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MISSION STATEMENT

Pottery Southwest, a scholarly journal devoted to the prehistoric and historic pottery of the Greater Southwest (*https://potterysouthwest.unm.edu*), provides a venue for students, professional, and avocational archaeologists in which to publish scholarly articles as well as providing an opportunity to share questions and answers. Published by the Albuquerque Archaeological Society since 1974, *Pottery Southwest* is available free of charge on its website which is hosted by the Maxwell Museum of the University of New Mexico.

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Pottery Southwest is a non-profit journal of the Albuquerque Archaeological Society

Pottery Southwest Editor Steps Down

Ramos Polychrome, Casas Grandes area. Catalogue No. 68.13.33. Courtesy of the Maxwell Museum of Anthropology, University of New Mexico.

After 14 years at the helm of Pottery Southwest, M. Patricia Lee has resigned as editor. Patricia, with the aid of other members of the Albuquerque Archaeological Society, and assisted by Dave Phillips and Christine VanPool, revived the moribund publication in 2005 (Lee 2005). Patricia's interest in ceramics was brought to fruition by her study of the Lumholtz Collection from Casas Grandes for her dissertation at The City University of New York (Lee 2013). Patricia was tireless in her encouragement of submissions to Pottery Southwest, indefatigable in her efforts to keep the publication continuing, and a master juggler of the editorial arts. Patricia was largely responsible for the resurrection of Pottery Southwest early in the new millennium and has guided its development and content ever since. With some variable support, Patricia fielded and published four issues a year from 2005 to 2017. In appreciation of her devotion to Pottery Southwest for so many years, Patricia received the Richard A. Bice Award for Archaeological Achievement from the Archaeological Society of New Mexico at its annual meeting in May. Congratulations, Patricia! And many thanks for all your contributions to the success of Pottery Southwest!

Lee, M. Patricia
2005 The Return of Pottery Southwest. *Pottery Southwest* 24(1&2):2-3.

Lee, Patricia M.
2013 Analysis of the Carl Lumholtz Collection of Casas Grandes Ceramic Artifacts at the American Museum of Natural History. Ph.D. Dissertation, The City University of New York.

A TEST OF H. P. MERA'S CERAMIC COLLECTION STRATEGY

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Abstract

In the early 20th century, archaeologist H. P. Mera collected ceramics from hundreds of sites in the northern Southwest. However, the utility of these collections for modern study is debatable (e.g., Franklin 2014) because apparently Mera never described his collection strategy. As part of a study of early pueblos in central New Mexico, we tested whether Mera's ceramic collections could provide more than presence/absence ceramic type information. Comparison of his sherd collections with published data from a later survey that used a systematic, randomized collection strategy confirms that archaeologists can generally rely on the representativeness of the sherd types present in the Mera collections. Using this information, we found that occupation at early pueblo sites in Mera's eastern Piro division likely continued longer into the fourteenth century than did pueblos in the neighboring Jumanos district, a fact that has implications for regional social interactions. This study is very small and localized, however. We recommend that other researchers confirm our findings for their own study areas.

Introduction

Archaeologist Harry P. Mera made numerous surface collections of ceramics from the northern Southwest in the early 20th century. In 2016, we examined some of these museum collections in the Center for New Mexico Archaeology, Santa Fe, as part of a study of early pueblo occupations in central New Mexico. We examined sherds from early pueblo sites in Chupadero Arroyo, an area Mera (1940) called the eastern Piro division. This area is located just west of what Mera termed the Jumanos division of the Salinas Province of central New Mexico (Figure 1).

Given our discovery of social conflict and burning at several Jumanos pueblos on Chupadera Mesa (Chamberlin et al. 2011; Rautman 2014), we wanted to investigate the Jumanos pueblos' neighbors in the eastern Piro division. We already knew that people in both areas were manufacturing Chupadero Black-on-white pottery and trading it with one another (Chamberlin 2008; Clark 2006). However, we wanted to be able to investigate temporal and social relationships between these two areas in more detail.

Our study was hampered, however, by a lack of information about Mera's collection strategy; it seems that he left no published or known unpublished documentation of his surface collection methods. In fact, Franklin (2014:vi) explicitly cautions that that Mera's collections "…obtained from site surfaces were not collected 'scientifically' and did not necessarily reflect a representative sample of the pottery present." It was therefore difficult to know how useful these museum collections would be for any study that concerned assemblage composition or ceramic type representation.

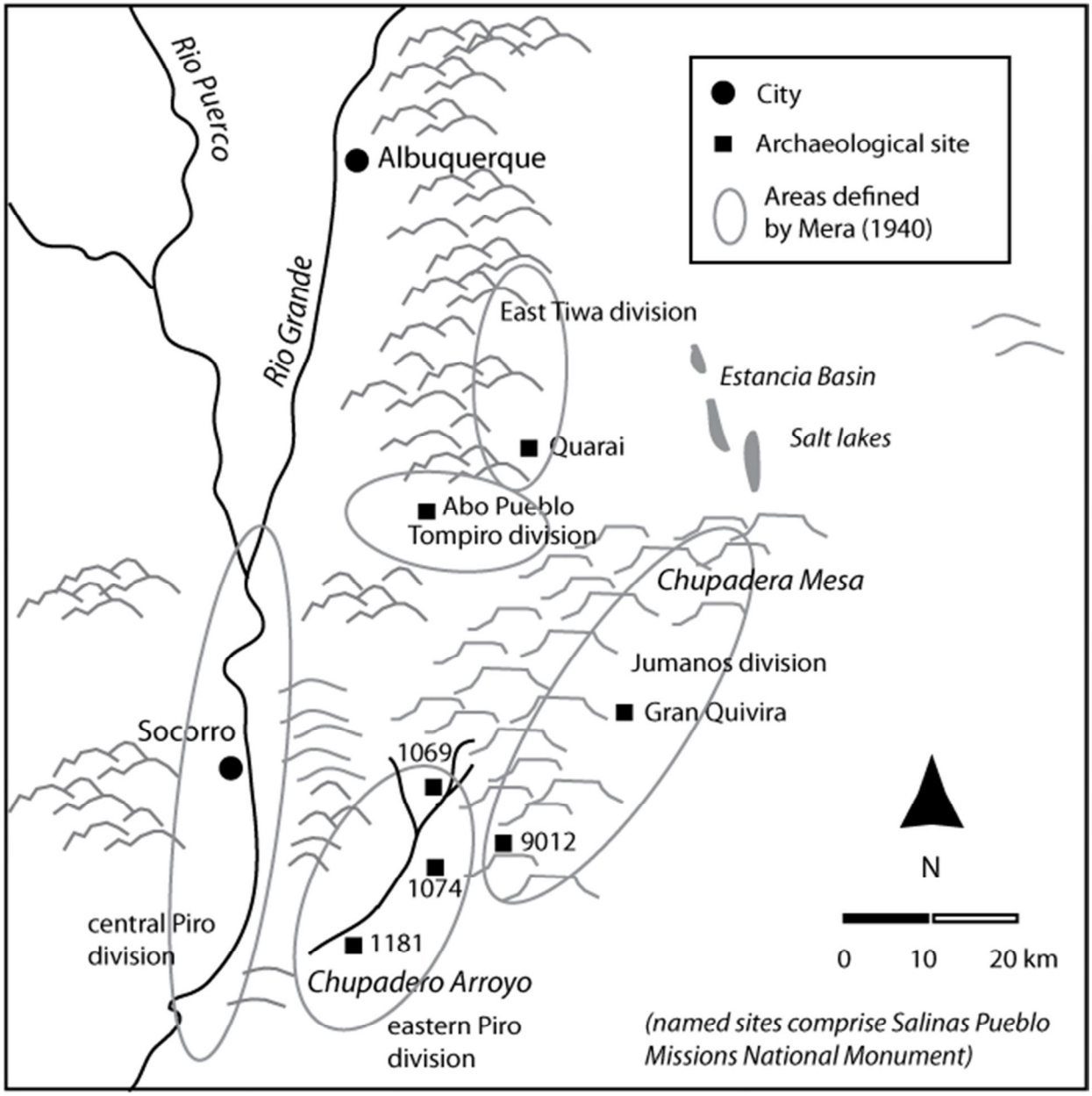

Figure 1. Map showing the location of the ceramic collections. Pueblos of the Salinas Province include those of the Jumanos, Tompiro, and East Tiwa Divisions.

For at least some of Mera's sites in Chupadero Arroyo, however, a later archaeological survey by Eastern New Mexico University included detailed information regarding ceramic collection strategy, along with ceramic type identifications and sherd counts for each type (Kyte 1988; Montgomery and Bowman 1989). Adding our own count data to Mera's handwritten lists of ceramic types from each site, and comparing the information to the published data from some of the same archaeological sites, allowed us to infer more information about Mera's sampling strategy, and to test Franklin's (2014) statement in this one area.

The Research Problem

Early pueblo sites in central New Mexico are distinguished by the presence of at least some Glaze A pottery (Caperton 1981). Mera terms these early pueblo sites "Period I" sites; they are also called "Glaze A pueblos" (Rautman 2014). In central New Mexico, Agua Fria Glaze-on-red is one of the earliest glaze ware types found on pueblo sites. Its manufacture starts about A.D. 1313 and continues for some 150 years (Eckert 2006:37). Based on its presence, we infer that occupation at these sites dates to some period of time after A.D. 1313.

Mera's writings (compiled in Brown et al. 2014) confirm that he used his surface collections to define specific ceramic types (e.g., Mera 1931) and also to obtain evidence about the range of variation in technique, decoration, and manufacturing of a given ceramic type. He used this evidence to infer how different types developed over time (e.g., Mera 1932). In addition, he used this information to track how ceramics and also people moved around the landscape (e.g., Mera 1940).

In central New Mexico (Mera 1940), he used the presence/absence of different glaze wares at eastern Piro pueblos in Chupadero Arroyo to group sites into a temporal sequence: Periods 1 through 5 (now called Glaze A through F; he did not distinguish Glaze B). But his published articles (collected in Brown et al. 2014) do not indicate whether the pottery types noted were common or rare at individual pueblo sites, nor do they reveal the details of his collection strategy. A search of published articles as well as unpublished records (and consultation with various archaeologists) at the Laboratory of Anthropology (Santa Fe) site records office also did not yield any documents that referred to his sampling strategy.

We were concerned that Mera collected only decorated or diagnostic sherds from each site, or that he collected only a small number of representative sherds from each ceramic type. These strategies would result in collections that could be used today for studies of ceramic paste composition, but the collection would not be helpful for determining the relative proportions of the different pottery types at a single site.

For future archaeologists to use his sherd collections in their research, the ideal scenario would be that Mera collected the sherds from each site with an awareness of the principles of random sampling and statistics. Given his initial training in medicine, we thought that it was possible that he would have been aware of these concepts (see biographic information in Frisbie 2014). We asked:

Did Mera collect surface ceramics in a manner that would recover a representative sample of sherds from a given archaeological site? If he did so, we expect that the ceramic type and count data from his collections would be generally similar to those made later from the same sites by archaeologists who used systematic, randomized sampling procedures.

To test this expectation, we compared different ceramic collections that were made at different times from the same sites in Chupadero Arroyo. Our study thus forms an explicit test of Mera's sampling strategy and, by extension, the utility of his collections for further archaeological research that would require a representative sample of sherds from specific sites.

We expected that surface artifact assemblages would exhibit some change over time due to weathering, the actions of various animals (trampling and burrowing), and also casual (illegal) collecting by local passers-by. However, if early and later ceramic collections were made according to similar randomized sampling strategies, we predicted that the earlier and later ceramic collections would be broadly similar in composition, with the most common ceramic types present in reasonably similar proportions. We also expected that the minor ceramic types (those represented by very small numbers of sherds) would vary more between collections, and would probably not be very useful for making assemblage comparisons.

Initial visual inspection of the several Chupadero Arroyo ceramic collections curated in the Archaeological Research Collection in Santa Fe showed that Mera did in fact collect a range of ceramic types from each site, including undecorated sherds and sherds of utility wares. The presence of highly variable numbers of sherds of different ceramic types also indicated that he did not just retrieve a single sherd (or small sample of sherds) from each identified ceramic type. In comparison to our excavated ceramic samples from Jumanos division sites, however, the Mera collections seemed unusually dominated by decorated red ware sherds. We were therefore concerned that he had preferentially saved decorated or diagnostic red ware pottery that was suitable for his study of Rio Grande glaze wares (Mera 1940).

The Ceramic Collections

Table 1 provides a list of the ceramic collections and published information used in this study. The approximate site locations for the collections are shown on Figure 1. We considered three sherd collections: those made by H.P. Mera, by Stuart Baldwin, and by Thomas Caperton. For comparison, we used two published data sets: an Eastern New Mexico University survey (Kyte 1988, 1989; Montgomery and Bowman 1989), and excavation data from the early Glaze A pueblo at LA 120, Gran Quivira (Hayes, ed. 1981).

The H.P. Mera Ceramic Collections

Due to the large number of sherds in some of the Mera collections, we focused on complete comparison of only two sites where both Mera and the ENMU survey collected surface samples: LA 1074 and LA 1181. In addition, we used Mera's collection from another site, LA 9012, to compare with a later collection made by Thomas Caperton (Caperton 1981).

Table 1. Archaeological Sites and Collections Considered in this Study.

LA #	Description	Source of Ceramic Count Data
	Sites in Mera's (1940) Eastern Piro Division, Chupadero Arroyo. Period 1 Pueblos (Glaze A Pueblos)	
1069	Pueblo Tinto Chupadero Arroyo, northern area. ENMU estimates about 900 m^2 in size (Montgomery and Bowman 1989).	Collections are from Baldwin's survey and from Mera's survey. Published sherd counts are from Kyte (1989:124).
1074	Pueblito del Pasto Chupadero Arroyo, central area. ENMU estimates about 600 m^2 in size (Montgomery and Bowman 1989).	Collection comes from Mera's survey. Published sherd counts are from Kyte (1989:124).
1181	Pueblo Arcillo Chupadero Arroyo, southern area. The southernmost large pueblo. ENMU estimates about 4000 m^2 in size (Montgomery and Bowman 1989).	Collection comes from Mera's survey. Published sherd counts are from Kyte (1989:124).
	Sites in Mera's (1940) Jumanos Division	
120	Gran Quivira Feature 1 (The buried circular pueblo.) East of Chupadera Mesa. Occupation pre-dates and continues into the Early Period (A.D. 1300-1400; see Hayes 1981:18).	Only published data was used from this site; see Hayes (1981:18)
9012	Lost Pueblo West rim of Chupadera Mesa. An early masonry pueblo occupied "up to" Glaze A times (Caperton 1981:6).	Collections come from Mera's survey and from Caperton's survey.

Published Count Data from the ENMU Survey Report

In the 1980s, archaeologists from Eastern New Mexico University (ENMU) revisited some of the same early pueblo sites that Mera had collected in the 1930s. The ENMU project included re-mapping 10 pueblo sites in Chupadero Arroyo; researchers made surface collections of artifacts from 9 of the 10 sites. These sherd collections are currently housed at ENMU; the sherd totals are reported in Kyte (1989:124).

Montgomery and Bowman (1989:55-57) describe a consistent set of field procedures for the ENMU survey. The report describes how randomly placed collection units were selected using a random number generator. Ceramics were collected in randomized circular plots, one meter in diameter. Two plots were collected from the "interior" part of each pueblo site (on the rubble mounds), and two plots were collected from outside the perimeter of the mounds (Montgomery and Bowman 1989:56). Note that Kyte (1989:123) refers to the sampling unit size as two meters

in diameter. Regardless of which statement is in error, it is clear that fieldworkers used a consistent and systematic sampling circle.

Kyte (1989:123) explains further that judgment samples from the pueblo sites were also taken on-site (that is, within the perimeter of the observed rubble mounds) and also off-site, from the sheet midden that surrounded the mounds. These sherds were collected to maximize the number of pottery types noted for the site. This sampling strategy ensured that rare types would be represented by at least one sherd in the total collection. The count information presented in Kyte (1989:124) therefore presumably includes the ceramics from random sampling and also a small number of sherds collected using judgment sampling.

The Stuart Baldwin Survey Collection

Stuart Baldwin (1983) conducted a survey and made surface collections of some sites near Abo Pueblo and in the northern portion of Chupadero Arroyo (Baldwin 1983). One of his collections came from LA 1069, a pueblo site also later visited by the ENMU survey. Due to the large size of Mera's collection from this same site, we used only the Baldwin collection and the ENMU data to provide us with ceramic assemblage information from this northern area.

The Thomas Caperton Survey Collection

Our test sample of Jumanos division sites includes an early pueblo, LA 9012. Mera (1931) had made a collection of pottery from this site, and Thomas Caperton (1981) did as well. It is an unexcavated early pueblo located on the west side of Chupadera Mesa, between Chupadero Arroyo to the west and Gran Quivira Pueblo to the east. Although Mera's handwritten list of ceramic types for this collection listed glaze ware (Agua Fria Glaze-on-red) as present, he did not include this site in his discussion of Rio Grande glaze wares (Mera 1940).

Thomas Caperton also made a surface collection from the site in the 1970s. Based on his ceramic evidence, he reported that this pueblo was occupied "up to" Glaze A times, and suggested a likely date of the late 1200s into the early 1300s. The general results of the survey were reported in Caperton (1981:6), but as far as we know, there is no report of his collection strategy or of the sherd counts. We therefore typed and counted the sherds in Caperton's collection ourselves.

Published Ceramic Counts from LA 120, Gran Quivira's Circular Pueblo

We also examined published information about the buried circular pueblo at LA 120 (Gran Quivira) to investigate questions about the temporal and social relationships between the early circular pueblo and other early pueblos of the Jumanos region. The Early Period of occupation dates from about A.D. 1300 to about 1400 (Hayes, et al. 1981:12), possibly overlapping with the occupation of nearby sites such as LA 9012. Occupation at Gran Quivira continued much later after the circular pueblo was abandoned, and includes a Spanish occupation; the entire pueblo was finally abandoned in A.D. 1672 (Hayes 1981:2). Here, it is important to note that Hayes'

ceramic counts (Hayes et al. 1981:18) are from excavation rather than the surface, and that he included only sherds in contact with the floor of the buried early circular pueblo.

Methods

Each box of sherds from Mera's collection was accompanied by his handwritten list of ceramic types present. He did not, however, include any count data. To test whether he had collected only temporally significant ceramic types, and/or only a few examples of each type, we therefore sorted his sherds into the types that he identified, and counted the number of sherds present from each. When we were not certain of the type identification of a given sherd, we made a new category, based on our own identification, or using the sherd's attributes. In addition, we made new categories as suited our own research (e.g., we separated Mera's "Brown ware" designation into sub-groups of fine vs. coarse temper to compare with our excavated data).

The ENMU researchers sometimes identified ceramic types that Mera had not. The ENMU researchers also referred to "plain gray ware," which we believe is synonymous with our designation of "undecorated white ware."

Because the total number of sherds in a given collection can have a large impact on percentage values and on between-site comparisons, we developed an index value to evaluate the relative importance of glaze ware pottery on the different sites that had differing sample sizes. This index compares the number of decorated Chupadero Black-on-white sherds to the number of decorated Agua Fria Glaze-on-red sherds. Values less than one represent a dominance of Agua Fria pottery in the collection; values greater than one represent a predominance of Chupadero Black-on-white in the collection.

To get a general idea of how the ceramic assemblages of the Chupadero Arroyo sites (eastern Piro division) compared with our Jumanos division Chupadera Mesa sites, we examined two Jumanos division sites. Hayes' excavations at LA 120, Gran Quivira, listed a sample of 324 sherds from the earliest occupation of Mound 7 (Hayes, et al. 1981:18). We also sorted and counted sherds from Mera's and also Caperton's collection from LA 9012.

Results

Tables 2 through 5 show the ceramic types present at each site and the count data associated with each type. Mera's handwritten type categories appear in bold typeface. When we could not match a sherd with Mera's category, we used a dash (-) to indicate lack of information. Our own descriptions or type identifications are shown in plain text. Italic text refers to ceramic types that are unique to the ENMU survey.

For example, Table 2 shows count data for two collections from LA 1069, the pueblo located in the upper reaches of Chupadero Arroyo (Montgomery and Bowman 1989:76-78). Here, Mera's handwritten notes indicate that he identified both Chupadero Black-on-white and also Cebolleta Black-on-white (recorded in boldface type in Table 2). In the smaller Stuart Baldwin collection, we identified 62 sherds of Chupadero Black-on-white, but were unable to find any examples of

Cebolleta Black-on-white. Researchers from ENMU also did not find any Cebolleta Black-on-white. On the other hand, the italic typeface in Table 2 indicates that the ENMU researchers identified one sherd of Tularosa Black-on-white, 2 sherds of Arenal Glaze-on-polychrome, and 4 sherds of San Clemente Glaze-on-polychrome. Mera did not observe any of these three types, and we did not identify any sherds of these types in the Baldwin collection.

Table 2. Comparison of Ceramic Count Data from LA 1069

LA 1069[a]		Baldwin Collection n=	ENMU Collection n=
White ware			
	Chupadero Black-on-white	63	26
	Cebolleta Black-on-white	-	-
	Undecorated white ware; *Plain gray ware*	9	8
	Unknown black-on-white ware	2	-
	Tularosa B/w	-	1
Red ware			
	Agua Fria Glaze-on-red	27	13
	Kowina? Black-on-red	-	-
	Plain red ware	12	1
Polychrome			
	Heshotauthla Polychrome	-	1
	Kwakina Polychrome	-	-
	Kowina Polychrome	-	-
	Arenal Glaze-on-polychrome	-	2
	San Clemente Glaze-on-polychrome	-	4
	Unknown polychrome	3	-
Utility ware			
	Corona Corrugated	24	6
	Brown ware, plain, coarse	2	-
	Los Lunas Smudged	2	-
	Unknown plain ware	3	-
	Jornada Brown?	-	-
	El Paso Brown?	-	-
	Plain Brown ware	-	5
Total		147	67

[a] We used Mera's ceramic type categories (boldface) to organize this table. However, the count data is from the Baldwin collection. Boldface question marks refer to Mera's own query marks. The plain-face types and descriptions refer to our own categories. The ware categories in italics are those used uniquely by ENMU in Kyte (1989). Dashes (-) refer to "lack of data"—we did not find the reported ceramic type. ENMU data are from Kyte (1989).

Table 3. Comparison of Ceramic Count Data from LA 1074

LA 1074 [a]		Mera Collection n=	ENMU Collection n=
White ware			
	Chupadero Black-on-white	46	21
	Casa Colorado Black-on-white	-	-
	Unpainted white ware; *Plain gray ware*	2	4
	Unknown black-on-white	-	1
Red ware			
	Agua Fria Glaze-on-red	69	40
	Red ware, undecorated *(plain)*	6	14
	Red ware; glaze or paint, unknown	6	-
	Red ware; black and/or white paint	5	-
Polychrome, other			
	Los Padillas Polychrome	-	-
	Arenal Glaze-on-polychrome, black	1	2
	San Clemente Polychrome, tan and white	6	-
	Abiquiu Black-on-gray	-	0
	Cieneguilla Glaze-on-yellow	-	1
	Kwakina Polychrome	-	1
Utility wares			
	Corona Corrugated	10	4
	Brown ware coarse paste	14	-
	Brown ware fine paste	4	-
	Plain brownware	-	17
	Other plain ware	-	17
Total		169	122

[a] Mera's type categories are in boldface. The plain-face text refers to our own descriptions. The categories in italics are those used uniquely by ENMU in Kyte (1989). The dashes (-) refer to "lack of data"—we did not find the reported type or description. ENMU researchers refer to "plain gray ware," which we interpret as undecorated white ware. ENMU data are from Kyte (1989).

Table 4. Comparison of Ceramic Count Data from LA 1181

LA 1181 [a]		Mera Collection n=	ENMU Collection n=
White ware			
	Chupadero Black-on-white	109	23
	Casa Colorado Black-on-white	-	-
	Undecorated white ware; *Plain gray ware*	7	1
	Socorro Black-on-white	3	-
	Unidentified black-on-white, organic paint	4	-
	Unidentified black-on-white, mineral paint	3	2
	White ware with black and red paint	1	-
Red ware			
	Agua Fria Glaze-on-red	190	41
	Rayo Glaze-on-red	1	-
	White Mountain Red ware?	3	-
	Red ware; paint/glaze unknown	4	-
	Red ware, unpainted, orange paste	6	-
	Red ware, unpainted, buff paste	1	-
	Unknown glazed red ware	1	5
	Plain red ware	-	14
Polychrome			
	Heshotauthla Polychrome	1	-
	St Johns Polychrome	1	-
	Gila Polychrome?	1	-
	Gila Polychrome	-	-
	Los Padillas Polychrome	-	-
	Arenal Polychrome	-	-
	San Clemente Polychrome	14	3
	Cieneguilla Polychrome	6	1
	Kuaua Polychrome	-	-
	Wallace (now Kwakina**) Polychrome**	7	3
	San Clemente Glaze-on-polychrome	-	-
	Polychrome Little Colorado-unclassified	-	-
	El Paso Polychrome	-	-
	El Paso Polychrome?	1	-
	White Mountain Red ware; glaze unknown	1	-
	Ramos Polychrome	-	1
	Tabira Polychrome	-	1

Utility ware			
	Corona Corrugated	28	3
	Brown ware, plain, fine	7	-
	Brown ware, plain, coarse	36	-
	Brown ware, polished	1	-
	Plain Brown ware	-	4
	Other Plain ware	-	1
	Smudged Plain ware	-	8
Other			
	Lino Gray ware	1	-
	Textile impressed	1	-
Total		439	111

[a] Mera's type categories are in boldface. The plain-face text refers to our own descriptions. The categories in italics are those used uniquely by ENMU in Kyte (1989). The dashes (-) refer to "lack of data"—we did not find the reported type or description. Mera's "Wallace Polychrome" is now called Kwakina Polychrome. ENMU data are from Kyte (1989).

Table 5. Comparison of Ceramic Count Data from LA 9012

LA 9012 a		Mera Collection n=	Caperton Collection n=
White ware			
	Chupadero Black-on-white	24	172
	Tularosa Black-on-white	1	1
	White ware, undecorated	1	67
	Socorro Black-on-white	-	1
	Mineral paint, unknown	1	-
Red ware			
	Agua Fria Glaze-on-red	5	-
	Rayo Glaze-on-red	-	-
	White Mountain Red ware	1	5
	Red ware, plain slipped	-	4
Polychrome, other			
	Heshotauthla Polychrome	-	1
	St. Johns Polychrome	1	1
Utility wares			
	Corona Corrugated	8	29
	Brown ware plain, fine	-	5
	Brown ware, plain, coarse	2	31
	Jornada Brown ware	1	-
	Black polished interior	-	1
SUM		45	318

[a] Mera's type categories are noted in boldface. The plain face types and descriptions refer to our own categories. The dashes (-) refer to "lack of data"—we did not find the reported type in the collection.

Table 6 presents our comparisons of the Chupadero-to-Agua Fria index across sites. It is apparent that Chupadero Arroyo sites have numerous Agua Fria sherds, and that the index is broadly similar regardless of whether the collection was made by Mera or later by the ENMU survey. For LA 1074, the Mera collection has an index value of 0.66, compared to 0.53 for the later ENMU survey. However, for LA 1181, the two indexes are even more similar: 0.57 for the Mera collection, and 0.56 for the later ENMU data. Interestingly, the ceramic assemblages from the two pueblos are also quite similar to one another.

Table 6. The Chupadero-to-Agua Fria Index Value for Five Sites

Site	Mera Collection	ENMU Published data	Other Collection	Comments
Mera's (1940) Eastern Piro Pueblos				
LA 1069	--	26:13 = 2.0	63:27 =2.3 (Baldwin collection)	Very similar ratios between collections
LA 1074	46:69 = 0.66	21:40 = 0.53	--	Very similar ratios between collections
LA 1181	109:190=0.57	23:41=0.56	--	Very similar ratios between collections
Comparison with Mera's (1940) Jumanos Pueblos				
LA 120	--	--	161:8=20.1 (Published counts)	Few glaze sherds
LA 9012	24:5=4.8	--	172:9=19.1 (Caperton collection)	Few glaze sherds; similar to Gran Quivira

Note: The published data for LA 120 comes from Hayes, et al. (1981:18). Hayes counted only sherds that were in contact with the floor. Caperton's collection from LA 9012 lacked any identifiable Agua Fria sherds. We therefore generously included all red ware sherds in the index to see how it might compare to LA 120, Gran Quivira.

The general similarity in the index values between different collections that were made at different times from the same sites is rather surprising, given that the surveys were made nearly 50 years apart. Apparently, the surface ceramic assemblage at these sites was not dramatically altered, despite years of surface erosion and trampling. More importantly, the general similarity in index values over time suggests that Mera made his collections using a reasonably systematic and randomized sampling strategy—a strategy that was likely similar to that used by the more recent ENMU survey.

Given these positive results (and our time constraints), we did not sort the very large Mera collection from LA 1069; instead we used the smaller Baldwin collection to compare with the

ENMU published data and with the data from other sites. Although we are not sure of Baldwin's collection strategy, the index values from these two different collections are again quite similar to one another (2.3 for the Baldwin collection and 2.0 for the ENMU collection). It is interesting to note that this pueblo, located in the northern reaches of the arroyo, shows less glaze ware pottery than did the pueblos located further south.

Finally, we compared Mera's collection to Caperton's collection from a very different pueblo site: LA 9012. This site is located on Chupadera Mesa, near its western rim where various arroyos begin their descent to the west, ultimately draining into the broad valley of Chupadero Arroyo. It is therefore located near the boundary between the Jumanos district and the eastern Piro district. Caperton (1981) classified it as an Early Pueblo period site. These pueblos are defined as those having at least some glaze ware pottery (Caperton 1981). Indeed, Mera's ceramic collection from the 1930s did include a small number of Agua Fria Glaze-on-red sherds (N=5, with an index value of 4.8).

The very small amount of red ware or glazed ware in either collection from LA 9012 limits the utility of the index value for comparing Mera's and Caperton's collection strategies (both unknown). In fact, Caperton's collection contained no sherds that we could identify positively as Glaze A pottery. Even counting undecorated red sherds as possible Glaze A sherds, the Caperton collection has a very high index value (19.1). It is possible that this site experienced more surface disturbance between the times of their collections, or that Mera and Caperton used different collection strategies. We can confirm, however, through our visual inspection that this this pueblo's ceramic assemblage is markedly different from those of the Chupadero Arroyo sites, and that this regional difference is probably not due only to sampling issues.

Interestingly, the ceramic collection from the early circular pueblo nearby at Gran Quivira (LA 120) also shows a very high index value (20.1). Again, this information is of limited utility, due to the very small number of decorated glazed sherds recovered (Agua Fria sherds represent only 2 percent of all sherds in this sample). Hayes (1981) assigns the circular pueblo to the Early Period of the occupation of Mound 7 at Gran Quivira, which he dates from ca. A.D. 1300 to 1400. The very small amount of Agua Fria pottery suggests that this ceramic sample represents an occupation that dates to the beginning of the Early Period, rather than later.

Despite the problems of using our index value at the Jumanos sites where there is so little Glaze A pottery, and the inherent difficulties of relying on ceramic evidence to date site occupational periods, this study of LA 9012 and Gran Quivira does at least confirm that early pueblos of the Jumanos division are in fact distinctly different from those in the eastern Piro division in Chupadero Arroyo, and that sites within each region are in fact fairly similar to one another in their ceramic assemblage compositions.

Implications for Further Research

Mera (1940) emphasized that his regional sub-divisions were based on the spatial extent of known linguistic groups from the 17th century (Mera 1940:1), and would not necessarily apply to

the geographic distribution of social groups in earlier periods. However, we now can confirm that there is in fact a difference in the occurrence of glaze ware pottery at early pueblo sites between the eastern Piro and the Jumanos divisions.

It seems likely that this regional difference in ceramics does record some temporal or social difference between pueblos in the two areas, even at this early time in the archeological record. Given our discovery of social conflict in the form of fortifications and extensive deliberate burning at several of the Chupadera Mesa pueblos where we have excavated (Chamberlin et al. 2011; Rautman 2014), this evidence of a temporal difference and/or a social boundary between the Jumanos division pueblos on Chupadera Mesa and their neighbors to the west is particularly interesting.

Recent ceramic composition studies established that people in the two areas were in contact during the early pueblo occupation. For example, we know that groups in both areas were actively manufacturing and also trading Chupadero Black-on-white pottery with one another (Chamberlin 2008; Clark 2006). It is therefore clear that occupation of the early pueblo sites in both areas overlapped, and their populations were interacting, at least for some period of time.

The end of the Early Pueblo period in the Jumanos division, however, is marked by widespread abandonment of many of the small pueblos, resulting in these sites exhibiting, like LA 9012, only trace or minor amounts of glaze ware pottery in surface collections and (at other sites) in excavated deposits. At roughly the same time or slightly later, a few pueblos such as Gran Quivira become very large indeed. It is possible that observed social tensions and violence recorded among the Chupadera Mesa pueblos may have contributed to pueblo abandonment, and it is tempting to assume that the people from these small Jumanos pueblos moved to nearby sites such as Gran Quivira, or even to sites in Chupadero Arroyo. At present, however, the actors in these apparent conflicts, and the fate of the presumed refugees, are unknown.

It is clear, however, that the eastern Piro pueblos experienced a different history. Our small study demonstrates that occupation in Chupadero Arroyo likely continued for some time after neighboring pueblos in the Jumanos division were abandoned. The eastern Piro division experiences its own history of population nucleation somewhat later—by about A.D. 1450, only three of the 10 pueblos in the ENMU survey were still occupied (Mera 1940:6-13; Montgomery and Bowman 1989).

We still don't know the significance of these different historical events, or the details of the social, economic, or political relationships within or between the two regions. For example, it is not clear exactly why the early pueblos in both regions were abandoned, or how much population movement there was between the eastern Piro and Jumanos regions. Nor do we know if Chupadero Arroyo populations played any role in the apparent violent conflict that we observed on the Chupadera Mesa sites. The cultural and political significance of the unusual circular pueblo at Gran Quivira is also unknown (see discussion in Rautman 2016). Understanding the regional context of social violence and population movements in this general area thus remains a major topic for future research.

Conclusions

This small study is relevant to archaeologists who work outside our study area of central New Mexico because it provides the quantitative data needed to confirm that H.P. Mera's surface collection strategy was apparently fairly systematic and randomized, in a manner comparable to that used by more recent archaeologists. Because Mera apparently never recorded details of his collection strategy, we and other Southwestern archaeologists generally assumed that the Mera ceramic collections could not be used in studies of ceramic assemblage composition (e.g., Franklin 2014). In fact, the small study here shows that his collection strategy was more systematic than we thought.

This result opens the possibility that these older collections are in fact useful for some general research problems beyond analyses of individual sherd composition (e.g., Clark 2006). For example, here we focused only on the relative proportion of Glaze A sherds within a given ceramic assemblage. Our initial concern that Mera (1940) might have preferentially collected the decorated red glaze ware sherds was not supported in this study. Because our study is so small, however, and also so localized to central New Mexico, we caution that other archaeologists would be prudent to confirm these results in their own study areas.

Acknowledgments. We want to thank the staff at the Center for New Mexico Archaeology Archaeological Research Collection and Archaeological Repository, and also the Laboratory of Anthropology Archaeology Records Management Section (ARMS) for all their help, especially Julia Clifton and Crystal Kieffer. Regge Wiseman also helped us identify some problematic sherds. We also thank the staff at ARMS who were so helpful in pointing us to unpublished records and maps associated with Chupadero Arroyo site surveys. Alison's brother Chris Rautman and his family in Albuquerque generously provided a home base for couch-surfing archaeologists. This research was also aided by a research grant from James Madison University (VA) to Julie Solometo.

Data availability. The H.P. Mera ceramic collections, and those made by Thomas Caperton and by Stuart Baldwin are housed in Santa Fe at the Archaeological Repository of the Center for New Mexico Archaeology, which is part of the Museum of Indian Arts and Culture. Ceramic sherds from the ENMU survey are curated at Eastern New Mexico University.

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TEXTURED SURFACES ON PLAYAS RED POTTERY

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This study presents varieties of textured surfaces on Playas Red pottery found in southern New Mexico and northern Chihuahua, Mexico. Our research draws from a recent analysis of ceramics at White Sands Missile Range (WSMR) in the southern Tularosa Basin (Kurota et al. 2018), as well as the study of pottery from the Joyce Well Site (LA 11823), a major Animas phase village in New Mexico's Boot Heel, and other sites in southern New Mexico.

Although sources of published material on the Playas Red textured surfaces are limited and often provide only partial descriptions, we offer synthetic descriptions and visual depictions of the textured variants of Playas Red through photographs and pencil illustrations, as well as some descriptions of the paste, temper and slip on this pottery. After our review of all collected data, the main textured varieties include Playas Red Incised, Playas Red Cordmarked, Playas Red Punctate, Playas Red Corrugated, and Playas Red Corn Cob Impressed. This paper provides a comprehensive diversity of the textured surfaces on Playas Red pottery, as well as a map of our current understanding of its common occurrence and possible regions of local manufacture. We also outline a dataset table as an organizational chart of all presently known textured variants of Playas Red that could be used as a field manual.

Previous studies of this pottery have offered alternative names including earlier and no longer utilized terms such as Chihuahua Red Ware (Kidder 1916:254), Red Incised (Carey 1931:332), Casas Grandes Red Ware (Brand 1935:296), as well as the commonly used Playas Red Incised (defined by Sayles 1936:35-37). The manufacture of Playas Redware in southern New Mexico has been suggested by Wiseman (1981, 2016) and Kurota et al. (2018) based on studies of temper and paste. Further support to this argument was rendered by instrumental neutron activation analysis (INAA) by Creel et al. (2002).

A large portion of the pottery presented here was analyzed in the field. Another sample was recorded in Albuquerque at the Office of Contract Archeology laboratory, as well at as the Museum of Indian Arts and Culture in Santa Fe. Additionally, we use data collected on Playas Red pottery by other researchers from a range of sites in the southern Southwest (Figure 1).

Previous Research

Previous researchers have proposed subtypes of Playas Red. Di Peso and colleagues (1974:6:147), in the most extensive exploration of Playas Red to date, proposed six variants: standard, textured, Corralitos, red-on-brown, brown rim, and Ramos Black. The authors recognized the inherent problem of Playas Red variant divisions based on textured decoration, as sherds that would be identified as Playas Red and Playas Red Incised could be found on the same

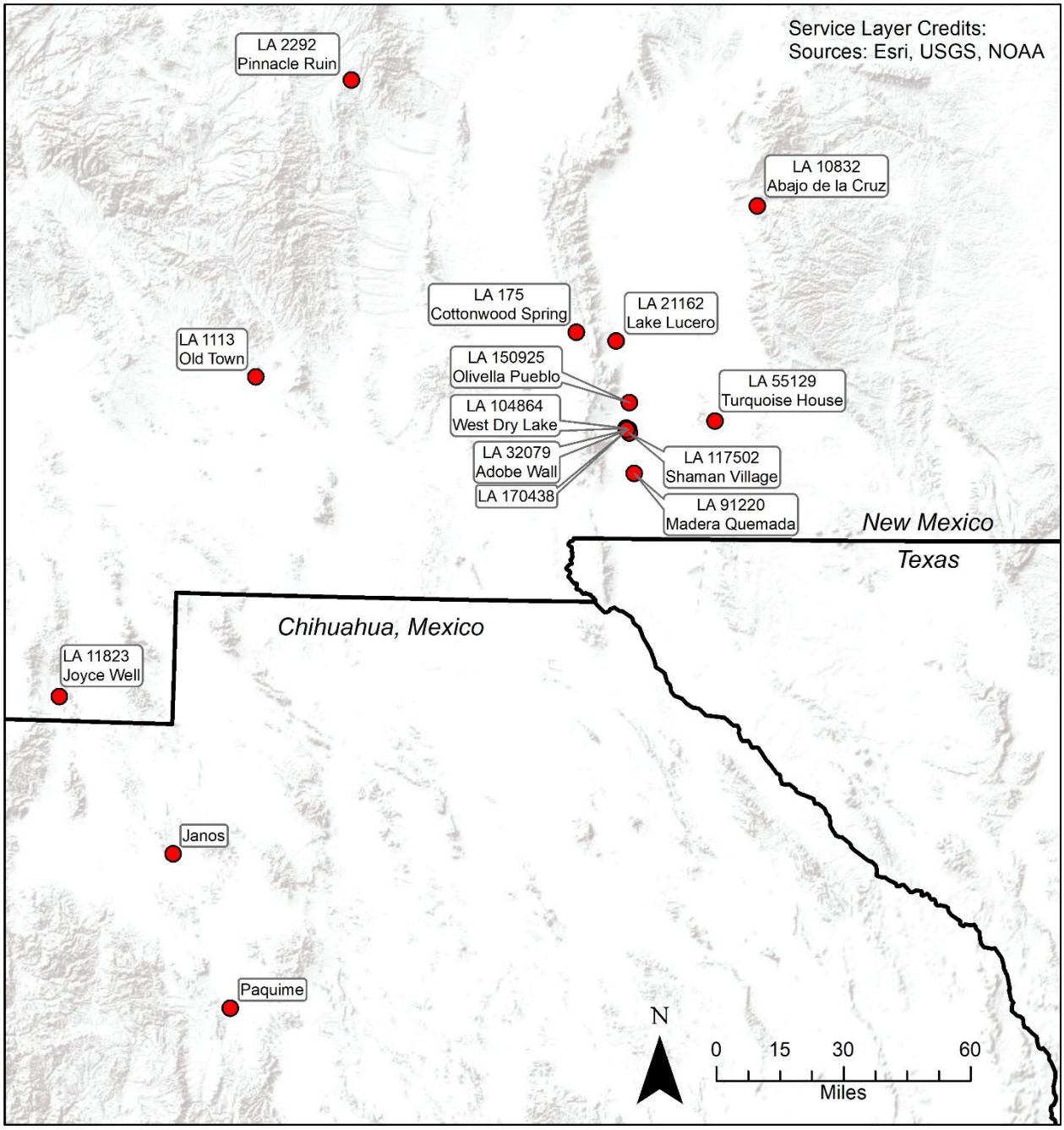

Figure 1. Map of southern Southwest region showing locations of archaeological sites discussed in text.

vessel, depending on which part of the vessel they originated. Also, not all portions of body Playas Red vessels were slipped with a red clay, resulting in sherds being typed as Casas Grandes Incised (Di Peso et al. 1974:6:147). There were 22 types of decoration noted to be present on Playas Red sherds recovered from Paquimé, which were combined into the six

variants. Playas Red Standard was characterized by the presence of a red slip over the entire exterior below the shoulder and was the most common found at Paquimé (66%). Playas Red Textured was characterized by the addition of incisions, punctates, punches, and corrugations and was the second most frequent (23.7%). Playas Red Corralitos was characterized by the presence of bichrome painted incised designs atop an unslipped brown paste with a red slip below the design (1.1%). Playas Red-on-brown was characterized by the presence of broad red painted and polished lines on brown paste (6.6%). Playas Ramos Black was defined on the use of black smudged designs (0.2%). Playas Red Brown Rim is characterized by an unslipped brown rim and neck, and a slipped body below the shoulder (2.4%). The descriptions provided were based on 71,925 sherds recovered from Paquimé and analyzed in the field and approximately 30,000 sherds analyzed in the laboratory (Di Peso et al. 1974:6:147).

Several different decorative techniques were identified by Di Peso and others (1974:6:151-152). Specific types of incising employed included diagonal, parallel, herringbone, and crescent. Incised texture was identified on 29% of Playas Red sherds. Corrugation textures identified (10.8%) were standard corrugation, rubbed corrugated, obliterated corrugated, incised corrugated, and punched corrugated. Punched techniques identified (8.9%) include tool punched, finger punched, punched incised, punched speckled, and rubbed punched. Scoring was identified on 0.5% of Playas Red sherds. Decorative techniques were identified more frequently on jars than bowls and many techniques were not found on bowl sherds (Di Peso et al. (1974:6:151).

Playas Red ceramics analyzed from other Medio period communities do not contain the same variety of textured decoration as found at Paquimé. In other areas, Playas Red ceramics are characterized by large variability especially in the Jornada Mogollon culture area, the other primary location where Playas Red ceramics have been identified (Bradley and Hoffer 1985). Differences extend beyond simply different raw clay material and temper and include differences in finish and decoration. In general, Casas Grandes Playas Red ceramics are characterized by the same fine silty paste exemplified in Ramos Polychrome, whereas Jornada Mogollon Playas Red ceramics are more similar to local brown wares (Bradley and Hoffer 1985). As a result, Playas Red ceramics found in the Jornada Mogollon culture area were likely locally produced and decorated and should not be considered evidence for a robust trade network with the Casas Grandes culture. Wiseman (1981) proposed a local variant of Playas Red termed Playas Incised, Sierra Blanca based on sherds recovered from LA 2315 and other sites in the Jornada Mogollon culture area. Wiseman (1981:23) justified the variant based on significant differences in temper, and thereby production, and advocated for the ceramic type to be considered a variant as opposed to a new type to limit confusion. Additionally, results of an initial examination of textured Playas Red sherds, Wiseman (1981:Figure 1) believed the Sierra Blanca variant represented a different population. This conclusion was supported by his analysis, although the critique that Di Peso and others (1974:6) stated regarding the presence of untextured and textured sherds within a single Playas Red vessel remains. Temper identified in the Sierra Blanca variant was a local grey feldspar with crushed biotite and hornblende (Wiseman 1981:24). The surface treatment of the Sierra Blanca variant is characterized by a red slipped and polished exterior with incised lines, punctates, or both present. Not all sherds identified as the Sierra Blanca variant included a red slip, reminiscent and identified as being similar to Casas Grandes Incised/Rubbed Incised,

although the temper matched the proposed Sierra Blanca variant (Wiseman 1981:25-26). Outside of the Sierra Blanca variant, no other well-defined Playas Red variant has been presented.

Three primary techniques of decoration, gouged, stylus-punctate, and incised-line, were identified within the Abajo de la Cruz Playas Red ceramic assemblage (Wiseman 2016:139). No sherds identified in the Abajo de la Cruz Playas Red ceramic assemblage contained two different techniques. The Playas Red ceramic assemblage at Abajo de la Cruz was composed of 113 textured sherds, including 65 gouged (57.5%), 41 herring-bone stylus-punctate (36.3%), 17 line incised (15.0%, and a single sherd each of herring-bone patterned incisions and lined punctate impressions. Wiseman (2016:139-140) cautions that this interpretation is based on small sherds and not whole vessels and contrast with Playas Red vessels from Paquimé that demonstrate the use of two or more textured techniques on individual vessels.

Sites in the Tularosa Basin

The largest portion of the data used in this paper draws from the in-field and laboratory analyses of Playas Red pottery in the southern and central Tularosa Basin, New Mexico. Here several El Paso phase melted adobe room block complexes have recently been redocumented by Office of Contract Archeology, University of New Mexico field crews. Most of these villages are part of the "Pueblo Core Area" (Whalen 1977) of the Jornada Mogollon—tightly clustered El Paso phase residential-positioned loci along playas in southern Tularosa Basin. They include LA 32079 (Adobe Wall Site), LA 104864 (West Dry Lake Pueblo), LA 117502 (Shaman Village), LA 150925 (Olivella Pueblo), and LA 170438. Ceramic data from two more sites outside of this region are also used, including LA 55129 (Turquoise House) located on Bureau of Land Management property north of the town of Orogrande, and LA 22162 (Lake Lucero Site) located on White Sands National Monument. Archaeological investigations at these sites have revealed diverse ceramic assemblages that included trade wares from the northern Jornada, Salado, Mogollon, Casas Grandes, and Middle Rio Grande regions (Kurota et al. 2016; 2018).

Joyce Well Site

Joyce Well (LA 11823) is a medium-sized Animas phase (1200-1450 CE) multi-roomblock village with an associated open-ended Chihuahuan-style ballcourt located along the southeastern side of the Animas Mountains on the eastern bank of Deer Creek in southern Hidalgo County, New Mexico. The Joyce Well ceramic assemblage represents more than forty different types, with Ramos and Gila polychromes dominating the painted ceramics. No formal detailed analysis of the recovered material from the 1963 excavations has been conducted or reported. The current ceramic analysis by Thatcher Rogers classifies the ceramics based on standard practices for Chihuahuan polychromes (Di Peso et al. 1974:6; VanPool et al. 2008; Whalen and Minnis 2009), Salado polychromes (Crown 1994; Lyons 2004); local and Chihuahuan unpainted ceramics (Di Peso et al. 1974:6; Kidder et al. 1949; VanPool et al. 2008), and Jornada Mogollon and other southeastern New Mexico associated ceramic types (Kurota et al. 2018). Approximately 1,200 sherds of the 9,985 reported sherds from the 1963 excavation have been analyzed to enable

comparison with nearby sites and regions, as well as with attributes found in Chihuahuan assemblages (see Whalen and Minnis 2009, 2012).

Other Sources of Data Collection

Our visual data also utilizes photographs taken from ceramic collections on display at Deming Luna Museum, University Museum at New Mexico State University, as well as selected sherds from excavations at Cottonwood Spring Pueblo (courtesy of Stan Berryman and William Walker). We also produced an illustration of a sherd that is on display from the Canada Alamosa Project posted on New Mexico Farm and Ranch Heritage Museum web page (2018).

It should be noted that, while Di Peso and others (1974:147) identified 9.3% of Playas Red sherds as bowls, our analysis data draws exclusively from jars, since little or no evidence for bowls was obtained from any of the sites. Furthermore, there are issues of distinguishing between Playas Red and Playas Plain sherds. The main reason for this problem is often poor preservation of slip on Playas Red sherds in surface assemblages, making such specimens appear as Playas Plain. While it is possible that some of the sherds in this study actually belong into the unslipped Playas Plain category, we are confident that the overall research provides compelling evidence for the emerging Playas Red textured variants.

Local Variants of Playas Red

Playas Red Incised

Playas Red Incised (Hawley 1936) is the most common textured variant of Playas Redware pottery. Regge Wiseman (personal communication 2015 and 2016) argues that Playas Red Incised vessels often have slip eroded to the point that only minute traces of it can be observed under the microscope, especially inside the incisions. Linear incised patterns often have either right-angle or oblique-angle design motifs (Figure 2a, b). The design's layout often terminates at the widest portion of the vessel with no specific border line at the start of the plain, polished portion. Playas Red Incised design elements were typically applied on the upper body area and ended at the widest portion of the vessel, with the lower portion typically left slipped and polished. The incised texture is often combined with other means of decoration. Perhaps the most common, the neck area of jars can be embellished with parallel cordmarked lines. Another secondary texture application is punctates.

With its incised decoration and jar forms, Playas Red Incised resembles other ceramic types in the region. It is notably similar to Mata Red-on-brown which can also exhibit incised decoration and dates to the Viejo period (Di Peso et al. 1974:6:65-67). Other more geographically distant ceramic types in the Southwest with similar incised decoration include Potsuwi'i Incised (Oppelt 2002:44) and Taos Incised (Peckham and Reed 1963) of northern New Mexico and Honani Tooled (Colton and Hargrave 1937:202) of northern Arizona.

Figure 2. Examples of complete Playas Red vessels from the Deming Luna Mimbres Museum: (a) Playas Red Incised with right angle pattern; (b) Playas Red Incised with randomly applied short incisions.

Usually the incised lines are laid out in a variety of patterns including herringbone, right angle, oblique angle, random, as well as long parallel horizontal or oblique lines (Figure 3). The long parallel or oblique lines can be found covering either the upper body or the entire vessel.

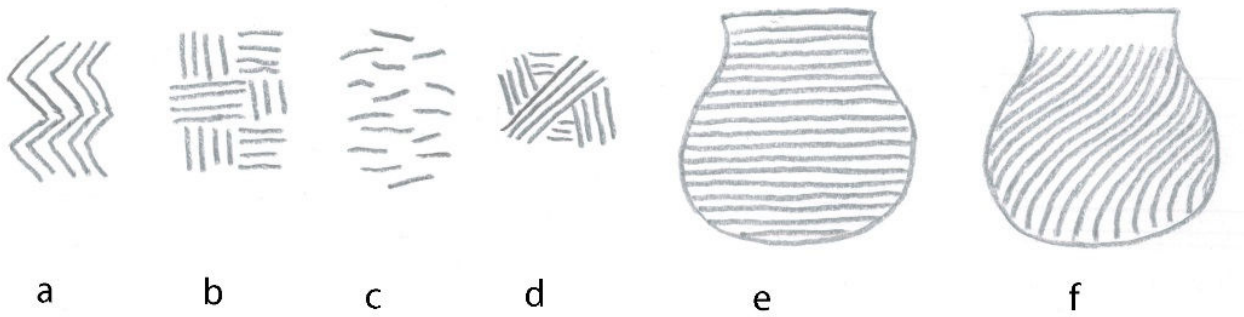

Figure 3. Variations of common incised patterns: (a) herringbone; (b) right angle; (c) random; (d) oblique angle; (e) long parallel horizontal lines, all over body; and (f) long parallel diagonal lines, all over body.

We have assigned two Playas Red Incised variety names based on how the incisions were applied to the surface of the vessels: *comb variety*, utilizing a multi-tipped tool perhaps resembling a comb, and *stylus variety,* utilizing a single-tip tool; these will be further explained below.

Playas Red Incised Comb Variety. Examples of Playas Red Incised Comb Variety reveal evenly-spaced straight lines that appear to be made with a tool with multiple tips (Figure 4). At least two types of this tool appear to have been used; one would have had sharp ends producing tapered impressions (Figure 4d, g-j, v), while the other would have had flattened ends, producing evenly flat impressions (Figure 4a-c, e, f, k-m).

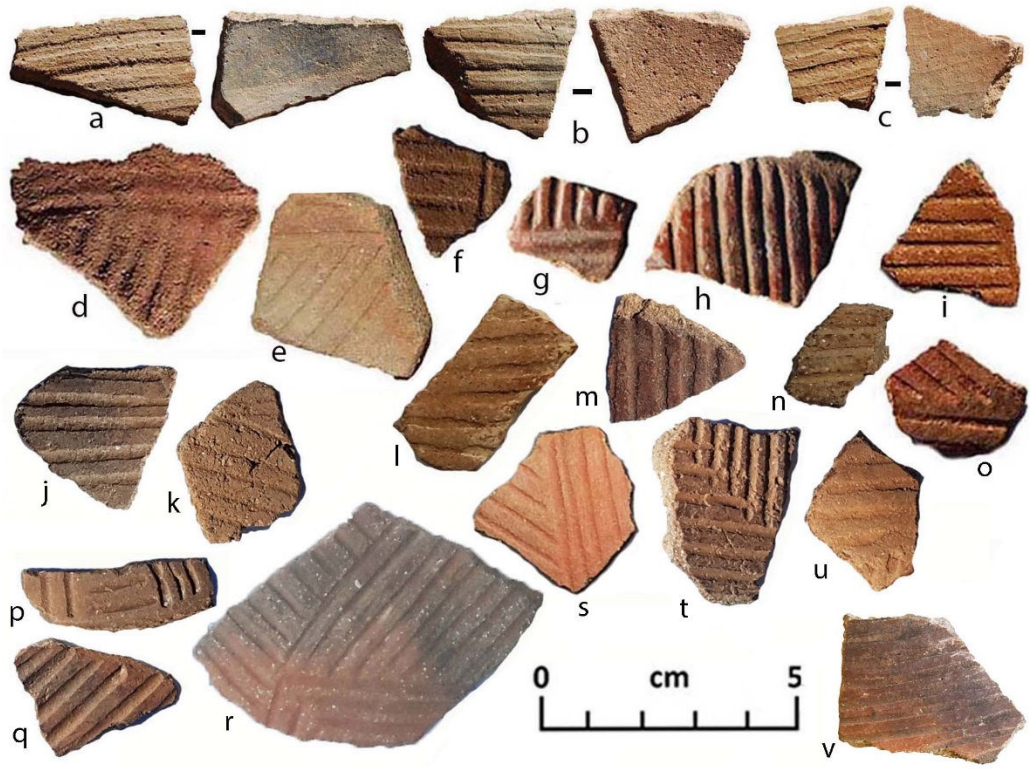

Figure 4. Examples of Playas Red Incised Comb Variety sherds: (a-c) are from LA 166324; (d-f) and (i-n) are from LA 104864; (p-r),(t), and (u) are from LA 21162; (s) is from LA 175; and (v) is from LA 11823.

The combs were probably made by incising narrow lines into a straight edge of an implement perhaps made of wood or bone (Figure 5). Such combs have been recovered at various sites throughout the Southwest. One of them, a relatively large specimen, was found at Hinds Cave in West Texas and exhibited traces of red hematite (Shafer et al. 2017) that could have come from incising an unfired Playas Red vessel.

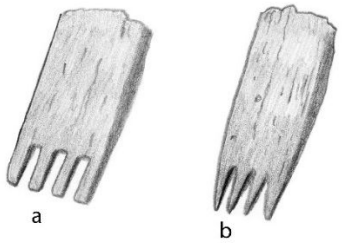

Figure 5. Hypothesized reconstruction of flat (a) and pointed (b) tips on combs.

Playas Red Incised Stylus Variety. Wiseman (2016:141) uses this term [elsewhere also referred to as single-tip tool variety (Kurota et al. 2018)] to describe incisions made with a pointed object. Such designs were executed in a more uneven fashion than the comb variety. The resulting design layout would have been impossible to make with a comb-like tool. Incisions in this variety are often not quite parallel and may vary in depth from the paste surface (Figure 6). The analyzed examples indicate that the "stylus" would have been a sharp-tipped tool with little or no evidence of a flat-tipped tool as is seen in the combed variety. Most of the incised texture, comb and stylus variety, ends at the widest portion of the vessels (Figure 7).

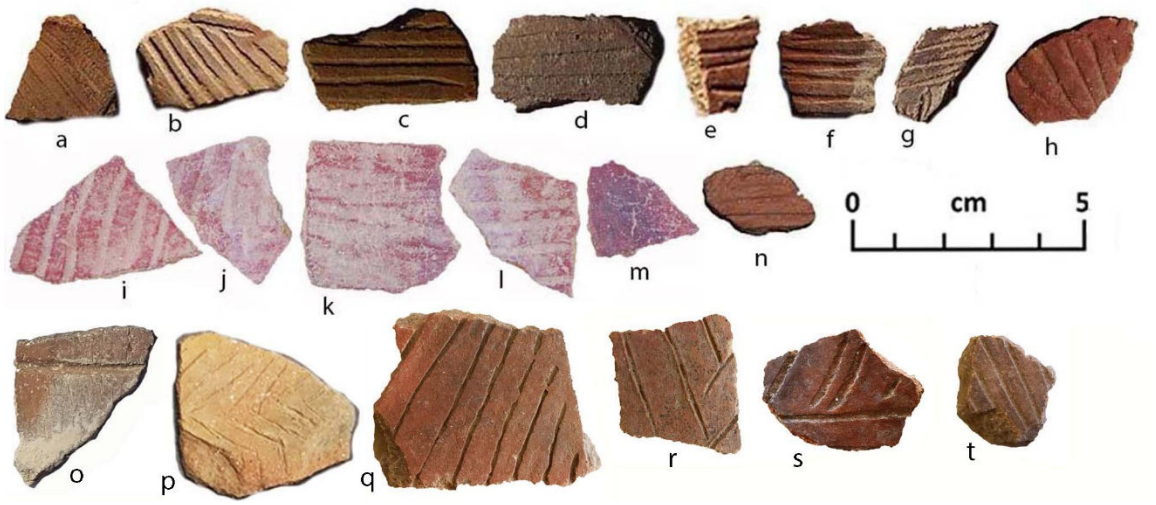

Figure 6. Examples of Playas Red Incised Stylus Variety sherds: (a-e),(h), and (n) are from LA 104864; (f) and (g) are from LA 117502; (i-m) are probably from the same vessel at LA 165433; (o) is from LA 21162; (p) is from LA 175; and (q-t) are from LA 11823.

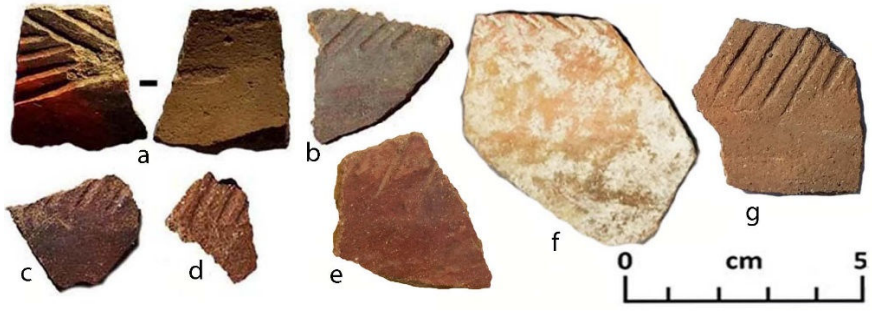

Figure 7. Examples of body sherds showing bottom portion of incised design: (a-d) are from LA 104864; (e) is from LA 11823; (f) is from LA 175; and (g) is from LA 21162.

Playas Red Cordmarked

Cordmarked texture most commonly occurs in combination with other types of textures, mainly incised. For this reason, the variety name Playas Red Cordmarked should be used primarily as a texture description. If both cordmarked and incised textures are present, a combination name *Playas Red Cordmarked/Incised* should be used.

Our observations on complete vessels on display at the Deming Luna Mimbres Museum (Deming, NM) show that this textured design was likely made using a single strand of cordage that was pressed firmly into the unfired clay surface. In southern New Mexico, the cordmarked texture is most commonly found applied along the jar necks. A second line impression was made a few millimeters above the first, with this pattern continuing four to eight times toward the vessel rim (Figure 8a, b). Examples with these elements have been called Playas Red Cordmarked, although the rest of the vessel primarily has an incised motif. As such, some sherds classified as Playas Red or Playas Red Incised may in fact be examples from portions of cordmarked vessels. These cordmarked impressions are different from the common cordmarked textures found in the American Midwest and along the east coast (Egloff and Potter 1982), as well as in central Mexico (Griffin and Krieger 1947) where a wooden paddle wrapped with a cordage (Figure 8c) would have been pounded onto the exterior surface to create a variety of textures.

Examples of Playas Red Cordmarked were found on WSMR at LA 104864, LA 150925, LA 117502, and one also from Turquoise House (LA 55129) on the east side of the Jarilla Mountains (Kurota et al. 2016). The cord marks have been associated with both comb and single-tip varieties of Playas Red Incised sherds.

Often, sherds with cord marked texture may resemble other textured surfaces, such as incised or punctate, especially when the cord marking have been partially obliterated. A good way of distinguishing these types is to look for individual fiber impressions that are often visible inside the depressions left from pressing the cordage against the vessel surface. Such marks are absent on punctate or other incised textures. As shown in Figure 9, it appears that there was some variability in the size of the cordage used for the impressions with some being very thin and finely made (Figure 9a-c, k, l) while others were more robust (Figure 9e-h, p). Additionally, some of the cordage impressions were made deeper into the clay (Figure 9a, b, g, h, i, and n) while others were barely discernable on the surface (Figure 9d, e, j, r). As with other Playas Red ceramics, some of the sherds have moderate to quite visible red slip (Figure 9b, d, g, i, m, n, o, q, and r), while others have merely a thin wash or were unslipped (Figure 9c, e, f, l, and s). Besides the most typical neck area location (Figure 8a), Playas Red Cordmarked texture can also be found on the upper half of jars (Figure10b) or on the entire vessel body (Figure 10c).

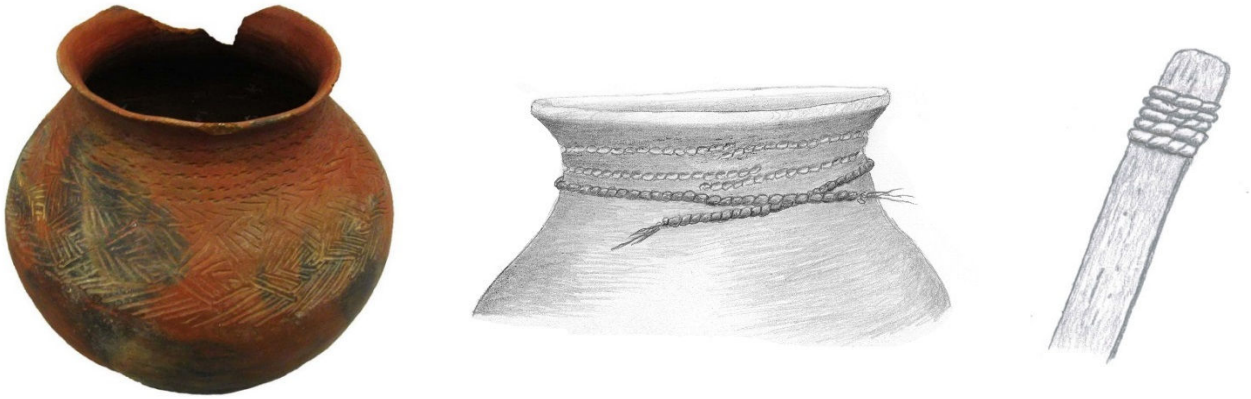

Figure 8. (a) Playas Red Cordmarked/Incised jar on display at Deming Luna Mimbres Museum with cordmarked impressions along the neck; (b) stylized reconstruction of the application of cordmarked impressions using a single strand of cordage as evidenced on some Playas Red sherds; and (c) wooden paddle used to create cordmarked texture on prehistoric pottery in the American Midwest and central Mexico.

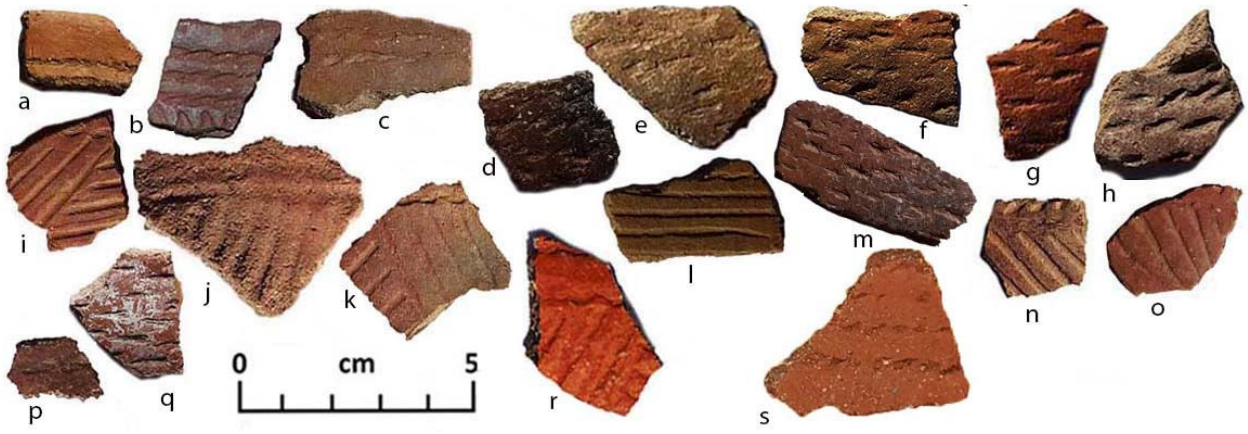

Figure 9. Examples of Playas Red Cordmarked and Cordmarked/Incised sherds: (d),(p), and (q) are from LA 117502, (m) is from LA 32079; (s) is from LA 55129, all others are from LA 104864.

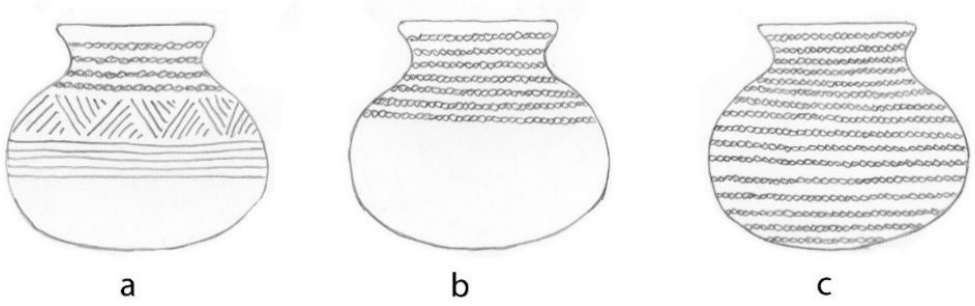

Figure 10. Examples of three areas of cordmarked texture application on Playas Red jars: (a) neck area (usually combined with incised motifs); (b) upper body and neck; and (c) entire vessel.

Playas Red Punctate, Hollow Tool Variety. This texture was observed on a jar from the Carl Lumholtz Collection from the Casas Grandes area which exhibited circular punctates. The punctates were apparently made by punching a circular hollow tool onto the vessel exterior that would have left the roughly 9 mm diameter rings (Figure 11a).

Playas Red Punctate, Solid Tool Variety. At the Pinnacle Ruin, LA 2292, sherds with circular punctates appear to have been made by applying 3 to 5 mm deep punctures into the exterior jar surfaces using a solid tool with a slightly pointed tip. The resulting holes are about 2 to 3 mm in diameter that also indicate the thickness of the tool (Figure 11b).

One Playas Red Punctate sherd was found on the surface of Lake Lucero Site, LA 21162. This specimen revealed the punctates were applied as a secondary textured design between parallel incised lines (Figure 11c, d). All punctates are very small measuring no more than 1 mm in diameter. The punctate/incised texture combination is not unique to the Playas Redware as other types with similar designs have been observed in other nearby and distant regions. In the Southwest, some of the sherds of Honani Tooled and O'Leary Tooled of the Tusayan Grayware tradition resemble this texture combination (American Southwest Virtual Museum 2017).

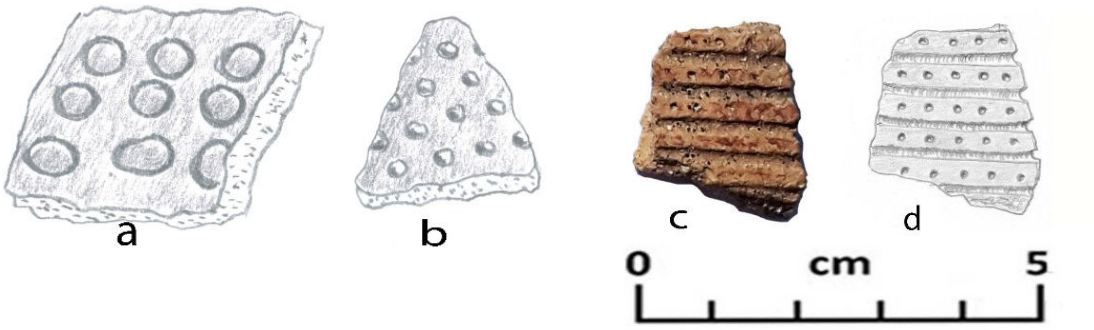

Figure 11. Example of Playas Red Punctate: (a) hollow tool punctate variety (redrawn from Lee 2013:417); (b) solid tool punctate variety from Pinnacle Ruin (redrawn from New Mexico Farm and Ranch Heritage Museum 2018); (c) photograph; and (d) pencil illustration of the same sherd with incised/punctate texture.

Additionally, this texture combination was also made on ceramics dating to the Cupica Phase of the Gran Darien culture in the Panama region (Martín-Rincón 2002), which roughly overlaps with the manufacture of Playas Red ceramics. The punctate or incised/punctate texture is even common in the Midwestern and southern regions of the United States (Setzler 1933).

Playas Red Punctate, Finger Nail Variety. This texture is relatively uncommon. One good example was noted by archaeologist Garrett Lietermann at the University Museum at New Mexico State University although its origin is unknown. Three sherds in the museum display probably come from a single Playas Red-on-brown jar (Figure 12 a-c).

To the finger nail variety, we also add a punctate texture that was probably made by a curved-tip tool which gives the appearance of a finger nail punctate. One such vessel is on display at NMSU's University Museum (Figure 12e). This type of punctate is common on vessels from the Casas Grandes area as evidenced on Lee's analysis of Carl Lumholtz Collection (Lee 2013). At least one rim sherd with finger nail-like punctate texture was recorded at the Joyce Well Site (Figure 12d).

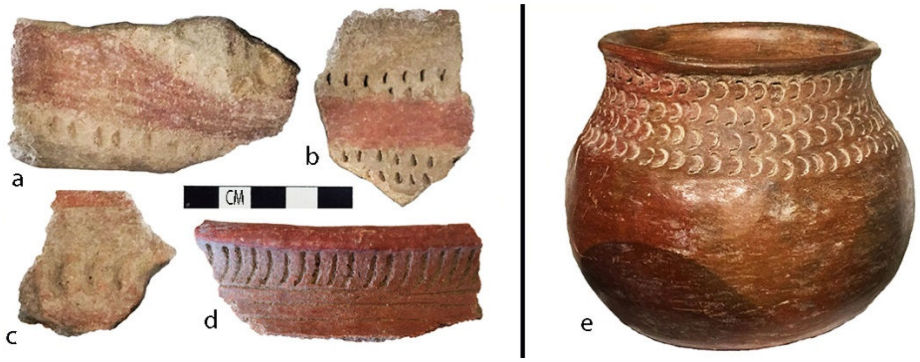

Figure 12. Examples of Finger Nail Punctates: (a-c) true finger nail punctates on Playas Red-on-brown sherds on display at NMSU's University Museum; (d) finger nail-like punctates on Playas Red Punctate from LA 11823; and (e) finger nail-like punctates on a complete Playas Red Punctate on display at University Museum (images (a-c) and (e) are courtesy of Garrett Leitermann).

Playas Red Smeared Punctate

This is a new textured variant that has been commonly observed in the southern Tularosa Basin, the Las Cruces area, and in the Boot Heel of New Mexico (Figure 13). Playas Red Smeared Punctate could be mistaken for a punctate, but it appears distinct. The veneer on these sherds slightly resembles that on smeared indented gray utility ware in the Rio Grande area, but these sherds were most likely made by first creating a punctate surface and then the whole vessel was polished over (Kurota et al. 2018).

It appears that at least half of these vessels were manufactured locally as evidenced by their El Paso Brown-style paste, with granitic temper often visible on the surface (Figure 13g, h, k). Visible remains of the punctates can be subdivided into ovular (Figure 13) and elongated/ triangular shapes (Figure 14). A few examples show fine temper and non-local paste (Figure 13i, j); however, as the majority of the sherds attributed to this type show greater similarity to locally-

manufactured wares, it is possible that Playas Red Smeared Punctate is a local invention with subsequent adoption in the northern Casas Grandes area. In order to evaluate this hypothesis, additional research is needed to see the potential geographic extent of production in Chihuahua.

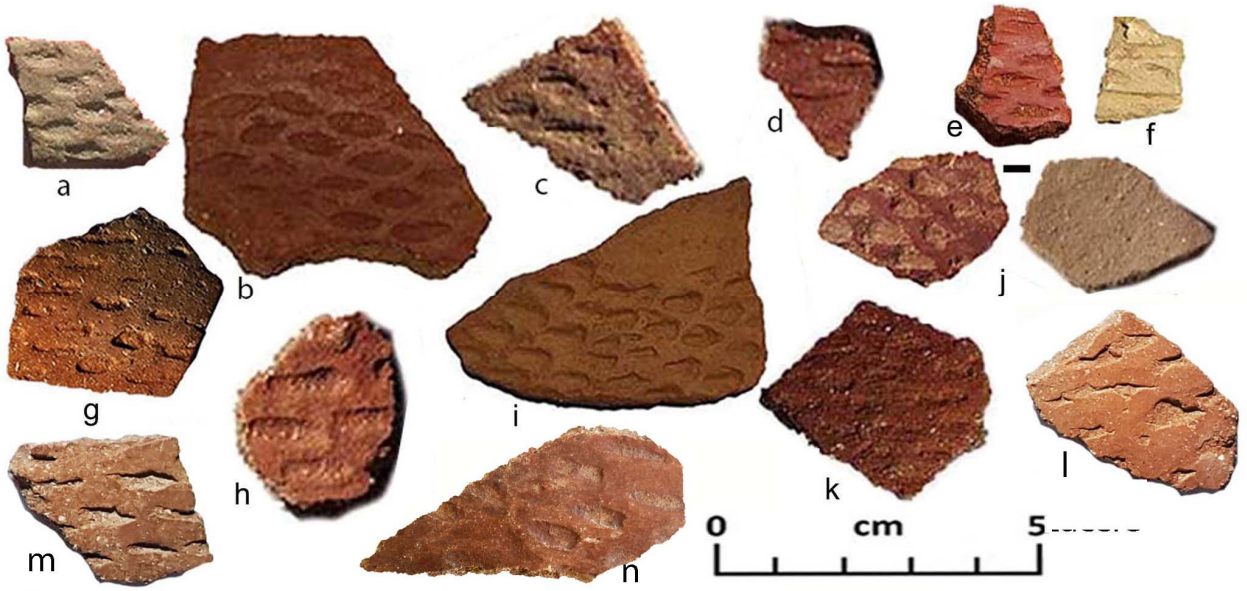

Figure 13. Examples of Playas Red Smeared Punctate with oval-shaped texture depressions. Note: (j) is from LA 117502; (k) is from LA 55129; (l) and (m) are from LA 21162; and (n) is from LA 11823; all others are from LA 104864.

The elongated and triangular smeared punctates (Figure 14) seem to be narrower than the ovular punctates (Figure 13). Sherds with this type of texture indicate, quite accurately, from which direction (left or right) the punctates were applied. Most of these punctates were applied from only one direction on a single vessel, although exceptions have been found at the Lake Lucero Site (Figure 14p). One sherd with a fine beige colored paste is consistent with that typically found on Playas series ceramics made in the Chihuahua area (Figure 14l).

Playas Red Smeared Indented Corrugated

This is a poorly understood type with limited information about its manufacturing technique and its spatial distribution. A good example of a Playas Red Smeared Indented Corrugated jar can be found at the Deming Luna Mimbres Museum. This vessel exhibits corrugations along the neck bordered with a single indented corrugated band resembling a rope-style swirl. Additionally, three parallel incised lines zigzag over the corrugations (Figure 15a).

We note that Playas Red Smeared Indented Corrugated is hard to distinguish from Cloverdale Corrugated. This type has been defined as a "red slipped corrugated ware" that occurs in a restricted area of Hidalgo County, New Mexico (LeBlanc 1980:283). Typical texture on Cloverdale Corrugated is smeared indented corrugated and the slip can either appear red or brown (Figure 15b). Since this type is hard to distinguish from Playas Red Smeared Indented Corrugated,

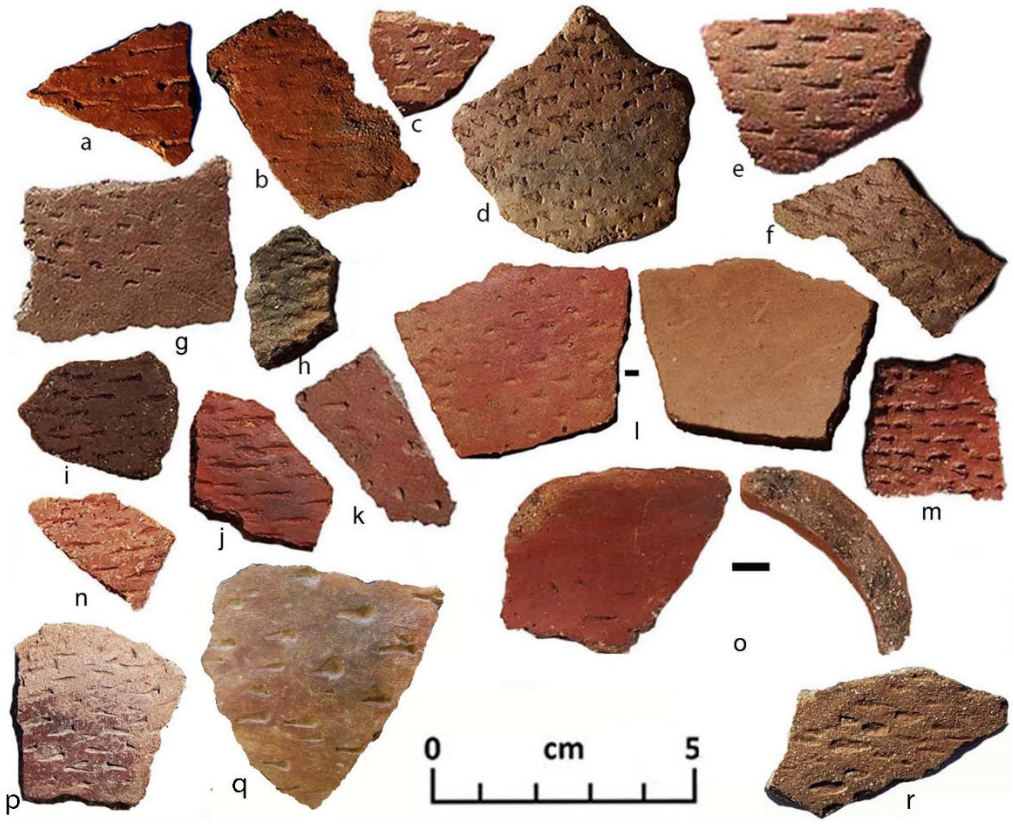

Figure 14. Examples of Playas Red Smeared Punctate with triangle-shaped texture depressions. Note: (k) is from LA 117502; (i), (j), (n), and (o) are from LA 186129; (p) and (r) are from LA 21162; (q) is from LA 11823; all others are from LA 104864.

Figure 15. (a) Playas Red Smeared Indented Corrugated jar from Deming Luna Mimbres Museum and (b) bowl rim sherd of Cloverdale Corrugated with smeared indented corrugated texture from LA 11823.

it is possible that Cloverdale Corrugated is another local variant of Playas Red (LeBlanc 1980:283).

Playas Red Corn Cob Impressed

This is a previously undescribed Playas Red textured variety. We documented two sherds with an apparent corn cob impressed texture in the southern Tularosa Basin and one at Joyce Well. As with most of the Playas Red specimens in this study, all three sherds are relatively small which offered limited space to provide more detailed descriptions. The first one was noted on the surface of West Dry Lake Pueblo, LA 104864, and revealed a true corn cob impression (Figure 16a). The second sherd came from the Turquoise House site (LA 55129) and appeared to have been smeared over (Figure 16c). Both sherds have typical southern Tularosa Basin reddish brown paste with monzonite temper. The last Playas Red Corn Cob Impressed sherd came from Joyce Well and revealed the deepest impressions of corn kernels. As with most Joyce Well's Playas Red ceramics, this sherd also exhibited the deep red slip on its exterior surface (Figure 16b). Reviewing the pattern of impressing the corn cob onto the Playas Red exteriors indicates that the texture was created by rolling a corn cob (see rows of kernels on a corn cob example atfar right of Figure 16) over the outer surface. The small size of the sherds prevented us from suggesting whether this was performed in a horizontal or vertical fashion.

Figure 16. Playas Red Corn Cob Impressed jar body sherds: (a) from West Dry Lake Pueblo, LA 104864; (b) from Joyce Well Site, LA 11823; and (c) from Turquoise House, LA 55129 (Kurota et al. 2016). Corn cob image on right is for comparison of kernel rows and impressions in clay.

Ceramics with corn cob impressions are quite rare in the Southwest with only a few examples being known. For example, occasional corn cob impressed Tusayan Gray sherds exist in southwestern Colorado (Sullivan 2008). In the nearby region of north-central Texas, Prikyl and Pertula (1995) report corn cob impressions on small redware cups. Corn cob texture is also reported from Late Woodland ceramic assemblages in the southeastern United States (Hancock 1986:84) as well as from Suwannee Valley sites in North Florida (Turner et al. 2005). Corn cob impressed pottery became even more popular after the middle of the eighteenth century, specifically on Cherokee ceramics of North Carolina (Riggs and Rodning 2002; Riggs 2015).

Summary of the Textured Variants of Playas Red

Our review of the known textured surfaces of Playas Red pottery and the introduction of the lesser known varieties indicate that Playas Red was a popular redware tradition in southern New Mexico and northern Chihuahua with a wide range of decorative themes. Future in-field and laboratory analyses can further refine this mosaic of textured decorations. To jump start this endeavor, we offer a field guide to the above discussed textured varieties of Playas Red (Table 1).

Table 1. Field Guide to Playas Red Textured Surfaces.

Playas Red Main Texture	Secondary Texture Attribute	Layout	Vessel Location
Incised	Comb	Right angle, oblique angle, herringbone, random, parallel horizontal, parallel oblique	Neck, upper body, base
	Stylus		
Punctate or **Smeared Punctate**	Ovals	Parallel horizontal, parallel oblique	Neck, upper body, all over
	Triangles		
	Dots (solid tool)		
	Rings (hollow tool)		
	Finger nail		
	Finger nail imitation		
Cordmarked	Narrow cordage	Parallel horizontal	Neck, upper body, all over
	Wide cordage		
	Cordmarked/Incised		
Corrugated	Plain corrugated	Parallel horizontal	Neck, upper body, all over
	Ind. corrugated		
	Smeared Ind. Corr.		
	Zoned Corrugated		
	Corrugated/Incised		
Corn Cob Impressed	Unfinished surface	Data not available	Neck, upper body, base?
	Smeared		

Regional Overview of Playas Red Pottery Production

Our review of recent sourcing studies and temper/paste documentation of Playas Red ceramics allows us to provide a discussion and synopsis of the proposed local manufacture of this pottery (Figure 17). Geochemical sourcing of mineralogical components in Playas Red sherds in northern Chihuahua and southern New Mexico has indicated the existence of several production centers (Table 2). Such centers include one along the Rio Casas Grandes around Paquimé and near Janos, one within the Sierra Blanca at Lincoln phase pueblos, two in Black Mountain phase pueblos within and near, separately, the Middle and Lower Mimbres Valley, three in the Hueco Bolson, and at least one in the southern Tularosa Basin.

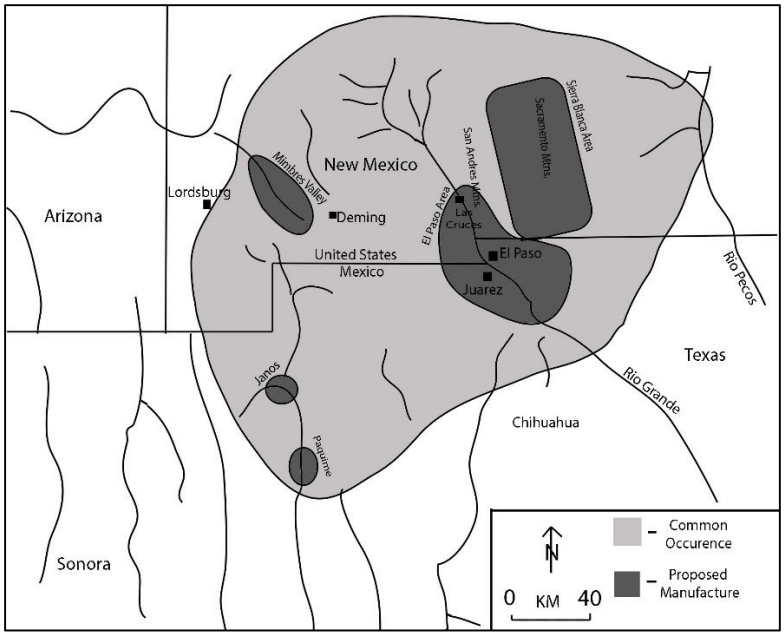

Figure 17. Map of southern Southwest region showing the area of common occurrence of Playas Red and proposed regions of its local manufacture (from Creel et al. 2002; Di Peso et al. 1974:6; Kurota et al. 2018, McCluney 1965, 2002; Wiseman 1981, 2016).

Table 2. Compositionally Distinct or Supported Production Areas for Playas Red.

Regional Area	Unique Area or Shared Area of Production	Method Employed	References
Paquimé, Chihuahua	Unique	XRF	Bradley and Hoffer 1985; Di Peso et al. 1974:6
Janos, Chihuahua	Unique	XRF	Bradley and Hoffer 1985
Middle Mimbres Valley	Shared with Lower Mimbres Valley	INAA	Creel et al. 2002
Lower Mimbres Valley	Shared with Middle Mimbres Valley	INAA	Creel et al. 2002
Northern Hueco Bolson	Unique	XRF	Bradley and Hoffer 1985
Middle Hueco Bolson	Unique	XRF	Bradley and Hoffer 1985
Southern Hueco Bolson	Unique	XRF	Bradley and Hoffer 1985
Southern Tularosa Basin/Alamogordo	Possibly shared with Hueco Bolson region	Paste-composition	Kurota 2008; Kurota et al. 2018; Bradley and Hoffer 1985
Sierra Blanca	Unique	Paste-composition	Wiseman 1981, 2016

In the Sierra Blanca region, Playas Red is frequently found without any Chihuahuan polychromes (Wiseman 2016:139). A Sierra Blanca production area for some ceramics found at Abajo de la Cruz was suggested based on gray syenite temper and stylus punctate decorative technique. Another manufacturing locale near the Mimbres Valley was suggested based on tuff/rhyolite temper and incised-line designs (Wiseman 2016:153). In the northern Chihuahua area around Janos or Paquimé, a probable manufacturing area was suggested based on fine

temper and stylus-punctate herring-bone designs (Wiseman 2016:153). Most Playas Red sherds identified in the Abajo de la Cruz ceramic assemblage could not be sourced to a location based on paste and decorative technique. Instead, they are generally thought to have been produced in the Sierra Blanca, El Paso, and northern Mexico areas with a mixture of temper materials and stylus-punctate, incised-line, and gouged designs present (Table 3; Wiseman 2016:140). The production of Playas Red ceramics at Black Mountain phase pueblos was suggested based on a sample of 83 sherds collected from twelve sites throughout the Mimbres Valley and surrounding area that were subjected to INAA (Creel et al. 2002).

Playas Red sherds were compositionally distinct from Jornada Mogollon ceramic types such as Chupadero Black-on-white and El Paso Polychrome, although similarities were found with Mimbres Classic Corrugated and the various smudged ceramic types. The variability present within the Mimbres Valley supports multiple production localities, perhaps separately along the Middle and Lower Mimbres Valley, and widespread exchange of vessels into the Casas Grandes Valley and into El Paso phase pueblos in the Hueco Bolson (Creel et al. 2002:43). Localized production on the site level in the Mimbres Valley could not be widely assigned using INAA, although the Old Town site has strong evidence for the production of Playas Red (Creel et al. 2002:43). No decorative differences between Playas Red found in the Mimbres Valley and adjacent areas has been identified/examined (Wiseman 2016).

Table 3. Proposed Differences in Paste, Temper, Decoration, and other Characteristics in Playas Red Production Areas (based on Wiseman 2002, 2016, and Kurota et al. 2018).

Regional Area	Paste	Temper	Decorative Style	Other Characteristics
Paquimé, Chihuahua	Fine, clear-fired tan	Finely ground light to medium grey feldspar	Gouged designs, stylus punctate, incised lines, cordmarked, corn cob impressed	Thicker sherds (>6mm); obvious red slips
Sierra Blanca, New Mexico	Medium to dark gray and brown	Grey syenite/gray hornblende syenite	Stylus punctate	Lower temperature fired, results in carbon in paste
Mimbres Valley	Data not available	Tuff/rhyolitic tuff temper with quartz phenocrysts	Shallow incised lines	Well-slipped, but less so and not fully as fired as Paquimé
Hueco Bolson/Tularosa Basin	El Paso-like	Variable temper of igneous rock, often light gray feldspar/monzonite	Gouged designs, stylus punctate, incised lines, cordmarked, corn cob impressed	Core zonation with thin ceramics. Higher firing temperatures, but insufficient duration of firing

In the Abajo de la Cruz study north of Hatch, undecorated sherds were not definitively identified as Playas Red due to strong similarities with the red-slipped Jornada-Three Rivers ceramic type (Wiseman 2016:140). Interestingly, Wiseman (2016:151) noted that although a red slip and polished surface are typological factors in the Playas Red designation, not all Playas Red sherds have clear indicators of the presence of slip and incised decoration. The unslipped incised sherds would be considered to be Playas Plain Incised.

Wiseman (2016:143-144) identified paste characteristics that can also be used to identify different locations of production based on his analysis of the Abajo de la Cruz Playas Red sherds. Playas Red vessels of suspected Paquimé-area manufacture are characterized by a clear paste similar to Ramos Polychrome and are well-fired (Wiseman 2016:143). A similar interpretation is supported by Wiseman's earlier analysis of ceramics from Di Peso's excavations at Paquimé (Wiseman 2002). Playas Red vessels produced in the Sierra Blanca area were differentially fired, resulting in variable coloration identified in the sherd paste (Wiseman 2016:143). "El Paso-like paste" found in Playas Red sherds likely produced in the southern Tularosa or Hueco Bolson is distinct in its dark grey to black core with reddish-brown to brown margins near the surface (Wiseman 2016:143). The zonation of the paste is the result of firing at sufficient temperatures to burn carbon within the clay matrix, such as found in the Paquimé-produced Playas Red, but for a too short duration to enable complete gray colored ceramic core (Wiseman 2016:143). Wiseman (2016:144) noted that it is difficult to directly correlate the "El Paso-like" paste with El Paso Polychrome due to noted compositional differences between the Playas Red and El Paso Polychrome sourcing conducted by Creel et al. (2002:41).

In addition to the Mimbres Valley study, an XRF analysis of a sample of 69 Playas Red sherds from primarily Jornada Mogollon sites identified five compositionally distinct groups (Bradley and Hoffer 1985). Three groups where identified within the Hueco Bolson (roughly upper, middle, and lower) and two groups in Chihuahua, one at Paquimé and one at Janos (Bradley and Hoffer 1985). Playas Red compositional groups identified near Janos and at Paquimé were the most discriminatory, with moderate overlap between the three Hueco Bolson groups (Bradley and Hoffer 1985:Table 2). No Paquimé Playas Red sherds were found in the sample from the Jornada Mogollon culture area. This contrasts to the presence of Janos Playas Red sherds identified, indicating that ceramic exchange of Playas Red between the Jornada Mogollon and Casas Grandes cultures was primarily undertaken through the Janos area (Bradley and Hoffer 1985). This hypothesis is also supported with regards to the exchange of Chihuahuan polychromes and El Paso Polychrome ceramics (Fish and Fish 2006; Kurota et al. 2018, Rogers 2018).

Summary

In conclusion this paper presented an initial study of the textured varieties of Playas Red pottery. Our intentions were to provide means of categorizing the diversity of this astounding redware that can better refine our understanding of the spatial distribution of the individual variants. Such potential data could outline peculiarities of discrete groups of potters and families using such pottery in daily life. We also summarized the most recent studies of tracing the Playas Red manufacturing regions as well as the general area of its common occurrence.

We have presented five main Playas Red textures (incised, punctate, cordmarked, corrugated, and corn cob impressed) that can occur alone or in combination with one or more other textures. Furthermore, a variety of secondary texture attributes exists for each of the main textures (particularly for punctate) that can potentially offer intimate differences between manufacturing centers. Researchers are encouraged to identify these differences on using the *Field Guide* presented in Table 1. Additionally, we summarized latest research on proposed manufacturing

areas of Playas Red with initial indicators of regional texture preferences. Our hope is that future research will aid in refining our understanding of regional production of the textured variants of Playas Red.

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WHAT MAKES THE HOPI BLUSH?

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and
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Abstract

The color of Hopi pottery is distinguished by its beautiful color either over the whole pot or sometimes in bursts (the "Hopi Blush"). Although Master Hopi potters (e.g., Mark Tahbo) know how to get these colors by the clays they choose and the way they fire, a technical account of how this happens is missing in the literature. We set out to provide such an account and did so with a three-step methodology. We were able to show that a) it is the chemical atmosphere not high heat *per se* that is the necessary component in producing the blush; b) that dung is what produces this atmosphere in Hopi firings; and finally c) that it is the sodium in the dung that is the necessary and sufficient component in the firing atmospherics that, *ceteris paribus*, produces the blush.

Introduction and Background

The color of Hopi pottery is distinguished by its beautiful color either over the whole pot or sometimes in bursts (the "Hopi Blush"). Master Hopi potters (e.g., Mark Tahbo) know how to get these colors by the clays they choose (e.g., Jeddito or Sikyatki clay) and the way they fire (viz., dung, or lignite/dung mix). A technical account or explanation of how the blush occurs is missing in the literature. Clearly the clay is a crucial component in the process, but the clay *per se* does not explain the color because achieving it is dependent on how it is fired. For example, contemporary Hopi potters who fire only in electric kilns, as opposed to dung firing, do not get the blush.

Theories regarding the cause of the blush typically take one of two general sides, or else a combination of the two. The first side claims it is the high heat of Hopi firing that causes the

blush because dung or dung and coal burn hotter than wood (the most common traditional firing method). The second maintains that the blush is a consequence of the atmospheric chemistry or gases produced during the firing. The compromise view maintains the middle position that it is both, that high temperature and kiln chemistry together produce the blush.

Here we show the three-step methodology we developed to get to the bottom of the question and demonstrate the result.

Step One: Is It Heat?

Hopi clay, in particular "Sikyatki" clay from First Mesa near the area where the prehistoric village of Sikyatki once stood, was generously made available by master Hopi/Tewa potter Mark Tahbo. Tahbo uses this clay to produce beautiful colors on his pots and is known for his "blush." To fire, he uses dung either by itself or sometimes with a small amount of coal (viz., lignite), and says his pots are fired to a temperature of between 850-900° C, the typical range of Hopi dung firings (personal communication 2014). To test the hypothesis that it is temperature that creates the blush, test tiles were made from the Sikyatki clay and fired in an experimental gas kiln in 100° C increments from 600-1,100° C, a range that begins well below and ends well above the range of Tahbo's firings.

Figure 1(a-c) shows the results of the test. Comparison of the same tiles refired in increasing increments of 100° C from 600 to 1,100° C show no appreciable difference in the color of the tiles, and not even the remotest hint of the Hopi Blush.

Figure 1(a). Three Sityatki clay tiles on the side of the experimental gas kiln before firing.

Figure 1(b). The three Sityatki tiles after firing to 1,100° C.

Figure 1(c). The three Sikyatki tiles after firing to 600° C.

Step Two: Chemistry (Atmospheric Gas) in Motion

The test results from Step 1 show clearly that firing at temperatures as high and even substantially higher than the typical Hopi firing does not produce the Hopi color or blush. This eliminates (falsifies) the core hypothesis from the school of thought that says it is temperature that produces the blush. This leaves chemistry, atmospheric chemistry produced during the firing that causes the blush. Step 2 of our work was designed to confirm this conclusion.

Typical Hopi potters fire almost exclusively with dung, although sometimes, as noted above, they also add some low grade coal (lignite). Because the blush is obtained with and without the lignite, making dung the constant, in other words the necessary and sufficient component of the two, we used only dung for our experiments. The Hopi use sheep dung to fire and so sheep dung was collected (Figure 2) and used for our experiments in the same gas kiln as the tile tests.

Figure 2. Sheep dung used in Step 2 experiments.

Two test bowls were prepared [Figure 3(a)] and placed in the experimental kiln upside down with some pieces of dung on and near them [Figure 3(b)] and fired to 800° C. The test results were dramatic. Both bowls [Figure 3(c)] showed blush on rims and inside. The backs of the bowls [Figure 3(d)], however, showed the most dramatic color, occurring where the dung was in close proximity or touching the bowls.

Figure 3(a). Two test bowls made from Sikyatki clay in Step 2, before firing.

Figure 3(b). The two test bowls in the kiln with pieces of sheep dung, before firing.

Figure 3(c). Blush on bowls after firing.

Figure 3(d). Backs of bowls after firing show dramatic color and blush.

These results clearly corroborated the implicate of Step 1, namely that it is the atmospheric chemistry of the firings rather than heat *per se* that produces the blush. Further experiments were done simulating the gaseous chemical environment of Hopi dung firings using pieces of dung in the test gas kiln to see the effect of proximity of the dung and quantity of the dung source on color. Figure 4(a), which shows the pot in the kiln, and Figure 4(b), which shows it outside the kiln, show the effect of a small amount of dung in close proximity to the outside of the pot. Figure 4(c) shows a pot with multiple pieces of dung around the pot inside the kiln after firing, and Figure 4(d) shows the rich color and blush all over the pot.

Figure 4(a). Pot with minimal dung and one piece right near pot inside kiln.

Figure 4(b). Pot outside kiln showing one main single area of blush.

Figure 4(c). Pot with more dung placed around the pot inside kiln after firing.

Figure 4(d). Pot outside kiln after firing showing rich color and blush.

Figure 5(a-d) shows what happens when multiple pieces of dung are placed around a pot and then cover sherds are used to "dodge" areas of the pot to keep the "dung gas" away thereby producing contrasting white areas on the pots, essentially devoid of color.

Figure 5(a). Pot exposed to multiple pieces of dung around pot inside kiln.

Figure 5(b). Pots exposed to multiple pieces of dung around the pot as well as sherd "dodging" (white areas) on some parts.

Figure 5(c). Pot exposed to multiple pieces of dung around the pot as well as sherd "dodging" (white areas) on some parts.

Figure 5(d). Pot exposed to multiple pieces of dung around the pot as well as sherd "dodging" (white areas) on some parts.

Step Three: But What Is the "Dung Magic"?

The experimental work shown thus far demonstrates the "chemistry" rather than "heat" hypothesis but forces another question: What is it that makes dung so "magic"? What is in the

dung or what is it comprised of that results in the gas in a dung firing that produces the remarkable Hopi Blush and color? There is nothing in the literature that explains this either, and it was this that we set out to resolve next. The most promising clue in our extensive search was the recollection by ceramicist Rick St. John (personal communication 2015) that at one time there was an ancient Chinese practice of soaking straw in a salty brine that resulted in streaking of colors just like we were looking for. He was not able to furnish a reference and we were unable to find this practice in a literature search either, but the idea that sodium could be the key seemed the most plausible direction to follow.

We now conducted a series of experiments to test this additional hypothesis. In particular, we soaked straw in a near saturated salt solution, let it dry, and then re-fired the tiles and a bowl that had been fired in Step 1 (without dung), this time covered with salt-soaked straw. None of them previously showed any Hopi Blush or color [Figure 6(a)]. Figure 6(b) shows this same tile after firing covered with the salt-soaked straw. It now is flooded with the vivid and vibrant color characteristic of Hopi Blush. Figure 6(c) shows the bowl and tiles in the experimental gas kiln after firing. The gray is ash from the salt-soaked straw. The color of all the pieces is rich and vibrant. Finally, Figure 6(d) shows the interior of the re-fired bowl. Here there is a characteristic rich orange to orange-red over the whole bowl as well as a burst of Hopi Blush, extra-intense color in parts of the interior.

Figure 6(a). Tile fired in Step 1 without dung.

Figure 6(b). The same tile re-fired covered with salt-soaked straw.

Figure 6(c). Re-fired bowl and sherds inside gas test kiln after firing with salt-soaked straw.

Figure 6(d). Bowl which had shown no color re-fired with salt-soaked straw showing vivid Hopi Blush and color.

The mostly widely used fuel for firing ceramics in the broad class of Ancestral and Historic Puebloan pottery other than dung is wood which does not, with whatever clay, yield the Hopi Blush or color. We conducted a series of further experiments to further corroborate the conclusion that sodium was the essential (both necessary and sufficient) component in producing the Hopi Blush and color. We fired two large "saucer" pots (18" diameter) made with Sikyatki clay in two separate firings in a wood-fired trench kiln laced with salt-soaked straw. Both pots showed strong Hopi color, although one of them, the one with the best color, broke due to uneven heating [see Figures 7 (a-d)].

Figure 7(a). Pieces of a large (18" diameter) "saucer" pot fired with wood and salt-soaked straw.

Figure 7(b). Pieces of the same pot glued together.

Figure 7(c). Another large "saucer pot".

Figure 7(d). Pot after firing.

Conclusion

The beautiful bursts of color or "Hopi Blush" and the color of Hopi/Tewa pots in general has been deservedly widely appreciated but little understood in terms of what causes it. In the series of studies presented here, we set out to solve this problem in three main steps. In the first we addressed the two-sided debate as to whether the cause was a matter of temperature or chemistry and were able to show clearly that the answer is the latter. In the second we corroborated that the atmosphere produced by dung is the source of the atmospheric chemistry producing the blush,

and in the final step, we set out to discover what the "dung magic" is, what is the chemical constituent (or constituents) of the dung that produces the blush, and were able to show that it is sodium. By soaking straw in a near saturated solution of salt and then firing ceramics made with Sikyatki clay both in an experimental gas kiln and in a wood-fired trench kiln we produced the blush and overall color.

Acknowledgements. This work would not have been possible without the generosity, the talent, intelligence and encouragement of Mark Tahbo (see Memoriam in this issue). Invaluable insight was provided by Rick St. John. We thank others for their encouragement and enthusiasm at the Southwest Kiln Conference where these findings were first presented. Thanks also to Wes Bernardini from the University of Redlands, who was first given a copy of the original findings by Mark Tahbo, for encouragement and support. And of course we could not close without acknowledging the generations of Hopi (Hopi/Tewa) potters who made the original discoveries and developed the remarkable and beautiful Hopi Blush in the first place and without whom we would not have even been thinking about these things. All photos and pottery by Rod Swenson.

IN MEMORIAM: MARK TAHBO (1958-2017)

Rod Swenson, CESPA Fellow, University of Connecticut;
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On December 23 of 2017, the world suffered a great loss with the untimely passing of Tewa/Hopi master potter Mark Tahbo at the age of 59. Mark was not only a brilliant potter whose achievements way outmatched his years, he was a remarkable human being. The article preceding this memoriam ("What Makes the Hopi Blush"), at least as far as my contribution to it goes, would not have been even remotely possible without Mark's input, as well as his talent, vision, generosity, and friendship.

For those who did not know him, Mark lived in Polacca, First Mesa, Arizona at the foot of the site where the ancient city of Sikyatki once flourished. Born in 1958, he learned pottery at the knee of his great-grandmother, Nampeyo's contemporary and neighbor, the legendary Grace Chapella who lived to 106 and still made pottery into her 100s. Mark carried on the tradition of these master potters in his own remarkable work (e.g., Adobe Gallery 2018; Heard Museum 2018; King Galleries 2018) in a lineage of what is often rightfully thought of as "Sikyatki Revival." As with Nampeyo before him, Mark was inspired by Sikyatki motifs and designs and spent hours walking amongst, studying, and getting inspiration from the ancient pottery sherds that still litter the ground of Sikyatki. His work, both visionary and at the same time, deeply traditional, deservedly rose to prominence quickly in his way-too-short career, bringing him numerous awards from the Heard Museum, where in 1992 he won Best of Division; the Southwest Association for Indian Arts Santa Fe Indian Market, where in 1991 he was awarded the Overall Prize as well as the prestigious Helen Naha Memorial Award for Excellence in Hopi Pottery (of which he was a three-time recipient); as well as awards at the Gallup Inter-Tribal Ceremonials; and others. His work has been featured in numerous books, and his work featured in prominent galleries and museum collections.

A visit to Mark's at Hopi was always a much anticipated annual trip for my wife Miriam and me. Getting past Dog's (for that was his dog's name) enthusiastic welcome at Mark's front door and entering his home, the depth and stunning beauty of his vision through which he saw the world became immediately apparent. Spending hours with him over the years talking about pots, paint, and firing, and hiking with him to explore the sherds at Sikyatki are irreplaceable experiences I will never ever forget and will always feel deeply privileged to have had. A visit to Mark's simply put, for both Miriam and me, was a joy. We stayed in touch throughout the year with emails (when he eventually got email) and phone. My last emails from him just weeks before he died were filled with creative ideas, and excited, contagious, and forward-thinking plans. An excerpt edited for space is included below. The news of his passing not many weeks later brought with it the deepest of grief, so completely unexpected—such a remarkable, vibrant person seemingly interrupted only part way into his life. Words cannot ever do justice to someone like this and can be nothing ever but inadequate. Mark's shining career ended far too soon. It is at least some small comfort that we have a great body of work, albeit too small, to remember him by. Mark made the world a brighter place and it would be much brighter still if

he'd been with us for a few more decades. You were one of a kind, Mark. You will always be deeply missed. R.I.P, friend.

> Hi Rod. Here's a picture of the most recent piece. What I like about this design is that it's free…no framing line. The color is so peach/apricot. . . . Walked up to Sikyatki yesterday. It's been at least 2yrs that I haven't been up there. Found me some treasures. Will have to go back up for clay. The pit is full of dirt, I have to clean it back out. I'll try to send you a picture of my finds. I been preparing clay to have on hand for this winter. I made a lot of clay covers out of the grog like the ancient people did. I really love your tiles. They're beautiful in shape form and color and your pot is lovely. Anyway, my friend, take care. Mark

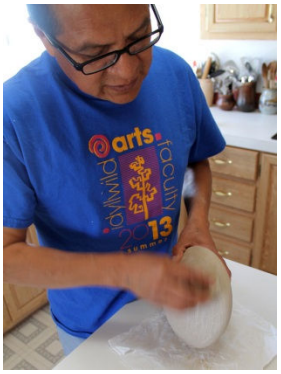
Dog examines sherd at Sikyatki.

Mark points out lignite deposits where ancient potters got fuel to fire (Miriam Swenson on left).

Looking at sherd showing stippling during exploration of Sikyatki with Mark.

Mark puts framing lines on pot with yucca brush.

Mark does stippling inside lines as done at Sikyatki.



Mark sands outside of a bowl using a piece of sandstone

Two just-finished pots on Mark's kitchen table with a design without framing lines as described in his email.

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BOOK REVIEWS

Lines of Communication: Mimbres Hachure and Concepts of Color. Will G. Russell, Sarah Klassen, and Katherine Salazar. 2018. *American Antiquity* 83(1):109-127.

Reviewed by Peter J. McKenna

Following the lead of Steven Plog's analysis (2003), the authors test the hypothesis that Mimbres hachure might have served as a visual proxy for blue-green, a color of multifaceted value in prehistoric Southwestern systems. Using cross-media comparisons (colored motifs on nonceramic artifacts), the interchangeability between Mimbres hachure and Mimbres Polychrome colored motifs, and elements on figurative motifs (life forms) across dimensions of species and sex, the results fail to support the hypothesis that Mimbres hachure represents blue-green. Data lemons are then converted to interpretive lemonade. The authors discuss Mimbres use of hachure as interchangeable with an alternate color, yellow, and part of an array of subtle signals contributing to the interregional complementarity between two contemporaneous systems.

Plog, Steven
2003 Exploring the Ubiquitous through the Unusual: Color Symbolism in Pueblo Black-on-white Pottery. *American Antiquity* 68(4):665-695.

Smudged Wares: The Importance of Color and Iridescence as a Long-Lived Decorative Attribute in the Mogollon Highlands. Tammy Stone. 2018. *Kiva* 84(1):1-26.

Reviewed by Peter J. McKenna

An argument pivotal to Stone's paper is that basic colors and 'iridescence' are as much a part of pottery stylistics as are painted designs or surface texturing. Stone concentrates on smudged bowls as this form emphasizes the heightened visibility of contrast important to the preeminence of stylistic displays and requires planning and specialized execution for production, particularly in firing technique. Smudging as style moves to prominent consideration when the weakly developed arguments for its 'functional' role are shown not to be a factor in the use of bowls. The color contrast—and often texturing—between bowl interiors and exteriors, combined with interior polish often to iridescence (formerly discussed as luster) are a long-lived tradition (a 'canon') in the Mogollon Highlands. Smudging used on multiple types of bowls and the production of smudged bowls is found to increase with outside contact and changes in social relationships. Smudged bowls are held to be an important decorative canon of potters in the Mogollon Highlands.

Current Exhibits and Events

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

The **2018 Pecos Conference** will be held from August 9 to August 12 at the Flagstaff Hotshot Camp on Snowbowl Road. More information is available at http://www.pecosconference.org/.

The **Southwest Kiln Conference** will be held this year in Blanding, Utah from September 27-30, 2018. The conference brings together ceramic artists, replicators, and archaeologists in a lively context of discussion and ceramic creativity. More information is at the website: www.swkiln.com

The **20th Biennial Mogollon Archaeology Conference** will be held from October 11-13, 2018 in Las Cruces. The conference (not to be confused with the Biennial Jornada Mogollon Conference which is a separate conference hosted by the El Paso Museum of Archaeology) will be sponsored by the NMSU Anthropology Department and Anthropology GSO and be held at the Corbett Center Auditorium on the NMSU Campus.

The **Southern Southwest Archaeological Conference** (SSWAC) will be held January 11-12, 2019 at the Pueblo Grande Museum in Phoenix, Arizona. SSWAC now seeks papers and posters presenting new archaeological research in the Southern Southwest US and Northwest Mexico.

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

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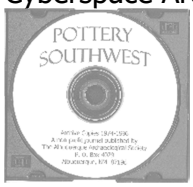

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