E. Cleland, pp. 317-342. Anthropology Papers 61, Museum of Anthropology, University of Michigan, Ann Arbor.

APPENDIX A:

DATA RECORDING SHEET

Area: EU: L=level F=vessel form T=vessel type E= Element #

L	F	T	Elem	Description

APPENDIX B:
COX RANCH PUEBLO ELEMENT COUNTS

Cox Ranch		Element														
Area	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M1	1				1		1								1	1
	2	3		4	1	5	17	10			1					1
	3			2		2	7	2								
	4			2		1	3	1						1		
	5	5		1			2	1								
All M1		8	0	9	2	8	30	14	0	0	1	0	0	1	1	2
M3	1	1	1			1	4	3							1	
	2			1			4	1							1	
	3					2	4								2	
	4	1		5	1		9	5		1	1				1	
	5					4	4	3							1	
All M3		2	1	6	1	7	25	12	0	1	1	0	0	0	6	0
M6	1		5	3			1	2								
	2			1			3	3			1				1	
	3		1	1		1	6	2		1	1					
	4		2	1			4	1							1	
	5		1	4		1	8	8			2					
All M6		0	9	10	0	2	22	16	0	1	4	0	0	0	2	0
M7	1						1	1								
	2															
	3			1		3	14	12			2				1	
	4			1			4								1	
	5			1			1	1								
All M7		0	0	3	0	3	20	14	0	0	2	0	0	0	2	0
M8	1						1			1	1					
	2		1	1												
	3	2		1		1	1									2
	4			1			1	1			1					
	5			2			2	2							1	
All M8		2	1	5	0	1	5	3	0	1	2	0	0	0	1	2
M10	1															
	2			1			1	1								
	3															
	4	1		1										1	1	
	5		1	1												
	6		1	2											1	
All M10		1	2	5	0	0	1	1	0	0	0	0	0	1	2	0

Cox Ranch		Element														
Area	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M11	1		1	4			6	5		1	1					
	2															
	3		2				4									
	4		1			2	4	4						2		
	5					1										
	6		1	1	1		3	2								
All M11		0	5	5	1	3	17	11	0	1	1	0	0	2	0	0
M12	1		4	5	1	2	15	5		1	3				1	2
	2		2	2	1	2	22	7	1		4			1	4	
	3	3	1	1		5	6	5								
	4	4	3	4	1	5	8	5	1		1			2	1	
	5	1	1	1		1	5	3			1				1	1
	6	1	4	2	3	6	22	8		1	2		1	1	3	
All M12		9	15	15	6	21	78	33	2	2	11	0	1	4	10	3
M15	1	3	11	6		8	17	12		1	3				1	1
	2					5	3	3								
	3		1	1							1					
	4					1	7	4	1	1	1					
	5		3	3			4	2	1		1			1	1	
All M15		3	15	10	0	14	31	21	2	2	6	0	0	1	2	1
GH	3					1	22	18		1						
	4		4	4	1	9	22	13							1	1
	5		3	3	1	5	17	9	1	1	3				3	
	6		7	3	2	3	19	16	1	1				1	1	
	7			2	2	2	23	16								
	8		3	6		1	15	10	3		3			1	5	
	9		6	7		3	12	10						1	1	
	10	1		5			1	2			1					
	11		1				5	1						1		
	12		7	2		3	21	13			3					
	13					1	27	24			1			1	1	
	14		1				3	2								
	15	3	11			6	26	25		1	2					1
	16	1	6	1	2	10	84	52	2	1	3				3	2
	17	1	4		3	1	19	11		1	1				1	
All GH		6	53	33	11	45	316	222	7	6	17	0	0	5	16	4
All CR		31	101	101	21	104	545	347	11	14	45	0	1	14	42	12

Cox Ranch		Element														
Area	Unit	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
M1	1									1	1					
	2		1		2	1				1	3		1			
	3				1											1
	4					1										1
	5		1													
All M1		0	2	0	3	2	0	0	0	2	4	0	1	0	0	2
M3	1									2						
	2					1				2	1					
	3										5					
	4		3							1	1	1				
	5		1							2						
All M3		0	4	0	0	1	0	0	0	7	7	1	0	0	0	0
M6	1										5					
	2									1	4	1	1			
	3					1				1	8	1				
	4									1		1				
	5										2	1				
All M6		0	0	0	0	1	0	0	0	3	19	4	1	0	0	0
M7	1									1			2			
	2															
	3					2				3	12					
	4									1	2	1				
	5									1						
All M7		0	0	0	0	2	0	0	0	6	14	1	2	0	0	0
M8	1									1	2			1		
	2											1				
	3									2						
	4										1					
	5															
All M8		0	0	0	0	0	0	0	0	3	3	1	0	1	0	0
M10	1										1	1				
	2									1						
	3															
	4										3					
	5															
	6									1						
All M10		0	0	0	0	0	0	0	0	2	4	1	0	0	0	0

Cox Ranch		Element														
Area	Unit	1 6	17	18	19	20	21	22	23	24	25	26	27	28	29	30
M11	1										2		1			
	2															
	3					1					1					
	4										2					
	5										1					
	6										3					
All M11		0	0	0	0	1	0	0	0	0	9	0	1	0	0	0
M12	1		1			1				8	6	1	1			
	2					4					4					
	3		1			1				6	2					1
	4									3	1					
	5									2	3		2		1	
	6				1	4				12	9		1	1		1
All M12		0	2	0	1	10	0	0	0	31	25	1	4	1	1	2
M15	1				2	5				8	10	1	2		2	
	2									2	2	1	1			
	3									1	2		1			
	4									1	6	1				
	5					1				2	5					1
All M15		0	0	0	2	6	0	0	0	14	25	3	4	0	2	1
GH	3									1	1		1			
	4			1		2				7	12	2		1		
	5			1		1				4	8			1		
	6					1				9	17			1		
	7									4	12		1		1	
	8					3				5	11	1	2			
	9					3				8	8	1				
	10										7					
	11									2	6					
	12	1		1						4	3					1
	13				1	3				3	15	6	1	1		
	14									2						
	15			2		3				13	17	1	1			1
	16				1	8				12	23	3	1	1		1
	17									2	10			1	1	3
All GH		1	0	5	2	24	0	0	0	76	150	14	7	6	2	6
All CR		1	8	5	8	47	0	0	0	144	260	26	20	8	5	11

Cox Ranch		Element													
Area	Unit	31	32	34	35	36	37	38	39	40	41	42	43	44	45
M1	1	11													
	2	31			3	3			4	1	1	6	6	3	1
	3	28						1	1		1		3		
	4	1				1								2	
	5	9											2		1
All M1		80	0	0	3	4	0	1	5	1	2	6	11	5	2
M3	1	12		1					3					2	
	2	8		1										3	
	3	23		5		1							2	2	
	4	34			4					1			4	3	
	5	27		1				1	1			2	2	2	2
All M3		104	0	8	4	1	0	1	4	1	0	2	8	12	2
M6	1	23		2	2				1				5	5	
	2	38							1				6	5	
	3	56		1	1								4	9	
	4	17							1				1	2	2
	5	41		2					1					2	
All M6		175	0	5	3	0	0	0	4	0	0	0	16	23	2
M7	1	7													
	2	2		1									1		
	3	40			2				3				4		1
	4	18												2	
	5	14	1	1					1				1	1	
All M7		81	1	2	2	0	0	0	4	0	0	0	6	3	1
M8	1	11											1	1	
	2	60	1										1	7	1
	3	24			1										
	4	5			1									4	
	5	8											1	1	
All M8		108	1	0	2	0	0	0	0	0	0	0	3	13	1
M10	1	6												2	
	2	9											1	2	
	3	7													
	4	20											1	1	
	5	7												1	
	6	11					1							1	1
All M10		60	0	0	0	0	1	0	0	0	0	0	2	7	1

Cox Ranch		Element													
Area	Unit	31	32	34	35	36	37	38	39	40	41	42	43	44	45
M11	1	24			1			1					2	3	
	2	8													
	3	14											1		1
	4	26			1		1							4	
	5	12		1				1					1		
	6	21	1		1									2	
All M11		105	1	1	3	0	1	2	0	0	0	0	4	9	1
M12	1	82		2	3							1	8	5	1
	2	68		3			1		3				4	9	1
	3	39	1					1	1		1		8	4	
	4	73			1								5	8	
	5	37			2				1				8	6	
	6	79	1	2	3				3				7	30	1
All M12		378	2	7	9	0	1	1	8	0	1	1	40	62	3
M15	1	72		2		2			1			3	9	9	2
	2	38				1			1			1	2	4	
	3	9											1	1	
	4	28		1					3				5	5	
	5	14			1			1						3	
All M15		161	0	3	1	3	0	1	5	0	0	4	17	22	2
GH	3	30											6	4	
	4	133	2		3				1				10	15	1
	5	131		1	2				3				18	3	5
	6	145		2	9		1	2					12	7	6
	7	41			1								11	1	1
	8	94		1	1	1			1				8	6	2
	9	87		1	2				1				9	12	2
	10	57			2								8	2	
	11	30							1				4		
	12	77			3			1	1				7		2
	13	88			7								15	7	4
	14	14		1	1			1					1		1
	15	128		4	3				2				24	16	3
	16	130		4	16	1		1	7				22	16	4
	17	78		1	8								8	6	2
All GH		1263	2	15	58	2	1	5	17	0	0	0	163	95	33
All CR		2515	7	41	85	10	4	11	47	2	3	13	270	251	48

Cox Ranch		Element														
Area	Unit	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
M1	1															
	2	1						1								
	3		1													
	4		1	1	2											
	5			1												
All M1		1	2	2	2	0	0	1	0	0	0	0	0	0	0	0
M3	1		2			2										
	2			2			2									
	3															
	4			2					1							
	5		1	1	1			1								
All M3		0	3	5	1	2	2	1	1	0	0	0	0	0	0	0
M6	1			1	4											
	2			1	1		1	2								
	3			1	2		1									
	4				2		1									
	5			1	2				2				1			
All M6		0	0	4	11	0	3	2	2	0	0	0	1	0	0	0
M7	1															
	2															
	3				3								1			
	4															
	5			1				1								
All M7		0	0	1	3	0	0	1	0	0	0	0	1	0	0	0
M8	1															
	2				2				1							
	3															
	4							1								
	5															
All M8		0	0	0	2	0	0	1	1	0	0	0	0	0	0	0
M10	1															
	2															
	3															
	4						1									
	5			1												
	6			1												
All M10		0	0	2	0	0	1	0	0	0	0	0	0	0	0	0

Cox Ranch		Element														
Area	Unit	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
M11	1				1											
	2															
	3															
	4															
	5			1												
	6				2											
All M11		0	0	1	3	0	0	0	0	0	0	0	0	0	0	0
M12	1			1	1		1			1						
	2				1			1	1							
	3				2				1		2					
	4				1				1							
	5			2	1				1	2		1				
	6		1	3	2			1					1			
All M12		0	1	6	8	0	1	2	4	3	2	1	1	0	0	0
M15	1		1	3				1								
	2				1											
	3															
	4			3				1								
	5						1	1								
All M15		0	1	6	1	0	1	3	0	0	0	0	0	0	0	0
GH	3				1									1		
	4		1	3	4			2	1	1					1	1
	5			2	1		1	1								
	6			3	6			1	1	2			1			
	7			1	4										1	
	8				2								1			
	9							4								1
	10			1	1											
	11															
	12			3				1								
	13				5			3	1							
	14															
	15			6	7			1		2						
	16			6	3			1							1	
	17				2			1								
All GH		0	1	25	36	0	1	15	3	5	0	0	2	1	3	2
All CR		1	8	52	67	2	9	26	11	8	2	1	5	1	3	2

Cox Ranch		Element				
Area	Unit	61	62	63	64	TOTAL
M1	1					17
	2					112
	3					50
	4					18
	5					23
All M1		0	0	0	0	220
M3	1					35
	2					27
	3					46
	4					79
	5					57
All M3		0	0	0	0	244
M6	1					59
	2					71
	3					99
	4					37
	5					79
All M6		0	0	0	0	345
M7	1					12
	2					4
	3					104
	4					30
	5					25
All M7		0	0	0	0	175
M8	1					20
	2					76
	3					34
	4					16
	5					17
All M8		0	0	0	0	163
M10	1					10
	2					16
	3					7
	4					30
	5					11
	6					20
All M10		0	0	0	0	94

Cox Ranch		Element				
Area	Unit	61	62	63	64	TOTAL
M11	1					53
	2					8
	3					24
	4					47
	5					18
	6					38
All M11		0	0	0	0	188
M12	1					163
	2					146
	3					92
	4					128
	5					84
	6					217
All M12		0	0	0	0	830
M15	1					198
	2					65
	3					18
	4					69
	5					46
All M15		0	0	0	0	396
GH	3					87
	4					259
	5	1				230
	6		1			281
	7					124
	8			1	1	188
	9					179
	10					88
	11					51
	12			1		155
	13					215
	14					27
	15					309
	16					429
	17					165
All GH		1	1	2	1	2787
All CR		1	1	2	1	5442

APPENDIX C:
CERRO POMO ELEMENT COUNTS

Cerro Pomo		Element														
Area	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
961	1	4	1			1	1	1			1					
	2			1											1	
	4										1					
	5	4	1	1				2							2	
All 961		8	2	2	0	1	1	3	0	0	2	0	0	0	3	0
965	surface	1														
	1		1	1												
	2															
	3															
	4				1		1				1				1	
	5															
	6	1	1			1	1	2			1					
All 965		2	2	1	1	1	2	2	0	0	2	0	0	0	1	0
967	1															
	2		1													1
	3					1	1									
	4															
All 967		0	1	0	0	1	1	0	0	0	0	0	0	0	0	1
969	1		1													
	2															
	3		1				1	1								
	4															
	5															
	6						3	2								
All 969		0	2	0	0	0	4	3	0	0	0	0	0	0	0	0
GK	1 (All)															
M1	1		2			1	1	1			1					
	2	1					2				1					
	3			1		2	7	4	1		1					
	4	1	1	1										1		
	5	1														
All M1		3	3	2	0	3	10	5	1	0	3	0	0	1	0	0
M2	1		1	1			2	1			1					
	2	2	2				1	2							1	
	3	2	3	2		1	2	2	1		1					
	4		2			1										
All M2		4	8	3	0	2	5	5	1	0	2	0	0	0	1	0

Cerro Pomo		Element														
Area	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
GH	1			1			3	3								
	2		1		1		4	4			1				1	
	3			1		1	1	1								
	4			1		1		1								
	5		1			1										
	6			1			2									
	8						1									
	9			2		1	1	3						1		
	10					1	5	6								
	11															
	12		2				3	1								
	13	2	2			2	10	8								
All GH		2	6	6	1	7	30	27	0	0	1	0	0	1	1	0
All CP		19	24	14	2	15	53	45	2	0	10	0	0	2	6	1

Cerro Pomo		Element														
Area	Unit	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
961	1									1	2		1			
	2									1						
	4															
	5															
All 961		0	0	0	0	0	0	0	0	2	2	0	1	0	0	0
965	surface															
	1										1					
	2															
	3															
	4															
	5									2						
	6									2						
All 965		0	0	0	0	0	0	0	0	4	1	0	0	0	0	0
967	1									1						
	2															
	3					1				1						
	4															
All 967		0	0	0	0	1	0	0	0	2	0	0	0	0	0	0
969	1															
	2															
	3										2					
	4															
	5									1						
	6															
All 969		0	0	0	0	0	0	0	0	1	2	0	0	0	0	0
GK	1 (All)															
M1	1									3	1		1			
	2									1						
	3									2	3	1				
	4									3	2		1			
	5									1	1					
All M1		0	0	0	0	0	0	0	0	10	7	1	2	0	0	0
M2	1									5	5					
	2					1				3	1					
	3									6	1					
	4										1					
All M2		0	0	0	0	1	0	0	0	14	8	0	0	0	0	0

Cerro Pomo		Element														
Area	Unit	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GH	1				1					1	3					
	2					2				1	6	2		1	1	
	3										1		1			
	4						1			1	3		1			
	5															1
	6					1					1					
	8										1					
	9										4			1		3
	10									1	3	1				
	11															
	12						1				1					
	13									2	8					
All GH		0	0	0	1	3	2	0	0	6	31	3	2	2	1	4
All CP		0	0	0	1	5	2	0	0	39	51	4	5	2	1	4

Cerro Pomo		Element													
Area	Unit	31	32	34	35	36	37	38	39	40	41	42	43	44	45
961	1	8											1		
	2			1										1	
	4														
	5	7			1									4	
All 961		15	0	1	1	0	0	0	0	0	0	0	1	5	0
965	surface	8						1					1	1	
	1	10			1								1		
	2	12											1	1	
	3	1													1
	4	7		1										1	
	5	24											2	4	
	6	26							1				4	5	1
All 965		88	0	1	1	0	0	1	1	0	0	0	9	12	2
967	1	15											3		
	2	14											1		
	3	23												1	1
	4	1													
All 967		53	0	0	0	0	0	0	0	0	0	0	4	1	1
969	1	8			1									2	
	2	4													
	3	19													
	4	7		1									1	1	
	5	4						1							
	6	7											1	1	
All 969		49	0	1	1	0	0	1	0	0	0	0	2	4	0
GK	1 (All)	1											1		
M1	1	25			2				1				4	3	1
	2	17											2	2	
	3	28			1								4	1	
	4	32												3	
	5	12												1	
All M1		114	0	0	3	0	0	0	1	0	0	0	10	10	1
M2	1	37											4	2	1
	2	52			2								2	2	2
	3	78			1				1				5	4	
	4	22											1		
All M2		189	0	0	3	0	0	0	1	0	0	0	12	8	3

Cerro Pomo		Element													
Area	Unit	31	32	34	35	36	37	38	39	40	41	42	43	44	45
GH	1	17			1		1						3		1
	2	28			3			1	1				3	1	
	3	8											2	1	
	4	9												1	
	5	10			1										
	6	10			1								3	1	
	8	4			1										
	9	14			2	1			1				2		
	10	21			4								4		2
	11	5												1	
	12	10											2	3	
	13	38			8								7	2	3
All GH		174	0	0	21	1	1	1	2	0	0	0	26	10	6
All CP		683	0	3	30	1	1	3	5	0	0	0	65	50	13

Cerro Pomo		Element														
Area	Unit	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
961	1															
	2				1											
	4															
	5						1									
All 961		0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
965	surface															
	1															
	2															
	3															
	4															
	5															
	6							3								
All 965		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
967	1															
	2			1					1							
	3															
	4															
All 967		0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
969	1															
	2															
	3															
	4															
	5															
	6															
All 969		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GK	1 (All)						1									
M1	1			3												
	2															
	3			1	1											1
	4							1								
	5				1											
All M1		0	0	4	2	0	0	1	0	0	0	0	0	0	0	1
M2	1							1								
	2				2			1		1						
	3			1												
	4			1												
All M2		0	0	2	2	0	0	2	0	1	0	0	0	0	0	0

Cerro Pomo		Element														
Area	Unit	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
GH	1			1	1		1									
	2							1						1		
	3			1			1				1					
	4															
	5															
	6							1								
	8							1								
	9				1			1								
	10												1			
	11															
	12															
	13			2	1				3							
All GH		0	0	4	3	0	2	4	3	0	1	0	1	1	0	0
All CP		0	0	11	8	0	4	10	4	1	1	0	1	1	0	1

Cerro Pomo		Element				
Area	Unit	61	62	63	64	TOTAL
961	1					22
	2					6
	4					1
	5					23
All 961		0	0	0	0	52
965	surface					12
	1					15
	2					14
	3					2
	4					13
	5					32
	6					49
All 965		0	0	0	0	137
967	1					19
	2					19
	3					29
	4					1
All 967		0	0	0	0	68
969	1					12
	2					4
	3					24
	4					10
	5					6
	6					14
All 969		0	0	0	0	70
GK	1 (All)					3
M1	1					50
	2					26
	3					59
	4					46
	5					17
All M1		0	0	0	0	198
M2	1					61
	2					77
	3					111
	4					28
All M2		0	0	0	0	277

Cerro Pomo		Element				
Area	Unit	61	62	63	64	TOTAL
GH	1					38
	2					64
	3					20
	4					19
	5					14
	6					21
	8					8
	9					38
	10					49
	11					6
	12					23
	13					98
All GH		0	0	0	0	398
All CP		0	0	0	0	1203

APPENDIX D:
COX RANCH PUEBLO TEMPORAL DATA

Cox Ranch	Element													
	1	2	3	4	5	6	7	8	9	10	12	13	14	15
GH Early	5	36	13	7	18	108	67	5	5	14	0	3	16	4
M1 Early	4	0	5	2	3	13	4	0	0	1	0	1	1	2
M10 Early	0	1	4	0	0	1	1	0	0	0	0	1	2	0
M11 Early	0	2	0	1	3	9	9	0	1	1	0	0	0	0
M12 Early	7	8	10	3	11	44	15	2	0	9	0	2	8	1
M15 Early	3	11	6	0	4	15	7	1	2	4	0	0	2	0
M3 Early	2	1	5	1	1	7	3	0	1	1	0	0	3	0
M6 Early	0	3	5	0	0	5	7	0	1	3	0	0	2	0
M7 Early	0	0	0	0	0	4	3	0	0	2	0	0	1	0
M8 Early	0	0	1	0	1	3	2	0	1	1	0	0	1	0
GH Late	0	5	7	1	23	195	149	0	1	2	0	0	0	0
M1 Late	1	0	1	0	5	17	10	0	0	0	0	0	0	0
M10 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M11 Late	0	2	1	0	0	7	2	0	0	0	0	0	0	0
M12 Late	0	2	0	1	10	30	17	0	1	0	1	0	0	1
M15 Late	0	0	1	0	8	15	14	0	0	0	0	0	0	0
M3 Late	0	0	0	0	3	16	9	0	0	0	0	0	2	0
M6 Late	0	3	0	0	1	13	8	0	0	0	0	0	0	0
M7 Late	0	0	0	0	3	12	10	0	0	0	0	0	0	0
M8 Late	0	0	0	0	0	1	1	0	0	0	0	0	0	2

Cox Ranch	Element														
	16	17	18	19	20	21	24	25	26	27	28	29	30	31	32
GH Early	1	0	2	0	18	0	46	9	2	0	1	2	2	73	0
M1 Early	0	0	0	1	2	0	2	0	0	1	0	0	1	17	0
M10 Early	0	0	0	0	0	0	1	2	1	0	0	0	0	17	0
M11 Early	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
M12 Early	0	1	0	1	7	0	22	13	1	3	0	1	1	112	0
M15 Early	0	0	0	1	5	0	12	7	1	1	0	2	1	21	0
M3 Early	0	3	0	0	1	0	6	2	1	0	0	0	0	19	0
M6 Early	0	0	0	0	1	0	3	0	0	0	0	0	0	2	0
M7 Early	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0
M8 Early	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0
GH Late	0	0	3	1	3	0	16	103	10	6	5	0	3	697	1
M1 Late	0	1	0	2	0	0	0	3	0	0	0	0	1	46	0
M10 Late	0	0	0	0	0	0	0	2	0	0	0	0	0	20	0
M11 Late	0	0	0	0	0	0	0	3	0	1	0	0	0	41	1
M12 Late	0	1	0	0	2	0	1	7	0	0	1	0	1	156	1
M15 Late	0	0	0	0	0	0	0	12	1	2	0	0	0	82	0
M3 Late	0	1	0	0	0	0	0	4	0	0	0	0	0	42	0
M6 Late	0	0	0	0	0	0	0	15	4	1	0	0	0	80	0
M7 Late	0	0	0	0	1	0	3	9	0	2	0	0	0	44	0
M8 Late	0	0	0	0	0	0	2	2	0	0	1	0	0	26	0

Cox Ranch	Element														
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
GH Early	11	15	1	0	3	12	0	0	0	10	9	19	0	1	10
M1 Early	0	1	2	0	1	5	0	1	0	4	1	2	0	2	0
M10 Early	0	0	0	1	0	0	0	0	0	0	3	0	0	0	1
M11 Early	1	1	0	0	2	0	0	0	0	0	0	1	0	0	0
M12 Early	6	4	0	1	0	5	0	0	0	11	25	2	0	1	4
M15 Early	2	0	1	0	1	1	0	0	0	3	1	1	0	1	4
M3 Early	4	2	0	0	0	2	1	0	0	1	1	0	0	3	1
M6 Early	4	0	0	0	0	1	0	0	0	0	0	0	0	0	1
M7 Early	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
M8 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Late	2	40	1	1	2	4	0	0	0	116	44	13	0	0	8
M1 Late	0	1	2	0	0	0	1	1	6	7	2	0	1	0	2
M10 Late	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
M11 Late	0	2	0	0	0	0	0	0	0	2	0	0	0	0	1
M12 Late	0	4	0	0	1	2	0	1	1	18	23	1	0	0	0
M15 Late	1	0	2	0	0	3	0	0	4	12	12	0	0	0	1
M3 Late	1	2	1	0	1	2	0	0	2	7	6	1	0	0	1
M6 Late	0	2	0	0	0	1	0	0	0	8	9	2	0	0	0
M7 Late	0	2	0	0	0	2	0	0	0	2	1	1	0	0	0
M8 Late	0	2	0	0	0	0	0	0	0	2	3	0	0	0	0

Cox Ranch	Element														
	49	50	51	52	53	54	55	56	57	58	59	60	61	63	64
GH Early	19	0	0	2	0	5	0	0	0	0	2	2	1	1	1
M1 Early	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M10 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M11 Early	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M12 Early	6	0	0	2	3	2	2	1	0	0	0	0	0	0	0
M15 Early	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0
M3 Early	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0
M6 Early	6	0	2	1	0	0	0	0	1	0	0	0	0	0	0
M7 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M8 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Late	14	0	0	9	3	0	0	0	2	1	1	0	0	0	0
M1 Late	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
M10 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M11 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M12 Late	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M15 Late	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
M3 Late	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
M6 Late	4	0	1	1	1	0	0	0	0	0	0	0	0	0	0
M7 Late	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
M8 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX E:
CERRO POMO TEMPORAL DATA

Cerro Pomo	Element													
	1	2	3	4	5	6	7	8	9	10	12	13	14	15
961 Early	8	2	0	0	1	1	3	0	0	2	0	0	3	0
965 Early	0	2	0	0	0	1	0	0	0	2	0	0	1	0
967 Early	1	1	0	0	0	1	0	0	0	0	0	0	0	0
969 Early	0	2	0	0	0	4	3	0	0	0	0	0	0	0
GH Early	2	4	4	0	4	11	8	0	0	0	0	1	0	0
GK Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1 Early	2	1	1	0	3	5	4	1	0	3	0	1	0	0
M2 Early	0	4	2	0	1	3	2	1	0	2	0	0	1	0
961 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965 Late	0	0	0	1	1	1	2	0	0	0	0	0	0	0
967 Late	0	0	0	0	1	0	0	0	0	0	0	0	0	1
969 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Late	0	1	2	0	3	17	19	0	0	1	0	0	1	0
GK Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1 Late	0	0	1	0	0	5	1	0	0	0	0	0	0	0
M2 Late	0	0	0	0	1	2	2	0	0	0	0	0	0	0

Cerro Pomo	Element														
	16	17	18	19	20	21	24	25	26	27	28	29	30	31	32
961 Early	0	0	0	0	0	0	1	2	0	1	0	0	0	10	0
965 Early	0	0	0	0	0	0	3	1	0	0	0	0	0	27	0
967 Early	0	0	0	0	1	0	1	0	0	0	0	0	0	22	0
969 Early	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
GH Early	0	0	0	0	3	2	5	5	0	2	1	1	2	28	0
GK Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1 Early	0	0	0	0	0	0	7	1	0	0	0	0	0	0	0
M2 Early	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0
961 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
965 Late	0	0	0	0	0	0	1	0	0	0	0	0	0	37	0
967 Late	0	0	0	0	0	0	1	0	0	0	0	0	0	20	0
969 Late	0	0	0	0	0	0	0	1	0	0	0	0	0	21	0
GH Late	0	0	0	1	0	0	0	24	2	0	1	0	2	90	0
GK Late	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
M1 Late	0	0	0	0	0	0	1	4	1	0	0	0	0	40	0
M2 Late	0	0	0	0	1	0	6	3	0	0	0	0	0	60	0

Cerro Pomo	Element														
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
961 Early	1	1	0	0	0	0	0	0	0	0	4	0	0	0	0
965 Early	1	0	0	0	1	1	0	0	0	5	4	2	0	0	0
967 Early	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0
969 Early	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
GH Early	0	1	0	1	0	1	0	0	0	4	0	2	0	0	1
GK Early	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
M1 Early	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
M2 Early	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0
961 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965 Late	0	0	0	0	0	0	0	0	0	3	6	0	0	0	0
967 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
969 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Late	0	20	1	0	1	1	0	0	0	18	5	2	0	0	0
GK Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1 Late	0	2	0	0	0	0	0	0	0	3	3	0	0	0	0
M2 Late	0	2	0	0	0	0	0	0	0	8	2	1	0	0	1

Cerro Pomo	Element														
	49	50	51	52	53	54	55	56	57	58	59	60	61	63	64
961 Early	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
965 Early	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
967 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
969 Early	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Early	1	0	2	3	1	0	0	0	1	1	0	0	0	0	0
GK Early	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
M1 Early	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M2 Early	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
961 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965 Late	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
967 Late	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
969 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GH Late	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0
GK Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M1 Late	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M2 Late	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX F:

INTER-SITE CHI-SQUARE ELEMENTS AND COUNTS

Area	Element 1	2	3	4	5	6	7	8
All CR	31	101	101	21	104	545	347	11
All CP	19	24	14	2	15	53	45	2

9	10	13	14	15	17	19	20	24	25
14	45	14	42	12	8	8	47	144	260
0	10	2	6	1	0	1	5	39	51

26	27	28	30	31	32	34	35	36	38
26	20	8	11	2515	7	41	85	10	11
4	5	2	4	683	0	3	30	1	3

39	42	43	44	45	47	48	49	51	52
47	13	270	251	48	8	52	67	9	26
5	0	65	50	13	0	11	8	4	10

53	54
11	8
4	1

APPENDIX G:

INTER-SITE CHI-SQUARE ELEMENT COUNTS WITHOUT SITE 961

Area	Element 1	2	3	4	5	6	7	8
All CR	31	101	101	21	104	545	347	11
All CP (no 961)	8	22	12	2	14	52	42	2

9	10	13	14	15	17	19	20	24	25
14	45	14	42	12	8	8	47	144	260
0	8	2	3	1	0	1	5	37	49

26	27	28	30	31	32	34	35	36	38
26	20	8	11	2515	7	41	85	10	11
4	4	2	4	668	0	2	29	1	3

39	42	43	44	45	47	48	49	51	52
47	13	270	251	48	8	52	67	9	26
5	0	64	45	13	0	11	7	3	10

53	54
11	8
4	1