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MISSION STATEMENT

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CONTENTS

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CHUPADERO BLACK-ON-WHITE: FIVE HUNDRED YEARS OF STANDARDIZATION

Leon Natker**,** Executive Director, Mesa Historical Museum

Abstract

Since the beginning of archaeological research, style has been used to characterize and define numerous aspects of social interaction and complexity. Among the myriad of black-on-white ceramic styles found in the American Southwest/Mexican Northwest (Greater Southwest) is Chupadero. Produced in central and southeast New Mexico, Chupadero Black-on-white was possibly the longest lived of all the black-on-white wares, manufactured from AD 1050 to 1550. Chupadero was also extensively exchanged. It has been found at sites from Texas to Arizona, and from the Galisteo Basin near Santa Fe to Casas Grandes in Chihuahua. Yet for all its longevity and ubiquity in the Greater Southwest, Chupadero style does not seem to change. The same two basic forms, bowl and jar, account for 98 percent of known vessels. The design style, based on rim morphology and painted decoration, appears to remain constant as well, implying a large and interrelated community producing Chupadero. In this research, I conduct an attribute analysis of decorative design and morphology of Chupadero to assess whether change in style occurs. Based on the results, I discuss the implications for the communities of practice which produced Chupadero and how the knowledge needed to manufacture Chupadero was transmitted. Finally, I conclude that the community of practice that produced Chupadero is unique in the Greater Southwest in terms of time depth and geographic scope, and that a kinship mode of production allowed for the transfer of knowledge necessary for its production.

Introduction

Chupadero Black-on-white, manufactured ca. AD 1050 to 1550 in central and southeast New Mexico (Figure 1), was first described by Mera (1931) and appears to be unique in the American Southwest/Mexican Northwest (Greater Southwest), as it was produced longer than any other whiteware in the region and has little variation in its painted designs and technological attributes through this long production period (Figure 2) (see Wiseman 1986). It is also the most widely exchanged whiteware (Figure 3) (see Creel, Clark, and Neff 2002; Creel, Williams, Neff, and Glascock 2002). In this research I examine whether Chupadero Black-on-white painted designs and technological attributes remained standardized through this five-hundred-year production period. The apparent lack of change allows us to explore how knowledge needed to make Chupadero could be passed on, and potentially why this particular ceramic type was made and exchanged for so long. Technological and decorative design elements are used to address these questions because they are the most consistently visible means available for assessing production techniques and learning in ceramic production (Kintigh 1985; Minar and Crown 2001; Rice 1987; Shepard 1942). The examination of these attributes on Chupadero Black-on-white allows me to investigate whether a single large community of practice was responsible for the entirety of production from the late Pueblo II period to the late Pueblo IV period (1050-1550). The study

of culture is an exercise in explaining patterns of variation witnessed within a given area. How do we explain a lack of variation?

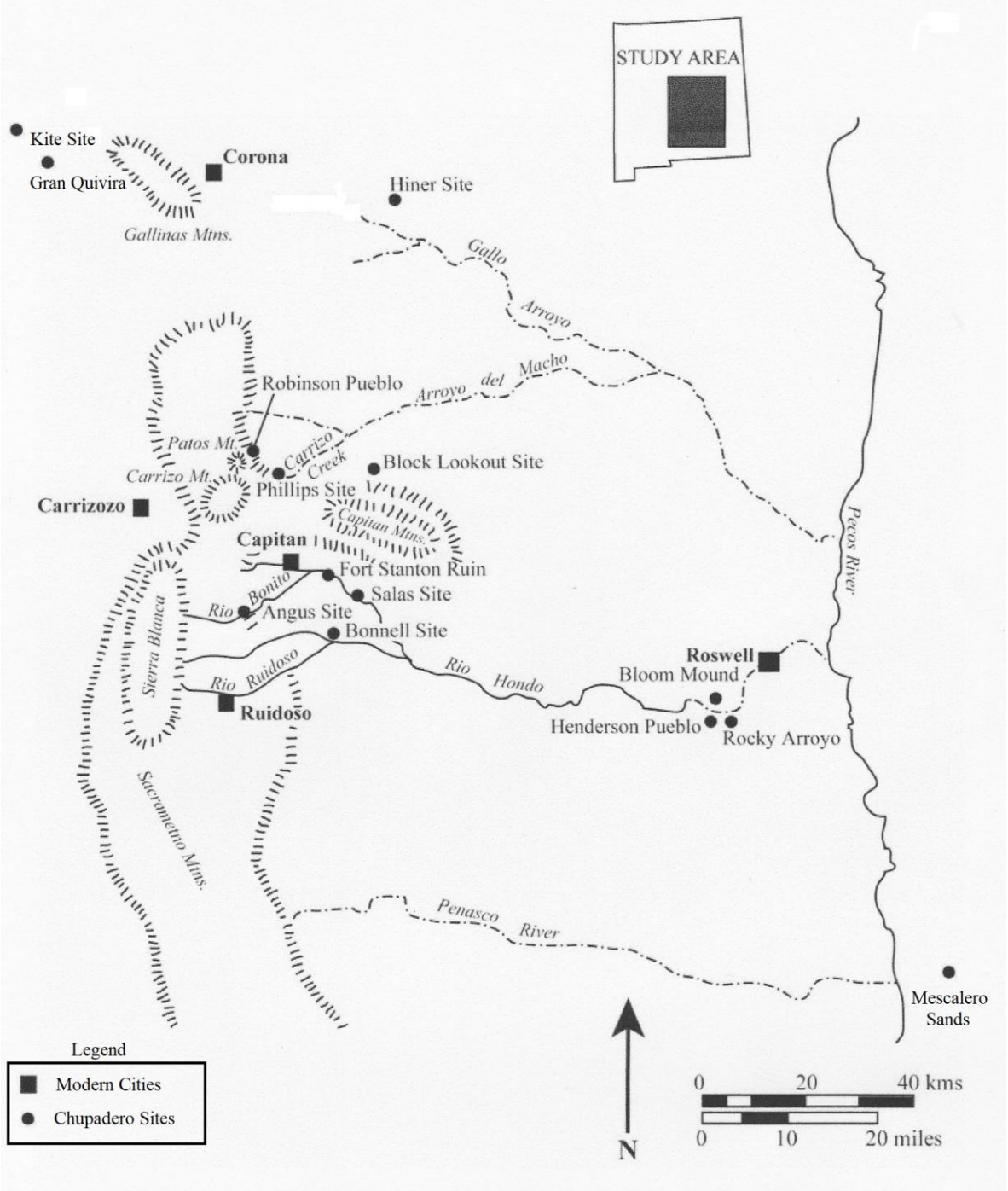

Figure 1. Research area (adapted from Clark 2006:40).

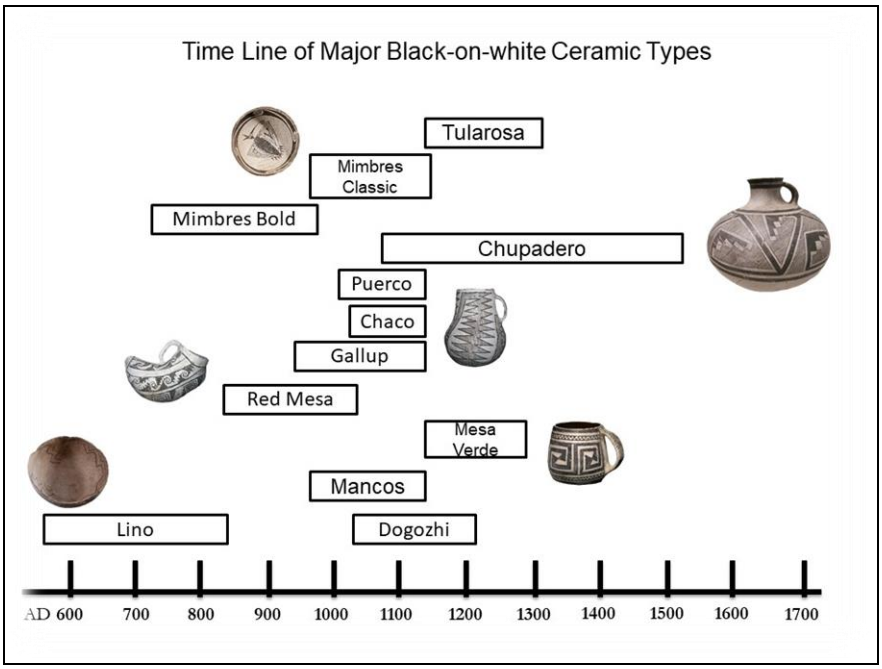

Figure 2. Timeline of major Southwestern Black-on-white ceramic types.
(Figure created by the author; dates from Oppelt 2010.)

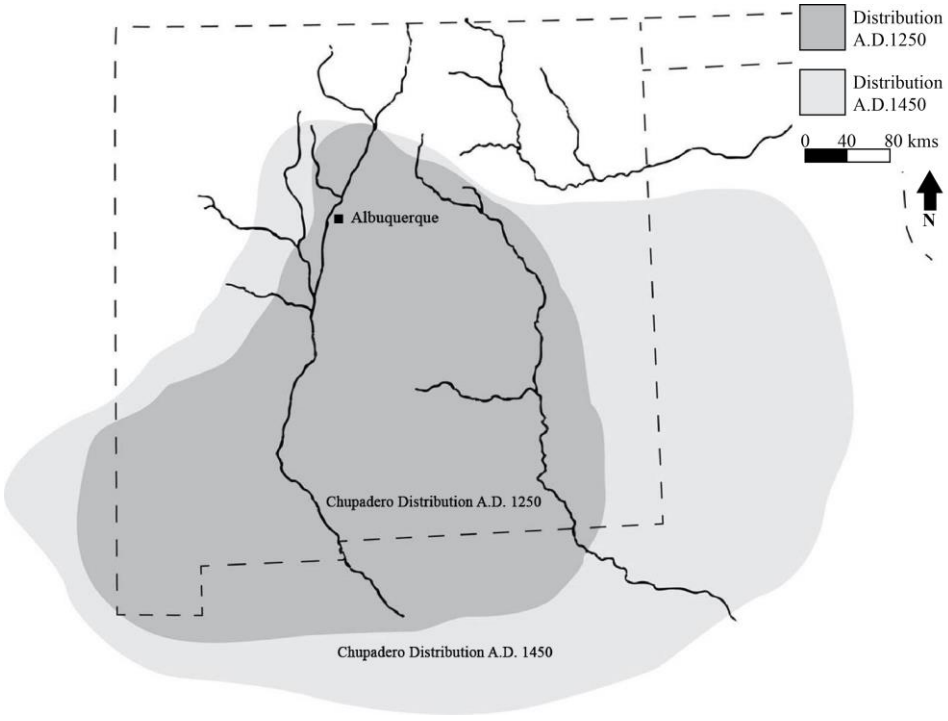

Figure 3. Distribution of Chupadero Black-on-white
(adapted from Creel, Williams, Neff, and Glascock 2002, Figure 6.1).

Style and Communities of Practice

Communities of practice are groups of people who learn from each other, sharing information and experiences in the process of developing a craft or imparting knowledge (Crown 2001:677-678; Gilpin and Hays-Gilpin 2012:45; Lave and Wenger 1991:101; Lyons and Clark 2012:27; Van Keuren 2006:91-92). What can consistency in the production of prehistoric ceramic artifacts tell us about past processes of cultural continuity and change? Communities of practice follow different types, scales, and modes of interaction that can vary widely from site to site and within a region (Eckert 2012:55; Stark 2006:26; Van Keuren 2006:101). The variation, or possible lack of variation, provides insight into the cultural system that created the artifact (Sackett 1990:35-36). Craft production is among the most integrating of social mechanisms. A standardized item is not only indicative of economic behavior but of social behavior. Standardization creates social networks beyond immediate family groups and can facilitate gaining access to key resources, including labor. As a society becomes more specialized, those who are recognized for a particular specialty would have a participatory advantage in the supra-domestic economic and social networks (Costin 1998:10). One possible reason for standardization might be a large community of practice drawing on a common pool of knowledge (Crown 1994:90; Huntley 2006:122; Joyce 2012:150; Lyons and Clark 2012:27). This could be related to a highly successful exchange good, and/or a vehicle used to convey information, memories, or ideology, or some combination of these scenarios.

Style, as seen in various artifacts, has been used to characterize and define numerous aspects of social interaction and complexity (Crown 1994; Kidder 1927, 1931; Longacre 1964; Sackett 1977; Wiessner 1983). Archaeologists have heavily debated the use and definition of style. Hegmon (1992:517-518) argues that most archaeologists agree that style is a specific way of doing something and that it is a choice made by the person producing the object. From that point, the debate diverges into discussions of functionality, communication, and cognition. Beyond a "choice," what is meant by style? In this research I follow Carr (1995b) in defining style as production attributes that include: vessel wall thickness, the shape of the rim, the painted design elements on the exterior surface of jars and the interior surface of bowls, as well as the scraping and smoothing of coils on unpainted surfaces (Carr 1995a:157). The totality of these attributes is what gives the vessel "style." All of these attributes were choices which must be taught and learned by the potter. When the choices made in craft production are equivalent or produce equally viable options, the choices we see, the "style," is dictated by societal enculturation (Sackett 1985:157; Wiseman 1986; Hegmon 1992; Carr 1995b).

These production attributes fall into two broad categories: decorative style, or high visibility attributes, and technological style, or low visibility attributes. High visibility attributes are easily identified from a distance, such as painted design and placement of design (Carr 1995b:186; Clark 2001:12). These include the painted decoration found on the outside of Chupadero jars and the inside of Chupadero bowls. Low visibility attributes, technological style, are pottery forming techniques such as thickness of walls, slip, scraping and shaping of clay, and rim shape (Carr 1995b:188; Eckert 2012:58). My research hypothesizes that the stability observed in the production of Chupadero Black-on-white represents a large community of practice that spanned

several centuries, bound together by a "canon" of design traits (Phillips 2012). Phillips' (2012) use of the word "canon" is based on *habitus:* "principles which generate and organize practices and representations that can be objectively adapted to their outcomes" (Bourdieu 1990:53). A canon is then a set of formal rules that a community of practice uses as a guide in the manufacture of an item of material culture (Phillips 2012:35). I argue that the community of practice, represented in the standardized production of Chupadero Black-on-white, represents active decisions made during the production process to maintain social cooperation and/or membership (Carr 1995a:160; Wiessner 1983).

Typology

Chupadero Black-on-white (AD 1050-1550) is considered a Cibola whiteware (Mera 1931; Wiseman 1986). It appears to have developed from a combination of artistic traditions in west-central New Mexico, including Reserve, Tularosa, Red Mesa, Puerco, and Cebolleta. Early researchers considered it a descendent of Socorro Black-on-white as the two types share many similar design attributes; however, recent research has indicated that Socorro and Chupadero developed at the same time as two separate, but related, types (Wiseman 2014:25). The production of Chupadero Black-on-white has several unique traits not observed among other Southwestern whitewares, which make identification of sherds in an assemblage relatively straightforward. Both the bowl and jar form were started with a flat disc, sometimes referred to as a pancake (Clark 2006). From the disc, coils were added and built up, then smoothed. Bowl exteriors and jar interiors are striated in the smoothing process (Figure 4), with an as yet unknown tool, which leaves distinct markings on the interior of jars and the exterior of bowls. The handles are made of two or three ropes of clay and are punched through the surface of the jar and then smoothed on the inside, giving them unusual strength.

Figure 4. Striated side of a Chupadero sherd.

Bowl designs are continuous from rim to base, usually with divisions into four sections; however, divisions of three, five, and six sections have been observed (Figure 5). The centers of bowls are often empty, but geometric designs such as crosses, sun images, and figurative decorations have been noted (Hayes, et al. 1981:71). The decoration on jars always includes a

band around the largest portion of the jar and one around the neck (Figure 6), although jars have been noted without the neck band (Hayes et al. 1981:70). The two bands are never connected, leaving a blank area between the neck and the largest portion of the vessel (Hayes et al. 1981:70). The lower band never reaches the bottom of the jar, leaving an undecorated area near the bottom.

Figure 5. Chupadero Bowl from LA 5380 (Museum of Indian Arts and Culture Cat. No. 46345/11; photo by the author).

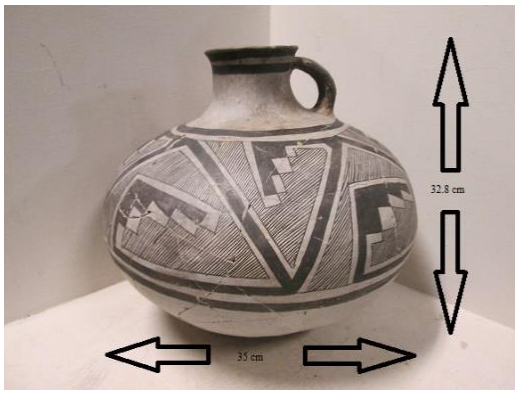

Figure 6. Chupadero Jar from LA 16297 (Museum of Indian Arts and Culture Cat. No. 51011/11; photo by the author).

Previous research suggests that the designs are almost universally geometric, with solid sections opposing hatched sections, divided by areas of empty space. One of the unique elements of the Chupadero painted design canon is the use of opposing saw-toothed patterns to create rhomboid shapes (Figure 5). The opposing areas are almost always alternately solid and hatched, with the empty or negative space in between creating the rhombus. The hatching is a clear inheritance from Cibola Whiteware (Wiseman 2014).

Data Collection

Methods

To examine whether Chupadero Black-on-white changes through time and across space, I recorded and then statistically analyzed high and low visibility attributes (Carr 1995a:154; Clark 2006:226) (see Table 1). High visibility attributes are defined as those attributes easily seen with the naked eye (i.e., painted design and placement of design). The objects conveying the attributes must be "widely distributed" spatially for maximum effect, and the objects, when seen, must be in either early or very late stages of production (Carr 1995b:174; Clark 2001:12). The visibility of the attribute is linked to its ability to convey information (Wobst 1977:330). The greater the visibility of an artifact and its attributes, the greater is its potential to communicate with a larger audience. Low visibility attributes are those which are not immediately apparent to the naked eye (i.e., vessel wall thickness, rim form). Artifacts from seven sites (Table 2), drawn from across the Chupadero Black-on-white production area (Figure 1), were analyzed for this project.

Table 1. Attributes for Analysis of Chupadero Black-on-white.

Low Visibility Attributes	High Visibility Attributes
1. Vessel Form	8. Hatching and solid
2.Sherd thickness	9. Points touching
3. Part of vessel	10. Line thickness
4. Rim form	11. Checkerboards
5. Slip	12. Spirals and commas
6. Striations on unpainted side	13. Sun designs
7. Position of design	14. Dots

Table 2. Sites used for Data Collection.

LA #	Site Name	Region	Dates	Manufacturing Site?	Museum
38448	Kite	Salinas	A.D. 1000-1200	Yes	Museum of New Mexico
176565	Hiner	Sierra Blanca	A.D. 1100-1300	Yes	Maxwell Museum of Anthropology
16297	Filingen	Sierra Blanca	A.D. 1100-1350	No	Museum of New Mexico
3334	Angus	Sierra Blanca	A.D. 1100-1400	Yes	Museum of New Mexico
12480	Mescalero Sands	Sierra Blanca	Archaic-A.D. 1450	No	Blackwater Draw Museum
1537	Phillips	Sierra Blanca	A.D. 1250-1450	Yes	Museum of Texas Technical University
120	Gran Quivira	Salinas	A.D. 1275-1650	Yes	NPS Western Archaeological and Conservation Center

Low Visibility Attributes

Vessel Form. My analysis of the Chupadero design canon began by determining whether the sherd was from a bowl or a jar. Each sherd was measured using a standardized chart of concentric squares starting at 4 cm^2 and increasing by 2 cm^2. Only sherds measuring 4 cm^2 or greater were used because clearly defining design elements on a sherd smaller than this is difficult. In addition, sherds where the design elements were obscured through deterioration were not used in this study. A total of 2,274 sherds were catalogued. Of the sherds catalogued, 858 (38%) were bowls, 1,406 (62%) were jars, and 10 (<1%) were unidentifiable forms (Table 3).

Rim Shape. Chupadero bowls are made in two varieties: one is a large open bowl, with rims that are either rounded, squared, or beveled, and a smaller bowl with everted rims (Figure 7). Chupadero jars universally have everted rims. Of the jar sherds, 102 were rim sherds; of the bowl sherds, 285 were rim sherds. If the sherd was from a rim, I then determined the shape of the rim (Figure 7) and the estimated size of the vessel the rim sherd represented.

Table 3. Sherd Counts by Site.

	Kite	Hiner	Filingen	Angus	Mescalero Sands	Phillips	Gran Quivira
Jars	120	462	71	196	24	332	201
Bowls	119	280	21	56	29	194	159
Other	1	2	2	0	0	5	0
Total	240	744	94	252	53	531	360

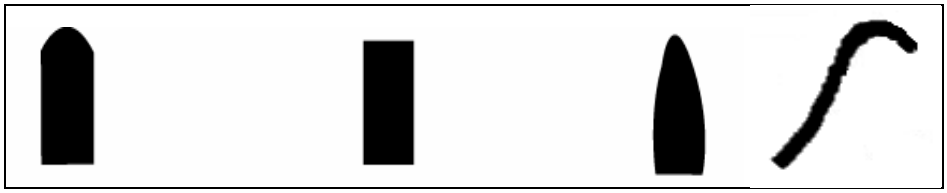

Figure 7. Chupadero bowl rim shapes.

During cataloguing, all rim sherds were classified using Figure 7 as a guide; the results are reported in Table 4, with the sites arranged chronologically by the date of end of occupation. Using a vessel diameter chart, I estimated the potential diameter of the bowls represented by each rim sherd. Most of the rim sherds, 78% or n=222, were of the larger variety of bowl. These bowls had a mean diameter of 23.44 cm. The smaller bowls all have an everted or rolled rim (Figure 7). There were 63 sherds of this type of bowl catalogued. They had a mean diameter of 16.81 cm.

Table 4. Percentages of Bowl Rim Shapes by Site

	N =	Bowls		Rim Sherds		Squared		Rounded		Beveled		Everted	
Kite	240	119	50%	29	24%	20	68%	7	24%	0	0%	2	<1%
Hiner	744	277	37%	117	42%	94	80%	0	0%	0	0%	23	20%
Filingen	94	21	22%	5	24%	5	100%	0	0%	0	0%	0	0%
Angus	252	56	22%	17	30%	10	59%	0	0%	5	29%	2	12%
Mescalero	53	28	53%	8	29%	4	50%	3	38%	1	12%	0	0%
Phillips	531	194	37%	63	33%	21	33%	1	2%	23	36%	18	29%
Gran Quivira	360	159	44%	46	30%	4	55%	1	1%	23	32%	18	25%
Total Assemblage	2,274	854	38%	285	33%	158	55%	12	4%	52	18%	63	22%

Vessel Wall Thickness. As previously noted, Chupadero Black-on-white was made in the coil and scrape method. Because Chupadero vessel wall thickness was controlled entirely by hand,

any lack of variation in vessel wall thickness suggests standardization (Costin 1991; Rice 1987; Sinopoli 1988). Each sherd was measured for thickness using a hand held digital gauging caliper. Each sherd was measured at three random points; the resulting measurements were then averaged. I catalogued a total of 2,274 sherds from the seven different sites. Clark (2006:251) reported that the mean sherd thickness in her study of Chupadero production (n = 4,146) was 5.7 mm for jars and 5.8 mm for bowls. Of the sherds examined in this study (n = 2,274), the mean sherd thickness for jars was 5.7 mm and 5.8 mm for bowls. Table 5 details the descriptive statistics of vessel wall thickness from each site.

Table 5. Descriptive Statistics of Chupadero Vessel Wall Thickness.

Site	n =	Mean	Median	Mode	s.d	CV
Kite	240	5.5275	5.5	5.3	0.6867	12.42
Hiner	744	5.9813	5.9	5.5	0.8439	14.11
Filingen	94	5.7989	5.9	5.9	0.4597	7.93
Angus	252	5.6218	5.6	5.2	0.8305	14.77
Mescalero	53	5.7580	5.8	5.8	0.8200	14.24
Phillips	531	5.6803	5.6	5.5	0.7061	12.43
Gran Quivira	360	5.9089	5.8	5.9	0.7860	13.30

Figure 8 shows a box and whisker plot comparing the assemblages from each site. The sites are again arranged chronologically. There is an 8 percent, or 0.4 mm, change in wall thickness between the Kite site (A.D. 1000-1200) and Gran Quivira (A.D. 1300-1550). There is almost no difference in the mean, median, and mode of the sherd thickness from each site (Table 5). Only Filingen shows a different (and much smaller) coefficient of variation (CV). Filingen has the smallest range in the variation of sherd thickness. Mescalero Sands, which is not identified as a manufacturing site, shows a CV consistent with the other sites.

Mescalero Sands (LA 12890) has been identified as a possible site for Pueblo-Plains interaction. Pots from a variety of production loci would likely have been present. These findings show a high degree of uniformity in vessel wall thickness, consistent with that found within and between sites in the Salinas and Sierra Blanca regions (Clark 2006:252), and through the five-hundred-year period explored in this study. From the beginning of occupation at the Kite site (ca. A.D. 1000) to the end of Chupadero manufacture at Gran Quivira (ca. A.D. 1550) there appears to be little difference in the manufacturing process of Chupadero Black-on-white, as reflected by comparing mean vessel wall thickness.

Scoring. Scoring, or striations, is a peculiar trait unique to Chupadero Black-on-white production (Figure 4). It is always found on the unpainted side of the vessel, the outside of bowls and the inside of jars. In this sample 92% (n=2,100) of the vessels had scoring on the unpainted side.

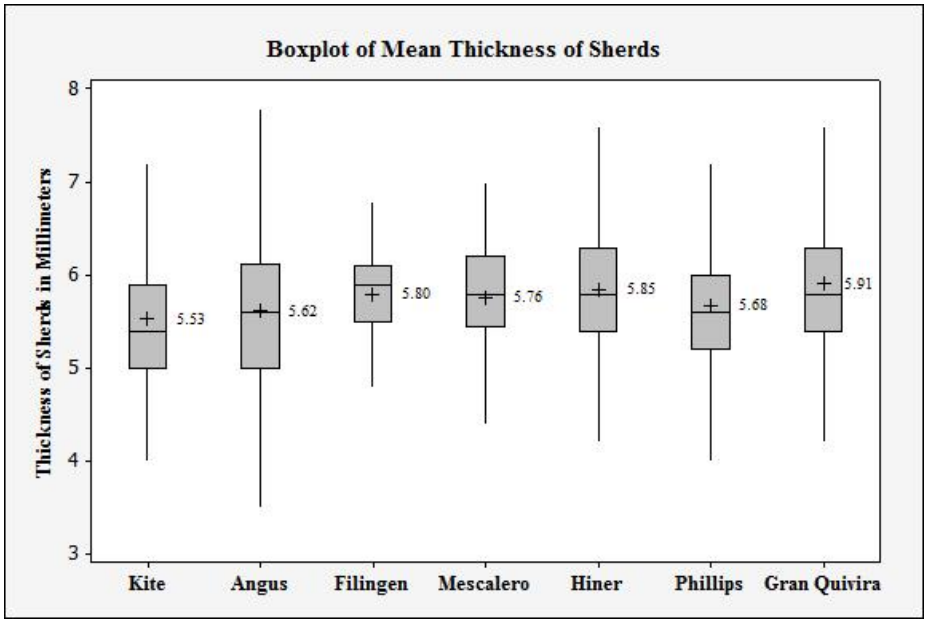

Figure 8. Boxplot of mean Chupadero vessel wall thickness by site.

Slip. The slip used on Chupadero Black-on-white ranges from a chalky white to gray. Many vessels are self-slipped or floated (Rice 1987:151), which has led some researchers to say that a large proportion of vessels are un-slipped. In this research, slipped refers to both floated and applied slip. Slipping ranged from a low of 65 percent at Angus to a high of 97% at Mescalero Sands. Mescalero Sands is a small sample and is possibly a point of exchange between Plains and Pueblo people. It may be that slipped pots were of more value than un-slipped. This is an area for further investigation that will be discussed below. The overall occurrence of slipped sherds was 78% (or n=1,766) for all the sites investigated.

In terms of low visibility attributes, vessel form appears to be the main source of variability in the sherds used in the data base; 62% (n=1,406) are jars sherds, 38% (n=858) are bowls sherds, <1% (n=10) are other. Additional multivariate analysis showed no significant variation in the low visibility attributes.

High Visibility Attributes

The most visible attribute is the painted design. To ascertain the similarity (or lack of similarity) in Chupadero painted designs through time, I examined the attributes listed in Table 6. Attributes were chosen based on previously successful design analyses (Clark 2006; Kintigh 1985; Wiseman 1986). Because the chosen attributes are easily observed and highly characteristic of Chupadero Black-on-white (Wiseman 1986), they represent high visibility traits (Carr 1995b; Clark 2001). The painted design represents the most visible evidence of a choice made on the part of the artist making the vessel; therefore, any change (or lack of change) through time and across space is key to understanding the community of practice that made

Chupadero. The relative frequency of these attributes represented in the total ceramic assemblage as well as the ceramic assemblage from each site is catalogued in Table 6.

Table 6. Frequency of Chupadero High Visibility Design Attributes

	n =	Checker boards		Points Touching		Points Opposed		Spirals& Commas		Suns		Dots	
Kite	240	7	3%	36	15%	17	7%	7	3%	2	<1%	10	4%
Hiner	744	45	6%	210	28%	15	2%	7	1%	30	4%	38	5%
Filingen	94	4	4%	23	24%	19	20%	5	4%	0	0%	0	0%
Angus	252	13	5%	49	19%	48	19%	3	1%	0	0%	5	2%
Mescalero	53	0	0%	13	25%	8	15%	0	0%	1	2%	4	8%
Phillips	531	32	6%	85	16%	133	25%	27	5%	5	1%	16	3%
Gran Quivira	360	25	7%	115	32%	54	15%	11	3%	10	3%	29	8%
Total Assemblage	2,274	126	6%	531	23%	294	13%	60	3%	48	2%	102	4%

Note: Many sherds displayed more than one attribute; percentages can add up to more than 100%.

The most prevalent attribute of Chupadero painted design is the opposing of solid and hatched saw-toothed points, either touching or in opposing pattern (Clark 2006:229; Wiseman 1986:25). It should be noted that I only catalogued a sherd as points touching when it was visible on the sherd. It is possible that some of the sherds catalogued as "points opposing" were touching, but not visible because of the size of the sherd. Overall, this design element, combining both states, touching and opposing, was present on 36% of the total sherds catalogued (Table 6). This ranged from a high of 47% at Gran Quivira to a low of 22% at Kite. The remaining prominent design elements, checkerboards, dots, spirals and commas, and suns, all appear at 8% or less in varying frequencies. This pattern of distribution does not appear to change between the sites when arranged chronologically (Table 6).

To assess the similarity level of the painted design attributes between each site, I performed a Cluster Analysis (CA). CA is a form of data mining that divides data into groups or clusters based on levels of similarity (Tan, et al. 2006:490). It can use various algorithms and is often a starting point for further analysis. The fewer the clusters the greater the similarity, which can be an indicator of a high degree of specialization (Costin 1991:35; Sinopoli 1988:590-593). The high visibility attributes were used (see Table 1). Using the raw data with standardized variables (log base 10), Ward linkage, with Euclidean distance, the result is seven clusters. A similarity level of 96 or greater is seen in 2,165 observations with a low average Euclidean distance. Because some of the attributes are recorded in different states, this result may be anomalous. I then placed the data into a contingency table aggregating the presence and absence numbers of the various attributes by site (Table 7) and performed a second cluster analysis. This produced 2 clusters with a high similarity level (Figure 9).

Table 7. Contingency Table of High Visibility Attributes

Site	Checker board Present	Checker board Absent	Points Touch	Points Do Not Touch	Points Absent	Spirals Present	Spirals Absent	Sun Present	Sun Absent	Dots Present	Dots Absent
Kite	9	231	37	18	185	7	233	10	230	9	231
Hiner	50	694	208	19	517	8	736	30	714	37	707
Angus	14	240	48	50	154	3	249	2	250	4	248
Filingen	4	90	23	20	51	4	90	0	94	0	94
Mescalero	0	53	13	9	31	51	2	52	1	3	50
Phillips	33	498	83	132	316	22	509	6	525	17	514
Grand Quivira	28	332	119	53	188	6	354	10	350	30	330

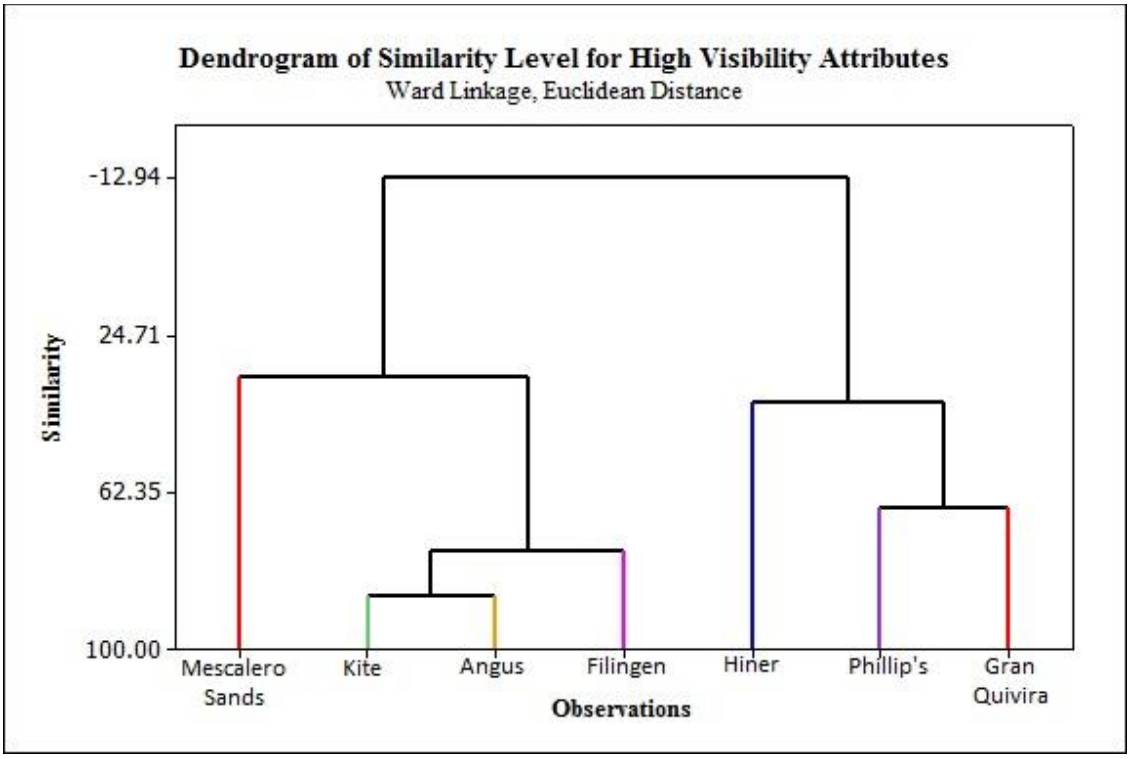

Figure 9. Dendrogram of Chupadero high visibility attributes for studied sites.

To further confirm the similarity of Chupadero production, I also conducted a Principal Component Analysis (PCA) of the same high visibility attributes used in the cluster analysis. PCA is a technique that emphasizes variation and brings out strong patterns in a dataset (it is referred to as Exploratory Data Analysis). It is used to visualize data, as it places variables in a linear projection using an X-Y scale. The goal of principal component analysis is to explain the maximum amount of variance with the fewest number of principal components (Powell 2016). The Principal Component Analysis of the same contingency table shows eigenvalues of 90% in the first two components and 100% in the first four components (Table 8).

Table 8. Principal Component Analysis of High Visibility Attributes

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
Eigenvalue	7.8566	1.8514	1.0273	0.2345	0.0264	0.0039	0	0	0	0	0	0
Proportion	0.714	0.168	0.093	0.021	0.002	0	0	0	0	0	0	0
Cumulative	0.714	0.883	0.976	0.997	1	1	1	1	1	1	1	0

As a final test to look for variability, I conducted a PCA of all the attributes collected, both high and low visibility (see Table 1); the score plot of this is shown in Figure 10. One would expect to see individual clusters from each site with some overlap. However, this plot shows the vast majority of data points as overlapping each other in one large cluster, with a few outliers. The majority of the outliers are from Hiner. I would argue that the outliers are the result of individual variations on the part of potters at Hiner (see Natker 2016). The remaining data points show a remarkable similarity in both high and low visibility attributes.

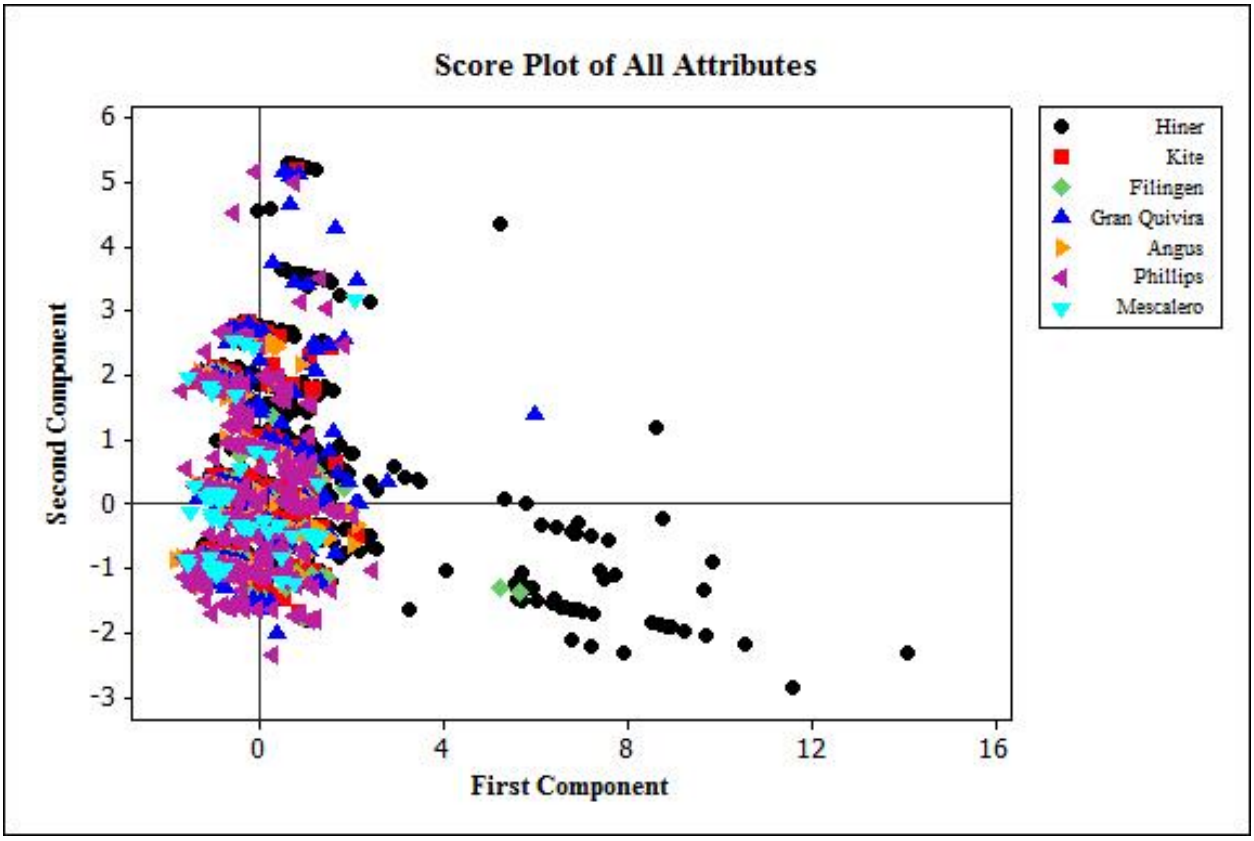

Figure 10. Principal component analysis of all attributes.

Analysis

The attributes used in this research are meant to explore whether Chupadero potters attempted to mark social boundaries through high visibility traits, and whether potters drew from a collective pool of knowledge, a canon, that conveyed how to make and finish a Chupadero vessel. I argue that the uniformity seen in Chupadero decorative and technological style over time and through space is the visual declaration of communal concepts of social identity that linked the highly dispersed populations of central New Mexico, starting in the late Pueblo II period.

Practice Theory (Bourdieu 1977, 1990) uses empirical observation and comparative approaches based on ethnographic research to characterize ceramic production. Artisans producing ceramics have great latitude in the production process and must make a series of technical choices that determine the appearance of the final product (Stark 2003:211). Situated learning theory, in which novices become journeymen and then masters, is based on the premise that the relationships which are the basis of this type of learning are in constant renegotiation (Lave and Wenger 1991). The entire manufacturing process creates a measurable entity that can be called technological style. Every gesture used in production to make a pot requires instruction, demonstration, and critique to move the apprentice towards the standards that conform to the community's expectations (Crown 2014:74; Cordell and Habicht-Mauche 2012:40; Gilpin and Hays-Gilpin 2012:45). The community of practice that produced Chupadero Black-on-white, I argue, is unique in the Greater Southwest.

There are three areas of ceramic production that ethnoarchaeological research has observed in the transmission of knowledge: clay preparation, shaping, and decoration. Clay sources are seemingly always inherited, whether ethnographically (Gosselain 2008; Stark 1991) or historically at modern pueblos (Bunzel 1929; McChesney 2003). The preparation and specific recipes of clay for pottery manufacture are often closely guarded secrets. For information on Chupadero clay sources, see Creel, Williams, Neff, and Glascock 2002 and Clark 2006. In addition, shaping techniques in some contexts are considered a "heritage" and only transmitted when the apprentice is deemed worthy, and only to someone who is part of their lineage (Gosselain 2008:161; McChesney 2003:426). At modern day Hopi, the knowledge of the techniques for pottery making is inherited. It can also be passed on to women who have married into the community; however, these women do not personally own the knowledge and may not be privy to all of the knowledge (McChesney 2003:427). In modern Pueblo history, the lineages of Nampeyo at Hopi, Maria Martinez at San Ildefonso, and Lucy Lewis at Acoma are testimony to this heritable tradition in Puebloan life documented historically by Bunzel (1929). In the Chupadero production area, the lack of change in technical style can be observed in three specific areas: a) Form—the same bowls and the same jars over the period of production, b) rim shape—the same rim shapes for the entire duration of production (Table 4), and c) vessel wall thickness—a remarkable consistency through time and across space (see Table 5 and Figure 8). These attributes, coupled with specific clay recipes at specific production loci (Clark 2006:166), imply that Chupadero was the product of a long lineage, one that had to be inherited. This type of production implies familial or "nucleated" groups and takes place in or near the domestic space occupied by the group (Costin 1991:29). The ownership of clay sources and technological

skills by a social group, such as a clan or extended family group, with members ranging over several Pueblo communities, in a system of community specialization, could account for the long-term stability seen in Chupadero (Gosselain 2008; Lyons and Clark 2012; Stark 1991).

The similarity in painted design attributes is yet another indication of a large community of practice with membership in many Pueblo communities. Table 6 shows the frequency which Chupadero design attributes were used at the various sites investigated. The dominant element in all assemblages is opposing areas of solid and hatched points. I am not implying that Chupadero designs were carbon copies of each other. Rather, I argue that there is a basic design repertoire that is maintained throughout time and space. To be sure, there is some variation. The other traits (dots, suns, spirals and commas, and checkerboards) are accents but are still part of a limited repertoire available to the potter.

Active, conscious choices in craft production can create an environment that regulates the social fabric (Carr 1995b:176; Conkey 1990:10). Material culture becomes symbolic and can function to promote the group's identity and cohesiveness, as well as maintaining internal and external boundaries (Sackett 1990:36). "Material culture is a symbolic system whose meaning is communicated through the culturally specific aspects, such as shapes, colors, or textures" (Conkey 1990:13). In the case of Chupadero, it is these shapes and textures that became the canon that identifies the community of practice producing Chupadero (see Phillips 2012:35). The choices made in the production of Chupadero Black-on-white can be seen as the expression of social information and the enhancement of social interaction (Carr 1995a:158; Hegmon 1992:522; Kintigh 1985:36).

Sharing Knowledge. The question remains: How did they pass on the knowledge for pottery making? Even as a lineage, the spatial distance represented by Chupadero production implies contact on a regional level in order to pass on knowledge. I argue that it was the need for exchange goods that drove the learning community. When the community lacks what is needed for subsistence, specialization can develop to promote the making of exchange goods (Costin 1991:12). The exchange of Chupadero ceramics to Plains people was well documented by the Spanish (Kenner 1969:11-12) and by modern archaeology (Creel, Williams, Neff, and Glascock 2002; Rautman 2014; Speth 2008; Spielmann 1996, 2002; Vivian 1961). The Salinas Pueblos were still active at the time of the Spanish Entrada (Hayes et al. 1981; Kenner 1969; Vivian 1961). Artifacts at the Bloom Mound excavation near Roswell, including turquoise, Edwards Plateau chert, and Chihuahuan pottery, have been taken to imply interaction with Plains groups, as well as Chihuahuan groups and groups to the west (Kelly 1984:44; Speth 2008:42-43; Speth and Newlander 2012:153-154). Mescalero Sands (LA 12890) is included in this study as another possible locale of Plains-Pueblo interaction. As a heritable commodity, pottery techniques become part of kinship relationships and are passed on via marriage to appropriate partners (McChesney 2003:426; Wolf 1982:91-93). Marriages were likely arranged between villages at interaction sites shared by ethnically compatible groups for exchange with outside groups. I would argue that technological information needed to make Chupadero pottery was passed on in a similar way at exchange sites, such as Bloom Mound, Gran Quivira, and possibly Mescalero Sands.

Ethnoarchaeological data suggest that communities of practice can exist at multiple scales (Gosselain 2008). Wolf (1982) finds kin-ordered production on large regional scales. Chupadero production lasts for nearly 500 years and takes place over an area of nearly 9000 sq. miles. In Melanesia, such patterns of production and exchange have been found to have considerable time depth, dating back before contact with Europeans (Stark 1991:72). The fact that Chupadero production is essentially the same throughout its production area suggests continuity in the sharing of information among potters for the entire duration of Chupadero manufacture and throughout the entire regional production area. It is a regional system likely linked through kinship, alliances, and worldview. Such linked regional systems have been described as a "community of culture" engaged in community level specialization (Stark 2006:26). I argue that what is visible in the Chupadero production area is this type of community-level specialization.

Conclusions and Future Research

This research adds to a growing body of data (Clark 2006; Hayes et al. 1981; Kelley 1984; Wiseman 1986, 2014) that suggests that Chupadero Black-on-white production is uniform throughout its various production loci and time parameters. How people learn and how they transmit that learned knowledge is the essence of a community of practice (Minar and Crown 2001; Cordell and Habicht-Mauche 2012). The consistency of style traits in Chupadero Black-on-white suggests a large community of practice continuing for a very long time—a canon of traits passed on through generations and across a large geographic region. How was this information passed on and why? Historical evidence from the Spanish indicates that the Tompiro speakers of the Salinas region were engaged in active trade with Plains tribes well into the seventeenth century (Vivian 1961:9-10). The accounts of the Spanish do not detail how this trade was carried out, but we can envision a coming together similar to what was seen historically at Pecos, large populations trading together for long periods of time. These "trade fairs" would have been an opportunity for the producers of Chupadero to meet and to instruct younger members in the details of Chupadero production. The Chupadero jar became iconic; it was likely an easily identifiable item at a trade fair. As time went on the clearly successful exchange ware became a case of "if it ain't broke, don't fix it."

More research needs to be done throughout the loci of Chupadero production to determine if there are yet unseen patterns in the production of Chupadero Black-on-white. Further research may include going back over previously documented collections with an eye to looking for anomalous traits. Using style to explore communities of practice gives us a richer understanding of the social life and social interactions of the prehistoric and protohistoric peoples of the Greater Southwest. The further addition of social theory, based on communities of practice, can make our understanding of these peoples richer and more diverse and help us to see them within the complicated human society they inhabited.

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FIRST EVIDENCE OF THE USE OF CACAO AT TWO JORNADA MOGOLLON PUEBLOS IN THE SOUTHERN TULAROSA BASIN, NEW MEXICO

Alexander Kurota[1], Timothy J. Ward[2], Thatcher Rogers[1], Anna Wilson[2], Zahra Faizi[2], Andrew Hollenshead[2], Jacob Niehaus[2], and Shivangi Patel[2]

[1]Office of Contract Archeology, University of New Mexico, Albuquerque, NM
[2]Millsaps College, Jackson, MS

Recent archaeological test excavations at Jornada Mogollon sites in the southern Tularosa Basin on White Sands Missile Range have brought about an important and exciting discovery. Two El Paso phase melted adobe roomblock structures were partially exposed by a University of New Mexico Office of Contract Archeology field crew. A sample of 32 ceramic sherds recovered from the two structures was submitted for chemical residue analysis to assess a possible presence of cacao residue. The results of analysis indicated that three ceramic sherds exhibited chemical traces consistent with cacao. Cacao (*Theobroma cacao)* is a tropical plant that grows in southern Mexico and other regions of Mesoamerica, but not in southern New Mexico. The cacao plant grows into a medium size tree that produces hard-shelled pods filled with beans that can be ground to produce cacao powder (Figure 1).

Figure 1. Cacao beans inside a pod (image is public domain).

Initially, it was thought the consumption of cacao was intended only for the ritual purposes of society elites, like those among the ancient Chacoans at Pueblo Bonito (Crown and Hurst 2009). Further research, however, has identified cacao-like residue on sherds dating between approximately AD 800 to AD 1450 at several sites across the Southwest (Crown et al. 2015). Research indicates that cacao consumption was not restricted solely to Chaco elites, and has been identified in the Mogollon, Hohokam, broader Ancestral Pueblo, and Casas Grandes regions of the Greater Southwest (Crown et al. 2015).

According to Crown and others (2015), three chemical compounds are used as evidence for the presence of cacao—caffeine, theobromine, and theophylline (Figure 2). The residue analysis of ceramic sherds from the two El Paso phase Jornada Mogollon pueblos by Dr. Timothy Ward and other Millsaps College researchers identified three sherds that have all three compounds present (Wilson et al. 2018). This is the first evidence for cacao consumption in the Jornada Mogollon region. These results compare favorably to Crown and other's (2015) argument that cacao consumption became more widespread in the prehispanic Southwest, in this case during the late AD 1400s.

One of the sherds with cacao residue was a Lincoln Black-on-red bowl rim sherd from Olivella Pueblo (LA 150925). The other two sherds that were positive for all three chemical compounds were an El Paso Polychrome bowl rim sherd and a Chupadero Black-on-white jar body sherd, both of which came from the North Roomblock Complex at West Dry Lake Pueblo (LA 104864).

To prevent contamination of the samples with modern cacao products, OCA ceramic analysts wore rubber gloves at all times while handling the ceramics. Additionally, the chemical analysts at Millsaps College removed the outer layer of the sherds and the analysis was performed on the inner matrix of the ceramics.

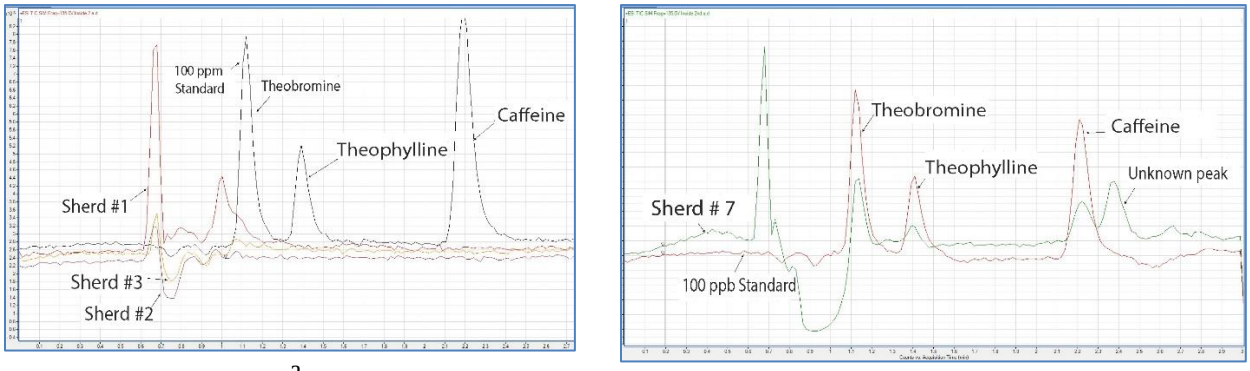

Figure 2. Examples of chromatograms showing analysis results: (a) sherds No. 1, 2, and 3 with no positive cacao residue; and (b) sherd No. 7 with positive cacao residue.

The fact that the residue was identified in both bowl and jar sherds suggests preparation, consumption, and perhaps storage of the cacao drink. Chupadero Black-on-white jars were typically made with a narrow orifice diameter which would make the jars excellent liquid transport and storage containers. It is possible then, that the cacao drink may have been transported or stored in such a vessel. By contrast, finding traces of cacao inside the Lincoln Black-on-red and El Paso Polychrome bowls suggests that such vessels were probably used for the direct consumption or production of the drink.

A variety of Chihuahuan polychrome ceramic types, diverse marine shell ornaments, and a small collection of copper ornaments have been previously recovered at El Paso phase Jornada Mogollon sites, indicating strong exchange networks with cultures south of the international border. It is now clear that the trade networks extended deeper into the tropics from where cacao beans or cacao powder were transported to the pueblo villages of the southern Tularosa Basin.

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TWO NOTABLE CERAMIC ARTIFACTS RECENTLY IDENTIFIED IN THE TULAROSA BASIN, NEW MEXICO

Alexander Kurota and Thatcher A. Rogers
Office of Contract Archeology, University of New Mexico

Two notable ceramic artifacts were identified during recent archaeological test excavations at West Dry Lake Pueblo (LA 104864) on White Sands Missile Range in the southern Tularosa Basin. One of them is Lincoln Black-on-red Coiled Variety, a new variant of Lincoln Black-on-red, while the other item is a possible ceramic altar pedestal. Both ceramic artifacts were uncovered from within Feature 146, a late El Paso phase melted adobe room that was repurposed as a midden in the late 15th century, post-abandonment (Kurota et al. 2018a).

The Lincoln Black-on-red sherd was uncovered during a test excavation of Feature 146 at West Dry Lake Pueblo (Figure 1a). The sherd came from a bowl with an unrestricted direct rim and exhibited at least one unobliterated coil on its exterior. Because of the small size of the sherd, it is impossible to assess whether more such coils were present on the exterior of the bowl. The interior is decorated with three purplish-black paint lines which resemble Three Rivers Red-on-terracotta designs, although the paint color tends to be more red or pink-red on such specimens. The estimated rim diameter for the original bowl is 30 cm, making it one of the largest bowls identified during this project (Kurota et al. 2018a). The Coiled Variety of Lincoln Black-on-red shares similarities with two recently recognized ceramic types with rare exposed coiling on the exterior—Chupadero Black-on-white Coiled Variety (Kurota and Smith 2018) and Exposed-Coil Rio Grande Glazeware (Franklin et al. 2018). The latter has been identified in several ceramic assemblages from Pottery Mound (LA 416), Kuaua (LA 187), Chamisal Pueblo (LA 22765), and Giusewa (LA 679), among other preeminent Middle Rio Grande and nearby sites. All three unique variant ceramic types mentioned date to AD 1300-1450.

Figure 1. Two ceramic objects from West Dry Lake Pueblo (LA 104864). (a) Lincoln Black-on-red Coiled Variety bowl rim sherd. (b) Molded and fired clay lump with a probable "feather hole" possibly used as an altar pedestal.

Chupadero Black-on-white Coiled Variety bowls have also been documented at the Adams Corona Ranch Site (LA 176561; Sierra Blanca region), and at Cottonwood Spring Pueblo (LA 175, west of the San Andres Mountains) (Kurota and Smith 2018), where approximately 80 specimens were identified. Coincidently, West Dry Lake Pueblo is the type site for Chupadero Black-on-white Coiled Variety, with 11 different sherds identified in a prior ceramic assemblage analyzed as part of the site's initial evaluation (Kurota and Smith 2018). Future investigations are needed to assess whether this represents an intentional practice by the inhabitants of West Dry Lake Pueblo to import bowls with rare coiled exteriors.

In addition to the Lincoln Black-on-red Coiled Variety sherd, a ceramic specimen that could have been used as an altar pedestal was also recovered at the site (Figure 1b). The possible altar pedestal is a brownware ceramic that was molded into a small pear-like shape with a single impressed hole at the top. The altar pedestal has indications that it was placed on objects due to its flattened base with indicators of wear. The pedestal shares strong similarities with some crenellated bowl fragments that are hypothesized to have held feathers (Kurota et al. 2018b; Miller and Thompson 2015).

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Exhibits and Events

Arizona State Museum presents "Life Along the River" displaying pottery from the Holomovi Excavations through June 29, 2019. For further details visit: http://www.statemuseum.arizona.edu/exhibits_events

The **Society for American Archaeology** 84th Annual Meeting will be held in Albuquerque from April 10th to April 14th, 2019.

The **Archaeological Society of New Mexico** Annual Meeting will be held at the Murray Hotel in Silver City from April 26th to April 28th, 2019. The theme of the conference is "Mimbres and Beyond: Archaeology of Southwest New Mexico and Connections to the Wider Region." Online registration is available. Registration form, hotel and restaurant information, field trip details, calls for papers and posters, and vendor application forms can be found at www.gcasnm.org. Early hotel reservations are advised. Direct questions to wmhudsonarch@yahoo.com.

The **Society for Cultural Astronomy in the American Southwest** will host a conference themed "Land and Sky in the Cultural Sciences of the Greater Southwest" at Northern Arizona University, Flagstaff from April 24th to April 28th, 2019. Contact conference@scaas.org for further information.

The **Tularosa Basin Conference** will be held at the Tularosa Community Center in Tularosa, NM May 17th and 18th, 2019. See the Jornada Research Institute website www.jornadaresearchinstitute.com for details on the conference.

The **Southwest Kiln Conference** will be held this year in Globe, Arizona at Gila Pueblo, Besh Ba Gowah and the Timber Camp Recreation Area of the Tonto National Forest from October 4th to October 6th, 2019. The conference brings together ceramic artists, replicators, and archaeologists in a lively context of discussion and ceramic creativity. See the Kiln Conference website www.swkiln.com for details.

The **21st Biennial Jornada Mogollon Conference** will take place on October 11th and 12th, 2019 at the El Paso Museum of Archaeology in El Paso. Abstracts are due August 31, 2019. Contact George Maloof at MaloofGO@elpasotexas.gov.

CONTENTS

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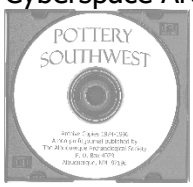

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