POTTERY SOUTHWEST

Volume 28, No. 1 April 2009
Spring 2009 ($3.00) ISSN 0738-8020

In This Issue: Hayward Franklin's meticulous paper describes an assemblage of potsherds collected by a landowner in Albuquerque's South Valley on a small and unreported site that has now been given the number LA 161967. The analysis was undertaken to provide an understanding of the significance of this small site and to evaluate its importance in the wider time-space panorama of prehistoric life in the Middle Rio Grande culture area.

Don Shiffler's thought –provoking paper describes the affect of a rapid introduction of human traffic to an area containing numerous ruins, and shows that the impact of people on these particular archaeological sites can be described in a logical, mathematical fashion. The preservation of surface ceramic assemblages, and the accurate counts of those ceramics, provide vital information; sometimes the only information, about archaeological sites. Yet, as Shiffler documents, human traffic can dramatically skew available data.

Finally, we provide some technical tips on submissions. An electronic publication creates formatting challenges beyond those of conventional printing or photocopying. These tips make publishing in *Pottery Southwest* easier for our contributors. We hope you will take advantage of them and send in your submissions (see Page 38 for how-to).

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

Analysis of a Pueblo III Potsherd Collection
from LA 161967,
South Valley, Albuquerque, New Mexico

by

Hayward H. Franklin

I. Introduction

This paper describes an assemblage of potsherds from LA 161967. It was collected by a landowner in Albuquerque's South Valley, and a field crew under the direction of Bradley Bowman, osteologist. The collection represents 100% of the visual surface sherds as seen on March 19, 2008. This small and unreported site has now been given the number LA 161967 in the State system. It is possibly related to a nearby site already designated as LA 582, but the relationship to that larger site is unknown; multiple modern landholdings and land disturbance make it difficult to determine the spatial and cultural relationships that existed prehistorically.

This analysis was undertaken to provide an understanding of the significance of this small site, and to evaluate its importance in the wider time-space panorama of prehistoric life in the Middle Rio Grande culture area. Thanks to Bradley for providing the sherds and to Jesse Murrell and David Snow for their thoughts and insights on the pottery.

II. Methods

The collection consists of 158 fragments of prehistoric ceramics, and one set of matching sherds that make up about half of a red glazeware bowl, typed as Agua Fria Glaze/red. The sherd sample was not recovered from a stratigraphic sequence. However, they may be seen as representing the range of pottery types present at this location.

The sherds were washed and then assigned to Southwestern Pottery Type, using the standard nomenclature. Then, analysis of the paste and temper was done to reveal ceramic materials used in manufacture. Each sherd was clipped and examined under a microscope to reveal the tempering materials. Next, a sample of each major type was also refired in an electric kiln, using the removed clips. This was designed to oxidize the fragments to a consistent temperature and atmosphere (900 degrees C. for 10 minutes). The oxidized samples were later assigned a Munsell Color Chart color, and compared to each other for clay color variation.

Photographs were taken of all sherds, grouped into types, for visual comparison. Photos were also taken through the microscope to illustrate the kinds of tempering materials identified.

III. Archaeological Framework

These potsherds are assignable to standard known pottery types with little difficulty. Collectively, they belong to the prehistoric Puebloan cultural sequence typical for the Albuquerque vicinity. Temporally, they fall within a time frame of AD 1050 to about 1350. In the Southwestern time framework, this places them in the late Developmental, mainly in the Coalition, and very early Classic phases of Wendorf and Reed (1955). In the Pecos Classification, they fall into the Pueblo II-III, and early PIV periods. During this time, cultures in the Albuquerque area were expanding. Larger settlements of pithouses, and then small above-ground adobe pueblos were appearing across the landscape. Other reported sites of this culture in the Coalition period include numerous villages on the Lower Puerco, for instance Fenega (1956), Fenega and Cummings (1956), Warren (1982), Marshall (1980), Marshall and Walt (1984). In the Albuquerque-Socorro corridor along the Rio Grande, sites of the period were numerous. These include the Tunnard site (Hammack 1966), Dennison site (Vivian and Clendenen 1965), and the Sedillo site (Skinner 1965). Many sites of the period were noted in surveys of Kirtland Air Force Base (Franklin 1981; Franklin and Neal 1981a, 1981b, Higgins 1998). Some recent investigations undertaken through salvage and mitigation efforts belong to this period, e.g. Acklen (1995) Sullivan and Akins (1994), Marshall and Marshall (1994), and Murrell (2009). In the Tijeras Canyon vicinity sites of this era are also common. The formation of Tijeras Pueblo occurred at this time (Cordell 1980), and many other sites are evident up and down the Tijeras drainage as described by Bowman (2004), Oakes (1978), and Wiseman (1980). In all, this period was a florescent one, and formed the foundation for the massive expansion of populations and town sizes in the following Classic Period. Cordell (1979) summarized the evidence for the general Middle Rio Grande area.

Ceramics of this time have been described at all the sites listed above. In addition, specific discussions of these pottery types are found in Mera (1935), Wiseman (1980), Warren (1980a, 1980b, 1981, 1982) and Marshall and Walt (1984). Murrell (2009) reviews much of the ceramic evidence. Recent compendiums of local pottery have also been published (Wilson 2005; Dyer 2008).

IV. Typology and Chronology

Several matching sherds making up about half a glazeware bowl are classic Agua Fria Glaze/red (ca. A.D. 1315 - 1450). This pottery type is very common at large PIV (Classic) period pueblos in the Albuquerque area where it was produced in massive quantities during the AD 1300s. It was the first major ceramic type made in the area to have a brightly oxidized red slip together with glazed mineral paint forming a glassy painted appearance.

The other 158 sherds were assigned to known pottery types in the area, including well established Black/white types:
Socorro Black/white (AD 1050 - 1275),
Santa Fe Black/white (AD 1200 - 1325),
Wiyo Black/white (AD 1250 - 1400).

Typologically, only a few sherds were assignable to Socorro B/w, perhaps suggesting that its popularity was fading. More frequent were carbon-painted Santa Fe B/w examples, although some of these showed signs of slight mineral admixture. These may signify a transition between pure mineral and pure carbon painting over time. Other sherds were classed as late Santa Fe, or Santa Fe-Wiyo in style (Figures 1-4). These are carbon-painted and show an increasingly larger and bolder design treatment. Here, the layout is looser in arrangement; hachure is larger, wider, and less controlled. The fine linework of Socorro and early Santa Fe B/w is now gone. Finally, some sherds were placed into the succeeding type Wiyo B/w, known much better in areas to the north of Santa Fe. Indeed, the extent of Wiyo B/w is interesting and its existence in the Albuquerque area is not well documented. Here, it seems that it is a direct outgrowth of Santa Fe B/w and some examples seem to illustrate this transition. Finally, one early Biscuitware sherd was seen. This type was an outgrowth of Wiyo B/w in the northern Rio Grande district and it is seen as such here also. This is the only possible Biscuitware sherd; it is typologically early in appearance. The early Glaze A bowl and the early Biscuit sherd suggest continued occupation into the early 1300s.

Other whiteware types of this time period might potentially appear in this vicinity, since they have been identified in the area. However no Cibola Whiteware from the west, San Juan Whiteware, or trade ware from the northern Rio Grande were seen in this collection. Bice and Sundt (1972), and Bice (in Bowman 2004) employed the term San Ignacio B/w to some of the late carbon-painted pottery in the Albuquerque area. Essentially, this type refers to locally-produced Santa Fe and Wiyo B/w. As such, the "local" Santa Fe and Wiyo B/w of this collection might possibly be referred to as "San Ignacio" under Bice's definition. However, the term has not gained wide recognition.

Accompanying these decorated painted types are many sherds of utility ware used for cooking and storage (Figure 5). Included are several textured surface styles:

Clapboard (unindented) corrugated,
Indented (finger impressed) corrugated,
Obliterated corrugated (smoothed coils to point of almost invisible),
Plain grayware (completely obliterated gray rough surface).

Several sherds of Los Lunas Smudged appeared also; these are also typical for ceramic complexes in the area between Albuquerque and Socorro, New Mexico.

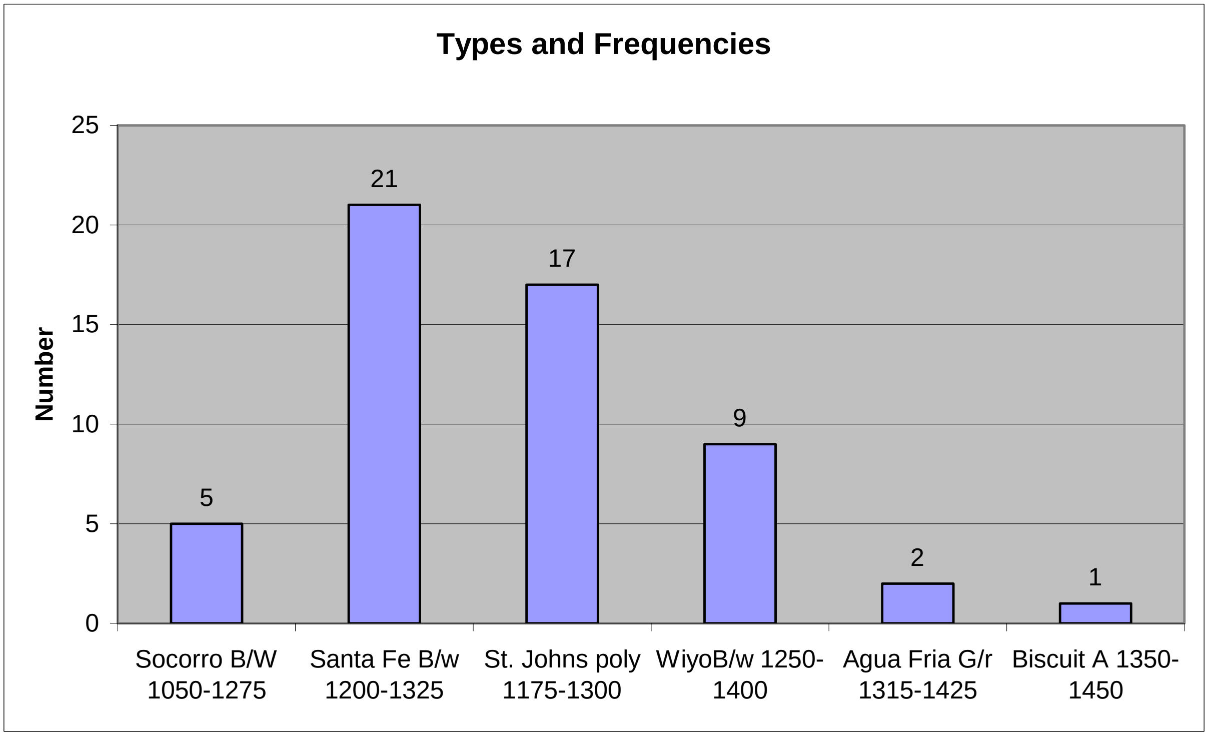
Together, these types suggest that the site was occupied between A.D. 1050 and 1350 at the outside extremes. Major occupation was more likely in the A.D. 1200 - 1300 period during which all the types present were in full manufacture. **Table 1** shows these types in order of starting date; a peak of frequency occurs in Santa Fe B/w times. The paucity of Socorro B/w at the early end and near-lack of glazeware at the late end, hint that the site's time span is probably a single occupation of no more than 100 years, focused mainly on the thirteenth century or approximately A.D. 1200-1300.

The painted whiteware pottery, like all such ware in the Southwest, was formed by the coil and scrape method still in use by Pueblo potters today. White slip was applied and then polished with a polishing stone, followed by painting with mineral or carbon-based paints. Socorro B/w is a mineral-painted type, while Santa Fe and Wiyo B/w are carbon-painted. Clearly, a transition from mineral paints to carbon (plant-based) paints was ongoing during this period. Many small sites in the Albuquerque area yield both mineral-painted and early carbon-painted ceramics. Surface associations suggest that many small communities were using, and probably producing, both mineral and carbon painted whitewares at the same time. This site falls into this interesting period of transition in painting technology.

The textured and plainware utility types are typical of the PIII to PIV transition period, and accompany the painted decorated pottery at most sites. In general, the more boldly textured indented and clapboard styles gave way to increased smoothing and obliteration of coils in the late 1200s. Finally, in PIV Classic times, coils were completely smoothed over, and a plain grayware resulted. As such, this was a period of transition in utility ware as it was in painted whiteware.

Table 1. Decorated Pottery Types and Frequencies at LA 161967

Pottery Type (in start date order)	N.	Pct.
Socorro B/W 1050-1275	5	9.1%
Santa Fe B/w 1200-1325	21	38.2%
St. Johns poly 1175-1300	17	30.9%
WiyoB/w 1250-1400	9	16.4%
Agua Fria G/r 1315-1425	2	3.6%
Biscuit A 1350-1450	1	1.8%
	55	100.0%



In the region of Albuquerque south to Socorro, NM, another utility type is frequently noted. Los Lunas Smudged is a brownware type found only in bowl form. Several definite Los Lunas Smudged pieces appear in this collection (Figure 6). It is intentionally smudged and polished on the bowl interiors and exterior texturing consists of exposed and often indented coils on the upper exterior bowl surface only. The interior and exterior of these bowls is typically well polished and brown-red in color. The use of smudged interiors, abundant polish, brown pastes, and decoration by texture are all traits associated with the Mogollon culture to the south and west of the Rio Grande basin. The nature of the connection between this pottery and that of the local Puebloan black/white ware has remained a somewhat unexplained phenomenon in local archaeology.

Aside from the partially reconstructable glazeware-red bowl (Figure 7), another 20 sherds of red-slipped, polished, and black painted pottery were found. Almost all these (18) belong to the White Mountain Redware tradition, centered in north-central Arizona (Carlson 1970) (Figure 8). These were certainly imported pieces from that region as determined from the light yellow pastes and potsherd tempers used in that archaeological region. Typologically, they are assignable to Wingate Black/red, St. Johns Polychrome, and Heshotauthla Polychrome. However, due to the small size of the fragments and the lack of exterior surfaces visible on the bowl sherds, it is impossible to assign specific types to these examples. Judging from the orange hue to the slip and the semi-glazed paint surfaces, they are most likely St. Johns Polychrome. Two sherds contained local volcanic basalt temper along with the sherd temper, indicating a locally-made variety of the imported redware. This illustrates the early production of local copies of White Mountain redware types here in the Rio Grande area. As such, they are typable as Agua Fria Glaze/red. Several other sherds of this type formed the partial bowl shown in figure 7.

V. Vessel Form

Table 2 shows the distribution of pottery (exclusive of the partially restored Agua Fria G/r bowl) according to vessel form. As expected, the total assemblage yielded both open mouth bowls and storage jars. A total of 77 sherds came from bowls, while 80 sherds belonged to jars. One handle fragment showing exposed coils probably came from a mug or pitcher. No other vessel forms were noted. As ordered by pottery type, bowl body sherds are the most frequent, followed by bowl rims. A gradual change from the jar form to the bowl form occurred in the whiteware over a century or more**;** by this time bowls were already more frequent than jars in the black/white decorated category (Table 2). Although a few black/white jar body sherds were seen, there are no jar rim sherds. The shift towards the bowl form in preference to painted jars was already evident by the 1200s.

Table 2. LA 161967 Pottery Type by Vessel Form

Pottery Type	bowl rim	bowl body	jar rim	jar body	other		Totals
Socorro B/w		5					5
Santa Fe B/w	5	5					10
Santa Fe-Wiyo B/w	6	4		1			11
Wiyo B/w	2	6		1			9
Biscuit A		1					1
Carbon paint unident.		6		1			7
Plain white	1	5	2	21	1	(handle)	30
indented & clapboard corrugated			2	14			16
obliterated ocrrugated			2	20			22
plain gray				16			16
Los Lunas Smudged	5	6					11
Wingate-St. Johns-Hesho.	4	13					17
San Clemente-Kwakina G/p	1						1
Agua Fria G-r		2					2
							0
Totals	24	53	6	74	1	0	158

As expected, the majority of the pottery actually comes from grayware utility jars, which were now assuming even more functional roles, including cooking, storage, and probably transport of liquid and solid contents. Many of these are smudged on the exterior from use over fires and some appear to be intentionally polished and smudged on the rim interior surfaces.

The 11 sherds of Los Lunas Smudged are all from bowls, about half of which are rim sherds. They all display typical characteristics of this type and are unmistakable. Presumably, these bowls were used for similar purposes as the whiteware bowls, that is, serving, food preparation, and some storage. Although they are manufactured in a different way and certainly differ visually from their whiteware counterparts, these bowls were probably used for quite similar purposes. The blackened and smudged interiors may have helped to retain liquids. Imported White Mountain Redware sherds are characteristically from open-mouthed bowls; certainly, all these examples are from large bowls.

VI. Materials Analysis - Temper

The tempering materials added to paste clay by the potter serve to strengthen the body wall and reduce firing shrinkage. For the archaeologist, these materials also provide clues as to the environmental sources of temper utilized in the vessels. Potsherd temper is ideal technically, and was employed by potters in some cultural districts. In other areas and times, crushed rocks, sand, and mixtures of these with potsherds were utilized as tempers. Because geological sources can sometimes be located today and because cultural-regional traditions of temper usage persisted for long periods of time, the study of temper can afford the archaeologist with important information on where and when the pottery was made (Shepard 1963). Tempers are listed in Table 3; photos of temper types through the microscope are shown in Figures 9-12.

The temper of Socorro B/w in the lower Middle Rio Grande basin is typically fine-grained potsherd, sand, and crushed rock. Usually, the paste is gray in color and potsherd comprises at least 50% of the temper. In many cases, potsherd is the only tempering material. Table 3 reflects this trend; the five sherds are tempered with potsherd or a sherd-sand mixture.

Santa Fe B/w is known to be tempered with a wider variety of materials, including sherd, sand, sandstone, and crushed volcanic rocks. At this site at least, the paste and temper resemble the Socorro B/w closely. A fine gray paste contains potsherd or potsherd-sand mixtures. There is really no major distinction between the pastes and tempers of these two types, at least at this locality. Likewise, the late Santa Fe B/w and Wiyo B/w contain essentially the same tempers as the earlier B/w types (Figure 9). Despite their surface distinctions, tempers of these types are largely the same.

A group of undecorated plain white sherds derived from other painted vessels also show tempers consisting of potsherd and fine sand in varying combinations.

Table 3. LA 161967 Pottery Type by Tempering Material

	potsherd	sherd/sand	sand	clear quartz	schist	schist/quartz	basalt	Totals
Socorro B/w	2	3						5
Santa Fe B/w	4	6						10
Santa Fe-Wiyo B/w	5	6						11
Wiyo B/w	4	5						9
Biscuit A		1						1
Carbon paint unident.	2	5						7
Plain white	12	16	2					30
indented & clapboard corrugated				1	6	9		16
obliterated ocrrugated			1	2	11	7	1	22
plain gray			4		9	2	1	16
Los Lunas Smudged		11						11
Wingate-St. Johns-Hesho.	17							17
San Clemente-Kwakina G/p	1							1
Agua Fria G-r							2	2
Totals	47	53	7	3	26	18	4	158

Corrugated and plain utility ware employed a different set of tempers (Table 3). Many of these clearly show micaceous schist temper (26) or schist-quartz combinations (18) (Figure 10). Five were tempered with sand, three with clear transparent quartz, and two with basalts. Geologically, this implies a variety of source-areas. Coarse sand dominated by quartz, some feldspars, and a bit of mica, etc. is fairly ubiquitous in the sands and gravels of the area. Basalt is available at many ancient volcanic cones and lava flows in the Middle Rio Grande rift zone. As such, it was an ideal tempering material and was used for this purpose extensively during PIV glazeware times along the Rio Grande.

The micaceous schist, however, is restricted in geological outcrops to the Sandia and Manzano Mountains. Outcrops have been visited and collected by this author in Tijeras Canyon, in Juan Tabo Canyon to the north, and in the Manzano range to the south. Dikes and narrow exposures of schist occur widely through these adjoining mountain ranges (Kelley 1977). Archaeologically, schist was utilized by prehistoric potters at Tijeras Pueblo (Warren 1980b) and other Puebloan settlements in the Tijeras vicinity (Bowman 2004, Oakes 1978, Warren1980a, Wiseman 1980). Mountain communities continued using mica in pottery into historic times (Dick 1968). Interestingly, however, micaceous pottery of a utility nature also occurs at many PIV glazeware sites in the Rio Grande bajada and inner valley in the Albuquerque vicinity (Acklen 1995, Franklin 1981, Franklin and Neil 1981a, 1981b, Higgins 1998).

The specific origin of the micaceous materials used in this utility pottery remains unclear. Either such finished pottery was imported from the pueblo communities in the mountains, such as Tijeras Pueblo, or micaceous rock washed downstream from tributaries and was gathered by potters resident along the Rio Grande. This phenomenon was first noted by Warren (1980a, 1980b, 1981) for Tijeras and Carnue sites in Tijeras Canyon. The lack of local micaceous rocks or alluvial detritus bearing mica or schist along the Rio Grande has suggested that much of the finished pottery was imported, for example at the Montano Bridge site (Franklin 2008), and as far south as Los Lunas (Murrell 2009). However, the location of LA 161967 near the confluence with Tijeras Arroyo, and the finding of a small piece of raw mica schist in the potsherd bag suggests that the residents of this site might have had access to raw mica schist fragments washed down from the mountains to the east. One utility sherd has a red-firing paste and temper consisting of both basalt and schist. Although rare, this combination shows that at least a few pieces made in the Valley were of local materials plus schist, possibly recycled from an earlier vessel.

The temper of Los Lunas Smudged, at least at this site, matches that of Santa Fe and Socorro B/w closely. That is, it is composed of a combination of potsherd and fine sand (Figure 11). All 11 sherds of this type were very consistent in their paste and temper; the use of white potsherd and very fine sand was uniform throughout.

Tempers used by the White Mountain Redware pueblos to the west, in western New Mexico and Arizona, were dominated by potsherd (Figure 12). Large chunks of white to yellow to red potsherd temper are visible in cross-sections. Paste is yellowish, and much lighter colored than those of the Rio Grande production sphere. This characteristic paste-temper combination is used to identify intrusive pottery from the White Mountain and Little Colorado areas of Arizona. Such pottery was carried up to 200 miles to be used in local Rio Grande Pueblos. Wingate, St. Johns, and Heshotauthla types were popular imports along the Rio Grande in the period just preceding the glazeware phenomenon of PIV times. As such, these imports can be distinguished from their local Rio Grande "copies" by the use of light buff pastes full of potsherd temper, while the succeeding locally-made glaze painted derivatives utilized red pastes and basaltic rock tempers.

In fact, examples of local glazeware production are not frequent at this site, suggesting its main occupation occurred before the glazeware explosion of post-1300 A.D. The partial Agua Fria G/r bowl and two separate sherds in the collection of 158 are assignable to the local Agua Fria G/r type. As an outgrowth of the intrusive White Mountain Redwares, the "imitation" of the northern Arizona types became known as Los Padillas G/p, Arenal G/p, and Agua Fria G/r on the Rio Grande. Only the Agua Fria type is confirmed in this collection and it is not numerically frequent. LA 161967 probably did not last long into the PIV glazeware phase.

VII. Materials Analysis - Paste Clay

Clips from 51 potsherds were refired in an electric kiln to 900 degrees C. The maximum temperature was held for 10 minutes before gradual cooling. The ensuing oxidized results bring out the clear and compatible colors of the original paste clays. Using a standard measure of color, such as the Munsell Soil Color Chart, it is possible to compare these colors to color chips, and, thus, compare potsherds to each other and to raw materials sources in the environment.

The refired sample is shown in Table 4. In order to summarize the frequency by color, standard statistics cannot be used, due to the fact that the Munsell chart is not a continuous numeric scale. However, tallies can be plotted on a representation of the Munsell chart, as shown in Table 4. Here, a tabled version of the Munsell color pages is used to record frequencies. The three major categories, whiteware, utility ware, and smudged brownware are shown according to the color chart pages in this table. As tabulated, it is a graphic representation of the three pages of the Munsell chart: 2.5YR, 5YR, and 7.5YR, ranging from Red to Yellowish-red to Reddish-yellow. All 51 oxidized sherds fell on these three Munsell pages.

Several results emerged from the refiring tests. First, all clays used in this pottery collection are relatively rich in mineral impurities (especially iron), which gives them bright colors. These are bright colors that vary mainly in their degree of yellow and red mixture. The Value (light to dark) is high and the Chroma, or saturation, is also high (6-8). They are definitely not the white to light buff clays typical of the San Juan Basin and Acoma areas. None of the tested sherds derived from those light Cretaceous sedimentary clay beds.

The whiteware types (Socorro, Santa Fe, and Wiyo) are located on the lighter and more saturated end of the 5YR and 7.5YR Hues. These bright colors are reflected in the range of 6/6 to 6/8 by Value/Chroma. Indeed, these 20 sherds are clustered closely. All are on two adjacent Hues and in a tight cluster of Value/Chroma. There is not a large amount of variability. In the whiteware, examination of the raw tallies showed no association between specific pottery type and Munsell color. Whiteware types were made from basically the same clay.

Secondly, Los Lunas Smudged is very consistent in color, centered on 5YR 6/8. Almost no variability exists in oxidized color. Evidently the clay utilized came from one source. Note that this coincides with at least some of the whiteware colors (on the 5YR hue). Color consistency agrees with the temper consistency in this type.

Thirdly, utility ware reveals some of the same coloration as other wares in the 5YR 6/8 area (Table 4). However, there are six specimens that fired redder than any whiteware or Los Lunas Smudged. These matched colors on the 2.5YR 6/8 and 5/8 chips. These represent a different clay source than seen in the rest of the utility sherds. This redder color was also not equaled by any of the whiteware or Los Lunas Smudged samples. Clearly, a certain amount of red-firing clay was used in some of the utility. Thus, while 14 utility sherds fall into the same color range as the whiteware and Los Lunas Smudged (5YR 6/8 - 5YR 5/8), six others derived from a distinctly redder clay source.

The raw data for the 51 oxidized sherds was then examined for any association between temper and color. In the case of the three whiteware types, there was no relationship between temper and color. Neither temper nor color varies widely, and what variation exists does not show any association between type, temper, or color. Tempers are all sherd combinations with fine sand or rock and the colors displayed are equally limited in range.

Table 4. Munsell Colors of Refired Sherds

Type = *Whiteware Types n=20*

REDDER

Hue: 2.5YR

Chroma (Saturation)

Value		0	2	4	6	8
light	6					
	5					
	4					
	3					
dark	2.5					

Hue: 5YR

Chroma (Saturation)

Value		1	2	3	4	6	8
light	8						
	7						
	6					*2*	*11*
	5						
dark	4						
	3						
	2.5						

Hue: 7.5 YR

Chroma (Saturation)

Value		0	2	4	6	8
light	8					
	7				*3*	*1*
	6				*2*	*1*
	5					
dark	4					
	3					
	2					

YELLOWER

Type = *Los Lunas Smudged n=11*

REDDER

Hue: 2.5YR

Chroma (Saturation)

Value		0	2	4	6	8
light	6					
	5					
	4					
	3					
dark	2.5					

Hue: 5YR

Chroma (Saturation)

Value		1	2	3	4	6	8
light	8						
	7						*1*
	6						*7*
	5						*3*
dark	4						
	3						
	2.5						

Hue: 7.5 YR

Chroma (Saturation)

Value		0	2	4	6	8
light	8					
	7					
	6					
	5					
dark	4					
	3					
	2					

YELLOWER

Type = *Utility Ware n=20*

REDDER

Hue: 2.5YR

Chroma (Saturation)

Value		0	2	4	6	8
light	6					*1*
	5					*5*
	4					
	3					
dark	2.5					

Hue: 5YR

Chroma (Saturation)

Value		1	2	3	4	6	8
light	8						
	7						
	6						*12*
	5						*2*
dark	4						
	3						
	2.5						

Hue: 7.5 YR

Chroma (Saturation)

Value		0	2	4	6	8
light	8					
	7					
	6					
	5					
dark	4					
	3					
	2					

YELLOWER

Los Lunas Smudged is very consistent in both temper and paste color. The sherd or sherd-sand temper is employed in a consistent paste. This suggests manufacture by a small group of potters and no importation from disparate distant sources.

Interestingly, the utility ware (consisting of clapboard, indented, and wiped or obliterated corrugated, and play gray utility) shows the greatest variation both in temper and clay. The appearance of six specimens of a reddish clay, not used in the other ceramics categories, signals a departure from the norm. Significant association between temper and clay color was seen in this case. The six sherds firing red (2.5YR 6/8 - 5/8) all contain dominantly sand tempers rather than the mica-schist tempers which fired to 5YR 6/8. Two of these had clear angular quartz grains, one intermediate igneous rock, one vesicular basalt, and two are sand with some mica mixed. This reddish firing group has tempers which would seem to be more native to the Rio Grande Valley, especially the basalt and the intermediate igneous rock. By contrast, all the utility which contained micaceous schist rock fired a yellowish-red (5YR) instead of red (2.5YR). These data demonstrate that several clay/temper combinations exist in the utility ware. At least two and possibly multiple materials sources are indicated. As a guess, the schistose tempers derive from Tijeras Pueblo, or at least some village in the Mountains (Warren 1980b). The redder pastes and sand-basalt tempers suggest points of origin in the Rio Grande Valley itself.

Actual sources of clay in the Valley, as well as in Tijeras Arroyo, should be sought and tested. Comparison to finished wares from pottery-producing sites would then be conducted, and matches could be made between pottery and environmental sources.

VIII. Discussion

A. Local ceramic evolution

Situated in an important geographic and temporal niche, the small site of LA 161967 illustrates what ceramics were like at this place and time. Occupied between A.D. 1175 and 1300 intensively, it may have started as early as 1100 and probably extended slightly into the early glazeware period post-A.D. 1300. During this occupational period of late PIII and early PIV, black/white ceramics were still the norm. Three sequential types are present: Socorro B/w, Santa Fe B/w, and Wiyo B/w. The paucity of Socorro B/w at the early end and the relative scarcity of Rio Grande glazeware at the late end, bracket the peak occupation to the Coalition period.

These whiteware types appear to form a local continuum of production. Here, they seem to grade into each other continuously in terms of their decorative attributes. Temporally, this continuum is also suggested by overlap between sequent types. Socorro and Santa Fe B/w overlap between AD 1200 and 1250, while Santa Fe and Wiyo B/w overlap for at least 50 years, between 1250 and 1300. Therefore, the three types likely form an unbroken sequence at this location. From LA 161967 to the Cerro de Los Lunas site to the south and the Tunnard site to the north, a whiteware sequence from Socorro B/w through Santa Fe and Wiyo B/w occurred area-wide.

Further evidence of the whiteware types forming an unbroken local continuum appears in the paste, temper, and paint compositions. This collection clearly shows a transition from pure mineral painting, into a carbon-washy mineral paint, then to a pure carbon paint well controlled. All stages in this change can be seen in this assemblage. Secondly, the tempers of the three types do not differ markedly. There is no association between temper usage and whiteware pottery type. Essentially all whiteware types used varying amounts of potsherd and fine sand/rock as temper. Temper usage persisted across at least three pottery types and over a period of 100 years at this locality.

The same may be said of paste clays. While some variability in whiteware paste color exists (Table 4) it is minor in magnitude and does not correlate with pottery type. Here again, a relatively consistent group of clay and temper sources is implied, along with continuous exploitation of those resources over the lifetime of this village. Fairly consistent employment of the same pastes and tempers also suggests a continuum of whiteware production from Socorro through Santa Fe and Wiyo types in this area. Other studies seem to point to the same conclusions. Hill and Larson (1995:95-99) comment on the "Local character of these types, especially in paste inclusions or temper." Hill (1994:285) shows petrographic similarity between these types in terms of paste and temper, even though some are mineral painted and some carbon painted.

The utility grayware and Los Lunas Smudged accompaniments of the whiteware pottery are quite expectable, given other similar assemblages in the lower Middle Rio Grande district. The change from purely corrugated to obliterated corrugated, then into plain gray utility took place during this 1200 - 1300 period and parallels changes in paint type noted for the whiteware. The frequent co-occurrence of Los Lunas smudged with Socorro B/w and Santa Fe B/w at many sites of the area is mirrored again at this site.

The slow transitions of whiteware and utility ware seen in the cross-dated ceramic typology, and in surface collections from Socorro to Albuquerque tend to confirm this evolution. At sites across the Rio Grande bajada on Kirtland Air Force Base, many small sites yield this combination of Socorro, Santa Fe, and Los Lunas types in combination (Acklen 1995, Franklin 1981, Franklin and Neal 1981a, 1981b, Higgins 1998). Although stratigraphic control is lacking at most locations, it would appear that the postulated sequence from LA 161967 is echoed throughout the Albuquerque area.

Recent work near Los Lunas along Route 6 has now provided stratigraphic and chronometric verification of these pre-glazeware ceramic trends (Murrell 2009). At the Cerro de Los Lunas site an apparent in situ progression of Socorro-Santa Fe-Wiyo B/w types resembles the situation here. Considerable amounts of St. Johns Poly occur there but no Rio Grande Glazeware. The Cerro de Los Lunas site is well dated by relative and chronometric means. Use of ceramic cross-dating, mean ceramic dates, as well as seven AMS radiocarbon dates, forms a well dated context. Murrell (2009:83) gives AD 1104-1285 as the outside dates, with the major use between 1151 and 1241. By comparison, the LA 161967 materials would appear to have about the same dates. The small amount of early Rio Grande Glazeware pottery at this site would suggest, however, that some occupation continued into the early Classic Period after 1300.

B. Ceramic materials

Based on known cross-reference dates, design changes, and paint composition, the shift from one whiteware type to the other was a matter of local evolution. No evidence of long-distance importation of whitewares is seen here. The paste and temper remained basically the same through the local whiteware sequence, a conclusion echoed by other examinations of these types (Hill 1994, Hill and Larson 1995, Murrell 2009). Consistency in material attributes now seems to be a feature of the whiteware series of the Albuquerque area.

Use of similar body clay and slip clay as well as the sherd/sand tempers unifies the whiteware sequence. Major changes occurred in paint composition, from mineral to mineral-carbon to pure carbon through time. Designs became larger, bolder, and less dependent on fine line hachure with time. In the end, banded layouts and bold geometric elements with pendant dots replaced balanced solid/hachured layouts of earlier times. At this site the local evolution of whiteware ceramics appears to have occurred in an uninterrupted continuum. Traditional explanations of this ceramic confluence essentially saw the Socorro B/w and Los Lunas types as deriving from the southern Middle Rio Grande, while Santa Fe and Wiyo B/w and perhaps Kwahe'e types came from or were inspired by northern prototypes (e.g. Hammack 1966). However, the coexistence of the Socorro-Los Lunas types along with Santa Fe-Wiyo carbon painted types at so many sites in the Albuquerque area requires a re-evaluation. The near-identical pastes and tempers employed in the local Socorro and Santa Fe B/w types at the present site and other Albuquerque area locations suggest local manufacture by potters resident at Coalition period sites. Further, the evolution of surface treatment (slip and polish), and design elements also indicates a local continuum of production. The change from mineral to carbon-mineral and then carbon painting can be discerned in this collection. Design influences from the north probably altered local pottery practices and the instigation of carbon painting along with design elements ascribable to the northern Rio Grande (Galisteo B/w), or even the Mesa Verde region (McElmo B/w), can be discerned in the Rio Grande whitewares after AD 1150, as illustrated by Bice and Sundt (1972). Again, however, these now appear to be influences expressed within a local Rio Grande production tradition.

Utility ware is morphologically and stylistically typical for this place and time. However, the use of diverse pastes and tempers implies several points of origin. Contrary to the typical situation, there is more paste/temper variation in the utility than in the whiteware of this site. Red pastes with basalt, sand, or mixed rock tempers would indicate origins in the Rio Grande Valley. Schist tempers and yellowish-red pastes, however, are from a different source. They either represent large-scale importation of schist-tempered utility vessels from large settlements such as Tijeras Pueblo or were made in the South Valley with schistose fragments which arrived there by downstream erosion from the mountains. To date, the schist tempered utility noted at many of the PIV glazeware sites in the Valley has been interpreted as owing to importation of finished utility vessels. This seems clear at many locations, such as Cerro de Los Lunas, Valencia, and Pottery Mound, where natural sources of the schist rock material do not exist. At LA 161967, however, the location near Tijeras Arroyo confluence and the discovery of small schist pieces, complicate the picture. More research will determine whether schist-tempered utility could have been manufactured at this site and other settlements in the Valley.

The paste-color agreement between most of the schist tempered utility and the whiteware suggests that a common clay source may have been used. The potential wide occurrence of similar clays, however, may not give as much specificity as desired in this attribute. It does appear, however, that the production and/or importation of schist tempered utility started before the main PIV glazeware florescence after A.D. 1300. At this locality the majority of the utility pottery is schist-tempered in the preceding PIII time period.

The interpretation of Los Lunas Smudged, derived ultimately from ceramic traditions of the northern Mogollon, has varied widely. Potentially, it was all imported from Arizona or western New Mexico sources. Or, it was made by two groups of people living in close proximity in the Socorro-Albuquerque area. Alternatively, perhaps it was made by the same population in the same villages as the whiteware but by different methods and for different purposes. The LA 161967 data favors the latter explanation. The near-identity of the clay and tempers of Los Lunas Smudged with the whiteware strongly suggests manufacture with the same materials. Moreover, the sherd temper of this Los Lunas Smudged came originally from whiteware vessels. The most parsimonious explanation is that the smudged bowls of Los Lunas type were made from the same materials utilized in the local whiteware. This does not necessarily determine if there were two groups of people involved or whether the intended usages were the same as for the whiteware vessels.

C. Non-local Ceramics

Importation of whiteware pottery is not evident in this sample. Nevertheless, contemporary sites in the area often demonstrate minor amounts of Cibola Whiteware from the central San Juan Basin or Acoma area in the form of Gallup B/w, Puerco-Escavada B/w, Tularosa B/w, and/or Cebolleta B/w (Dittert 1949). For instance, such intrusive types appear at the Cerro de Los Lunas site (Murrell 2009) and the Tunnard site (Hammack 1966). The connection to the Cibola-Chaco whiteware tradition was persistent and influenced Socorro B/w in particular in the Rio Grande Valley. After AD 1150 influences from carbon-painted types to the north and west also affected local potters. However, none of the present sherds were assigned to actual McElmo, Chaco McElmo B/w, or Loma Fria B/w imports. The possibility of such traded types being found in local Albuquerque area sites however is evident. Moreover, the spread of carbon painting as a technique to the south and east from the San Juan and Chaco cultures after AD 1150 affected potters of the Rio Puerco and then into the Rio Grande drainage (Baker and Durand 2003, Hurst 2003; Bice and Sundt 1972).

The considerable importation of White Mountain Redware types during this same A.D. 1200 - 1300 period is noteworthy. Actually, small amounts of this pottery tradition have appeared early in the sequences at most of the big PIV glazeware sites in the area, for instance at Tijeras Pueblo and Pottery Mound. Thus, it has been interpreted that the Rio Grande glazeware tradition, originating shortly after A.D. 1300, had its origins in these White Mountain Redware prototypes. Support for this interpretation lays in the appearance of abundant Redware types in sites just prior to the huge glazeware explosion on the Rio Grande. Numerous localities dated to the Coalition period reveal the increasing amounts of Wingate and St. Johns B/r and Polychrome imports from Western sources in the period just prior to the Classic (e.g. at ASRT site (Bowman 2004), Coconito (Wiseman 1980) at Los Lunas (Murrell 2009), the Tunnard site (Hammack 1966)), and at various pre-Classic sites in the Hidden Mountain area on the Rio Puerco. Here, at the present site, where true Rio Grande glazeware was barely beginning, there is still more intrusive St. Johns Polychrome than indigenous Rio Grande glazeware. Thus, the impetus behind the early glazed types such as Agua Fria G/r is clear. At both localities abundant imports of Wingate, St. Johns B/r and Polychrome (without any glazeware) mark substantial connections with the White Mountain Redware tradition of northern Arizona and West Central New Mexico. Therefore, the common assemblages between LA 161967 and the Los Lunas site show that the period of A.D. 1200 - 1300 had a common ceramic expression in the Albuquerque - Socorro area. Some, such as LA 161967 and Tunnard, survived into the early glazeware period; Cerro de Los Lunas did not.

In sum, this site provides an interesting view of the contents of ceramic assemblages in the late PIII or Coalition period in the South Valley near Albuquerque. The evolution of local whiteware is clearly visible, influenced by the Cibola Whiteware prototypes early and the carbon-painted San Juan-northern Rio Grande carbon painted tradition later. Also visible is the truncation of that sequence as glazeware in massive quantities took over. The antecedent prototypes of that early local glazeware are also quite apparent. The importation of quantities of White Mountain Redware, possibly together with human populations from that region, signaled an important shift in Rio Grande cultural orientation. With it came new pottery ideas, the foundation of a whole new way of glazeware ceramic production, which blossomed in the following years. As a result, local ceramics changed completely in technique and design in the early 1300s. Therefore, the evidence from sites such as LA 161967 affords a fascinating glimpse into the cultural traditions that immediately preceded and led up to the massive glazeware production and cultural change that soon followed in Classic Pueblo times in the fifteenth century.

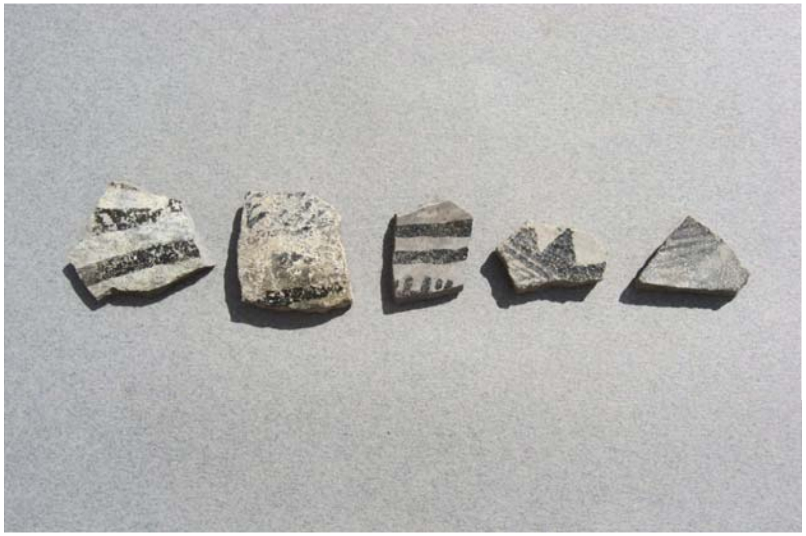


Figure 1. Socorro B/w

Figure 2. Santa Fe B/w

Figure 3. Late Santa Fe B/w

Figure 4. Wiyo B/w

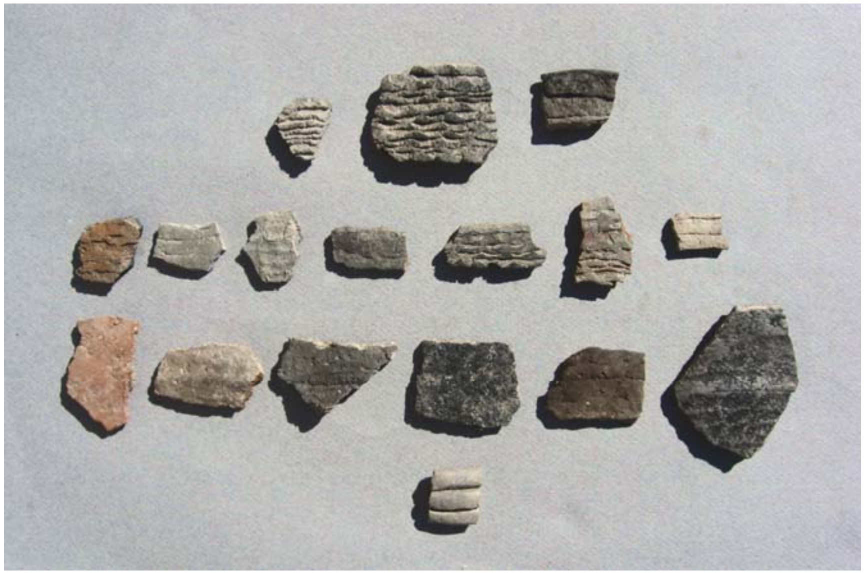


Figure 5. Utility ware (various corrugated), and handle

Figure 7. Partially restored Agua Fria G/r

Figure 6. Los Lunas Smudged

Figure 8. White Mountain Redware, and two Agua Fria G/r

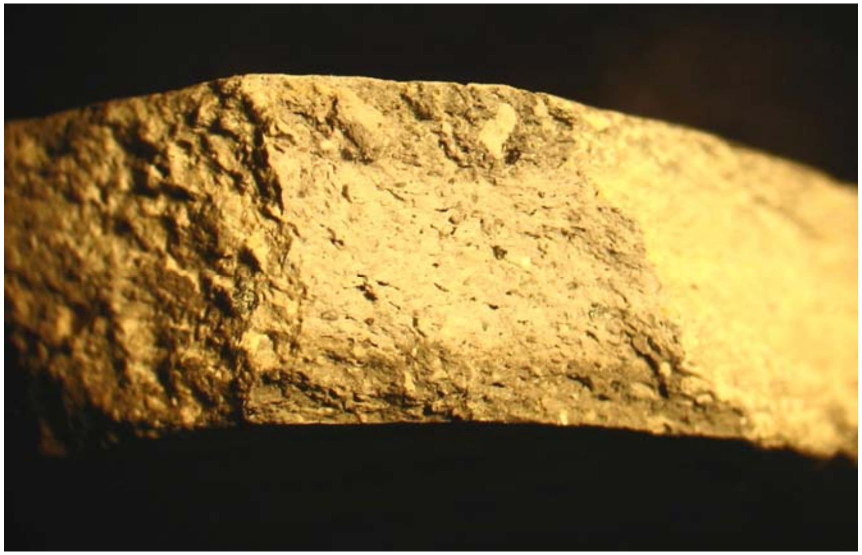


Figure 9. Light and dark sherd temper in Wiyo B/w

Figure 11. Los Lunas Smudged with light and dark sherd temper

Figure 10. Corrugated utility with micaceous schist temper

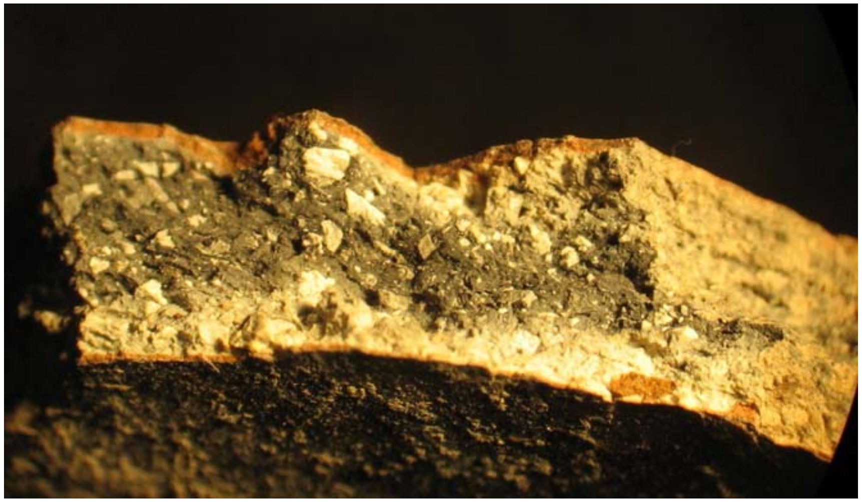


Figure 12. White sherd temper in St. Johns Polychrome

References Cited

Acklen, John C.

1995 *Data recovery at LA 100419 and LA 100420, International Airport Expansion, Bernalillo County, New Mexico.* Prepared for Greiner, Inc. Project No. 11288-0020, TRC Mariah Associates, Albuquerque. On file, Laboratory of Anthropology, Santa Fe.

Baker, Larry L. and Stephen R. Durand

2003 Prehistory of the Middle Rio Puerco Valley, Sandoval County, New Mexico *Archaeology Society of New Mexico Special Publication* No. 3.

Bice, Richard A. and William M. Sundt

1972 *Prieta Vista, A Small Pueblo III Ruin in North-Central New Mexico.* Albuquerque Archaeological Society

Bowman, Bradley F.

2004 Human Remains at LA 138465, a Late Developmental, Coalition Period Site, at the National Headquarters of the American Society of Radiologic Technologists, Albuquerque, New Mexico, December 2004. Museum of Archaeology and Material Culture, Cedar Crest, New Mexico, Report Number 11.

Carlson, Roy L.

1970 White Mountain Redware: A Pottery Tradition of East-Central Arizona and Western New Mexico. *Anthropological Papers of the University of Arizona* No. 19. University of Arizona Press, Tucson.

Cordell, Linda S.

1979 *Cultural Resources Overview of the Middle Rio Grande Valley, New Mexico.* U.S. Department of Interior, Forest Service, Southwestern Region, Albuquerque, New Mexico and Bureau of Land Management, New Mexico State Office, Santa Fe, New Mexico.

1980 *Tijeras Canyon, Analyses of the Past,* edited by Linda S. Cordell, Maxwell Museum of Anthropology and University of New Mexico Press, Albuquerque

Dick, Herbert W.

1968 Six Historic Pottery Types from Spanish Sites in New Mexico, in *Collected Papers in Honor of Lyndon Lane Hargrave*, A.E. Schroeder, editor, pp. 77-94. Papers of the Archaeological Society of New Mexico No. 1. Museum of New Mexico, Santa Fe.

Dittert, Alfred E.

1949 *The Prehistoric Population and Architecture of the Cebolleta Mesa Region, Central Western New Mexico.* Unpublished Master's thesis, Dept. of Anthropology, U. of New Mexico, Albuquerque.

Dyer, Jennifer Boyd

2008 *Middle Rio Grande Ceramic Reference Manual, Volume 1: Cochiti Pueblo to Socorro, New Mexico.* Prepared for Bureau of Reclamation, Albuquerque NM.

Fenega, F.

1956 Excavations at Site LA 2567. In *Pipeline Archaeology, Reports of Salvage Operations in the Southwest on El Paso Natural Gas Company Projects 1950-1953,* edited by Fred Wendort, Nancy Fox, and Orian L. Lewis, pp. 233-241. Laboratory of Anthropology, Santa Fe, and Museum of Northern Arizona, Flagstaff

Fenenga, F. and T.S. Cummings

1956 LA 2569: Cerros Mojinos, A Late Pueblo II-Early Pueblo III Village on the Rio Purco Near Los Lunas, New Mexico. In *Pipeline Archaeology, Reports of Salvage Operations in the Southwest on El Paso Natural Gas Company Projects 1950-1953*, edited by Fred Wendorf, Nancy Fox, and Orian L. Lewis, pp. 252-255. Laboratory of Anthropology, Santa Fe, and Musuem of Northern Arizona, Flagstaff.

Franklin, Hayward H.

1981 *Kirtland Air Force Base 1980B Archaeological Project, Bernalillo County, New Mexico*. Center for Anthropological Studies, Albuquerque, New Mexico.

Franklin, Hayward H.

2008 *Montano Bridge (LA 33223) Ceramic Analysis*. Report for Criterion Environmental Consultants, Albuquerque, NM

Franklin, Hayward H. and William R. Neal

1981a *Kirtland Air Force Base 1981 Archaeological survey Project in Bernalillo County, New Mexico.* Center For Anthropological Studies, Albuquerque, New Mexico.

1981b *Kirtland Air Force Base 1981B Archaeological Survey Project, Bernalillo County, New Mexico*. Center for Anthropolgicall Studies, Albuquerque, New Mexico.

Hammack, Lauren C.

1966 *The Tunnard Site: A Fourteenth-century Ruin near Albuquerque, New Mexico*. Museum of New Mexico Research Records, No. 3, Santa Fe.

Higgins, Howard C.

1998 *Results of Phase III Site Documentation and Other Field Studies for Kirtland Air Force Base, Bernalillo County, New Mexico.* TRC Mariah Associates, Inc. TRC Mariah Project 01784. On file, Laboratory of Anthropology, Santa Fe.

Hill, David V.

1994 Petrographic Analysis of Selected Sherds. In *Archaeological Excavations at Three sites within the Proposed Rio Bravo Boulevard and Paseo del Volcan Corridors, Bernalillo County, New Mexico,* by Michael P. Marshall and Christina L. Marshall, pp. 283-288. Cibola Research Report No. 97. Cibola Research Consultants, Corrales, New Mexico.

Hill, David V., and Dorothy L. Larson

1995 Ceramic Analysis. In *Data Recovery at LA 100419 and LA 100420, Albuquerque International Airport Expansion, Bernalillo County, New Mexico*, edited by John Acklen, pp. 95-108. Technical Report 11288-0020. TRC Mariah Associates, Inc., Albuquerque, New Mexico.

Hurst, Winston B.
2003 Typological Analysis of Ceramics from the Middle Rio Puerco of the East. In Prehistory of the Middle Rio Puerco Valley, Sandoval County, New Mexico, edited by Larry L Baker and Stephen R. Durand, pp. 55-117. Archaeological Society of New Mexico Special Publication No. 3. Scopcraft Press, Portales, New Mexico.

Kelley, Vincent C.
1977 *Geology of the Albuquerque Basin, New Mexico*. New Mexico Bureau of Mines and Mineral Resources Memoir 33. Socorro, NM.

Marshall, Michael
1980 Preliminary Analysis of Ceramic Materials from the Lower Rio Puerco-Rio Salado Drainages, New Mexico. In, *Reconnaissance Study of the Archaeological and Related Resources of the Lower Puerco and Salado Drainages, Central New Mexi*co, by Mark Wimberly and Peter Eidenbach, pp. 165-187. Human Systems Research, Inc. Tularosa, New Mexico.

Marshall, Michael P. and Christina L. Marshall
1994 *Archaeological Excavations at Three Sites within the Proposed Rio Bravo Boulevard and Paseo del Volcan Corridors, Bernalillo County, New Mexi*co. Cibola Research Report No. 97. Cibola Research Consultants, Corrales, New Mexico

Marshall, Michael P. and Henry J. Walt
1984 *Rio Abajo: Prehistory and History of a Rio Grande Province*. New Mexico Preservation Program, Santa Fe.

Mera, H.P.
1935 Ceramic Clues to the Prehistory of North Central New Mexico. *Technical Series of the Laboratory of Anthropolgy,* Bulletin No. 8. Santa Fe.

Murrell, Jesse B.
2009 *Archaeological Investigations at the Cerro de Los Lunas Site Valencia County, New Mexico*. Parametrix Environmental, Albuquerque, New Mexico.

Oakes, Yvonne
1978 *Excavations at Dead-Man's Curve, Tijeras Canyon, New Mexico: New Mexico State Highway Department Project I-040-3(55) 171 and I-040-3(35) 169*. Laboratory of Anthropology, Santa Fe, New Mexico.

Shepard, Anna O.
1963 *Ceramics for the Archaeologist*. Publication 609 of the Carnegie Institute Washington, D.C.

Skinner, S. Alan
1965 The Sedillo Site: A Pithouse Village in Albuquerque. *El Palacio* Vol. 72, No. 1, pp. 5-24.

Sullivan, Richard B., and Nancy J. Akins
1994 Archaeological Investigation at LA 15260, the Coors Road Site, Bernalillo County, New Mexico. *Archaeology Notes* 147. Office of Archaeological Studies, Museum of New Mexico, Santa Fe, New Mexico.

Vivian, R. Gwinn and Nancy W. Clendenen
1965 The Denison Site: Four Pithouses near Isleta, New Mexico. *El Palacio*, Vol. 77, No. 1, pp. 5-24.

Warren, A. Helene
1980a Geology and Mineral Resources of Carnue, and Appendix 4, In, *The Carnue Project: Excavation of a Late Coalition Period Pueblo in Tijeras Canyon, New Mexico,* by Regge N. Wiseman, pp. 3-12. Laboratory of Anthropology Notes, No. 166, Santa Fe.

Warren, A. Helene
1980b Prehistoric Pottery of Tijeras Canyon, In *Tijeras Canyon, Analyses of the Past,* edited by Linda S. Cordell, pp. 149-168. Maxwell Museum of Anthropology and UNM Press.

Warren, A. Helene
1981 The Micaceous Pottery of the Rio Grande. *Archaeological Society of New Mexico Anthropological Papers,* No. 6. Albuquerque, New Mexico.

Warren, A. Helene
1982 Pottery of the Lower Rio Puerco, 1980-1981 In, *Inventory Survey of the Lower Hidden Mountain Floodpool, Lower Rio Puerco Drainage, Central New Mexico,* edited by Peter L. Eidenbach, pp. 139 – 160, Human Systems Research, Tularosa New Mexico.

Wendorf, Fred and Erik K. Reed
1955 An Alternative Reconstruction of Northern Rio Grande Prehistory. *El Palacio,* Vol. 62, pp. 131-173.

Wilson, Gordon P., editor
2005 Guide to Ceramic Identification: Northern Rio Grande Valley and Galisteo Basin to 1700 AD. *Laboratory of Anthropology, Technical Series Bulletin No. 12,* (on CD). Santa Fe, New Mexico.

Wiseman, Regge N.
1980 The Carnue Project: Excavations of a Late Coalition Period Pueblo in Tijeras Canyon, New Mexico. *Laboratory of Anthopology Notes No. 166.* Museum of New Mexico, Santa Fe.

Depletion of Sherds in Surface Assemblages Due to Human Impact

Don Shiffler
Volunteer, Bureau of Land Management
Albuquerque, NM

I Introduction

The desert Southwest contains numerous ruins, large and small, remaining from previous Native American occupants of the region. Often, the first, and sometimes only, archaeological analysis of some sites consists of studies of the surface artifact assemblages. These assemblages typically consist of lithics, ceramics, ashes, bone and any combination of these materials. In particular ceramics and lithics play a key role in estimating the age of a site, and often can provide some information about the trade connections and cultural affiliation of a ruin. In fact, nearly every archaeological field report on ceramic cultures in the Southwest contains some estimates of surface ceramic assemblages (Marshall, 1979; Marshall, 1984; Powers, 1999, Varien, 1999). Thus, the preservation of surface ceramic assemblages, and the accurate counts of those ceramics, provide vital information; sometimes the only information, about archaeological sites.

However, as nearly every field worker knows, very few, if any, archaeological sites in the Southwest remain even remotely intact. The natural environment certainly affects surface assemblages, including processes such as erosion as well as small and large animal damage. Furthermore, human beings seem to have an irresistible urge to pick up interesting and/or pretty objects, such as certain archaeological ceramics. This paper describes the affect of a rapid introduction of human traffic to an area containing numerous ruins, and shows that the impact of people on these particular archaeological sites, can be described in a logical, mathematical fashion. In fact, one can reach some conclusions about human impact on a variety of sites that can provide value for cultural resource planning. Moreover, we derive formulae that, given the proper statistical analysis, might enable one to reconstruct the surface assemblage prior to large amounts of human impact. This work, to an extent, isolates the effect of the natural environment, apart from human intervention, on these ceramic counts in this type of geological setting.

Other investigators have experimented with and documented the effects of both the natural environment and human bias on field surveys (Banner, 2006 provides both an enhancement of existing mathematical analysis of survey techniques, as well as a good review of the problem). These effects include ambient factors such as vegetation, soil type, and local geology, as well as the color and surface morphology of the artifacts in question. Workers have investigated the human effects of bias and simple error on these types of surveys, taking into consideration optimal survey transects and other such quantities.

While the work described here relates indirectly to these examples of experimental work, we present data that differs in several key aspects. First, we describe ceramic counts at fixed spatial locations and plot the temporal variations of these counts. Next, the impact on these fixed sites consists solely of human intervention not necessarily by individuals interested in the prehistory of the sites in question. Hence, we describe a much different type of human impact than that of the work of other investigators. Finally, the "control" sites for this work have been selected for a perceived lack of human impact, rather than by a conscious decision on our part. In retrospect, we posit, without immediate proof, that those removing ceramics from the Newton Community sites built little intuition about site location in terms of the local geography. Thus, due to geological and vegetative features, these sites remains obscured from easy observation and, at least when the work developed here concluded, suffered no quantifiable impact to the surface assemblage.

This paper proceeds as follows. I first describe the Newton Site Complex in west central New Mexico, the area in which we conducted the study. I then describe how we conducted the ceramic counts, stressing consistency in measurement between sites. From this basis, one can demonstrate the onset and results of human impact, which reduces to a remarkably simple mathematical equation. From this equation and data, I show how ceramic counts varied temporally and spatially during the observation period. The paper concludes by discussing these results, and in particular how they can be applied to both archaeological research and cultural resource management.

II Site Location

The Newton Site Complex, named for the first site and largest site described in the area (Frisbie, 1973), consists of at least 73 masonry structures, 17 ceramic and lithic scatters, and one possible kiln site. Figure 1 shows the location of the Newton Site Complex relative to other areas of New Mexico, including its closest analogue, the Cebolla Canyon area. The complex lies approximately 20 miles south of NM 117, east of County Road 29. Figure 2 shows a closer view of the immediate topography and the location of the two largest sites of the cluster, the sites used in this study, and the possible kiln site. While each of the sites studied for this project has a field number (LA numbers have not yet been obtained for all the sites in question, we label them A-I for the sake of brevity). The Newton site itself sits on a mesa top, in a defensible position, with a commanding view of the main approaches to the complex. Kin Tadidiin, another large site not previously recorded, sits 1.3 km due west of the Newton Site, with a commanding view of the eastern, southern, and northern approaches to the cluster.

A complete overview of the Newton Site Complex is currently in preparation. However, I give a brief review here. Using a phase scheme initially proposed by Dittert (Dittert, 1959) and then further refined for the Cebolla Canyon area (Wozniak and Marshall, 1991), we proceed as follows. The possible kiln site contains the deepest time depth of ceramics, ranging from the Kiatuthlana Phase (ca. 800-870 A.D up to the Late Kowina Phase (ca. A.D. 1325-1400). This site, which is difficult to access, apparently sees little current human visitation and will be described in another publication. The major occupation appears to begin with the Red Mesa Phase (ca. 870-950 A.D) peaks during the Early Cebolleta Phase, (ca. 950-1050), through the Late Cebolleta Phase (ca. 1050-1125 A.D, the Pilares Phase (ca. 1125-1175 A.D and Early, Middle, and Late Kowina Phases (ca 1175-1325 A.D. Occupation begins to taper by the Late Kowina Phase, Early Pueblo IV (PIV), (ca. 1325-1400 A.D, with the appearance of early Acoma and Zuni Glazewares and a reduction in Tularosa and San Juan style white wares.

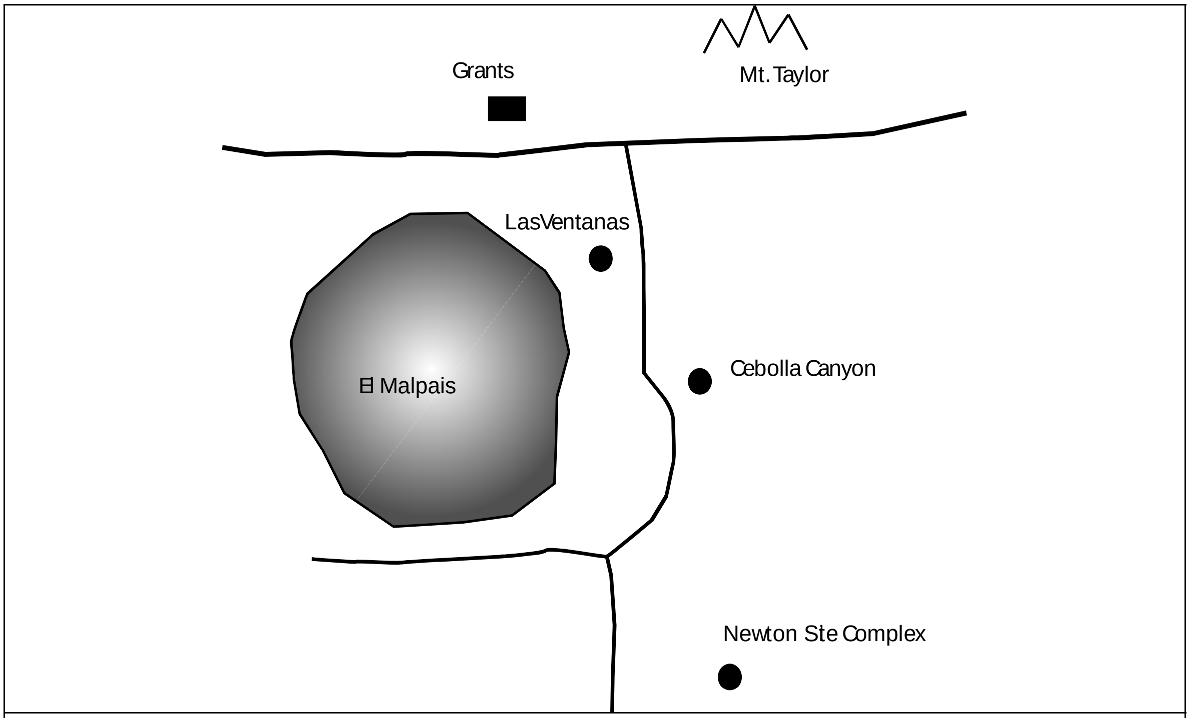


Figure 1. View of the Newton Site Community in the context of west central New Mexico. The community lies within the sphere of the Acoma culture. This figure is not to scale.

In this study, we observed the ceramic count from nine masonry sites, as shown in Figure 2 (labeled A-I), located at various positions in the complex. We counted ceramics in the highest density portion of the sheet middens present at each location, in a four square meter area. For consistency, a piece of rusted steel rebar, hammer into the ground until only approximately 3 inches protruded above ground level, marked the northwest corner of each area. I returned to count ceramics periodically over a 42 month period, beginning in November 2002. Each count consisted of tabulating the number of White Mountain Redwares, Cibola White Wares, grey/white utility wares and brownwares on each site. While counts were broken down into individual types (e.g, St. John’s Polychrome), such identification goes beyond the scope of requirements for this initial research. Insufficient data exists to make meaningful determinations of whether one type of red ware or white ware suffers human impact greater or more rapidly than another within that ware class.

During December and January 2002 to 2003, numerous dirt roads, which had been previously extraordinarily rutted and rough for years, were bladed and drastically improved with the beginning of a ranch-style subdivision whose western boundary begins about 1 mile from the eastern edge, as currently known, of the Newton complex. At this point, on a return visit to the complex, we noticed, that ceramics had begun to be removed from the sites. Consequently, I began a systematic survey of the area to determine how many sites had been affected. This sparked the idea for monitoring the masonry ruins to determine the impact of human gathering of sherds. Previous visits to the area, beginning in June 2000, showed little if any change in ceramic counts with time over a two year period. Hence, we posit that one can attribute changes in the sherd counts to human impact alone. Further, the fact that several sites located in topographically similar terrain but remote areas served as *de facto* “control” sites. These sites apparently remained untouched, as noted below, throughout the 42 month period. Thus, we posit based on the variation in ceramic counts between the two groups of sites, that the observed ceramic variation can be attributed to human intervention alone, rather than environmental factors.

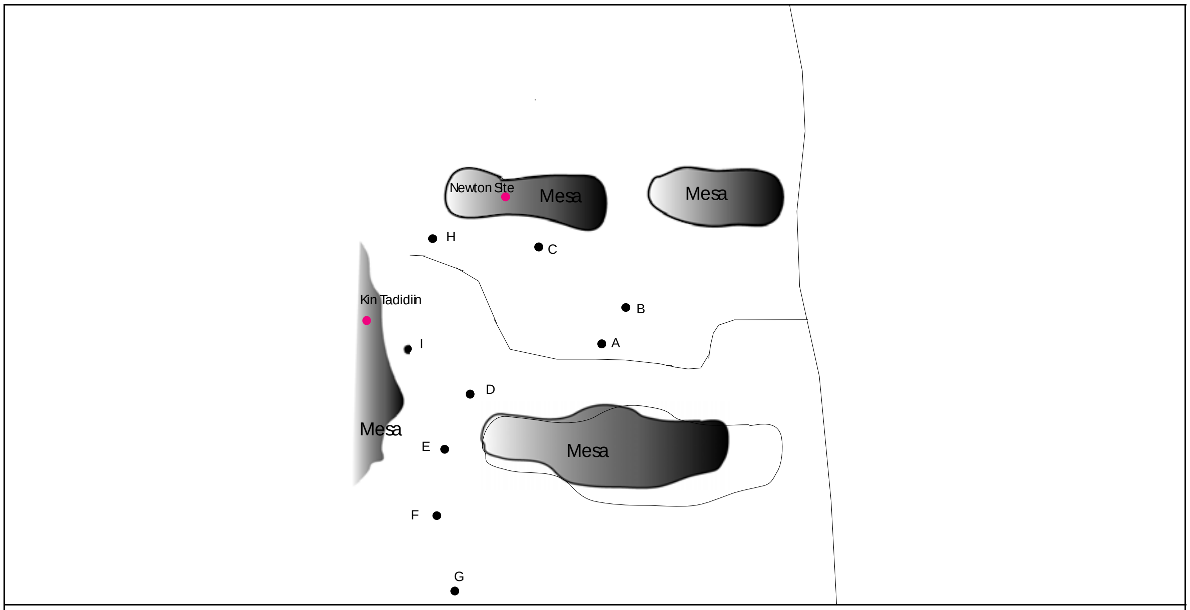


Figure 2. Sketch of the immediate topography of the Newton Site Community, showing in particular the two large sites in the complex and the sites selected for ceramic study. Sites *H* and *I* form the de facto controls. This figure is not to scale.

For this study we monitored nine sites, two of which suffered little apparent human impact. By default, these two sites served as controls for this research. The two control sites, while in similar geological settings as the other areas, where hidden from casual visitors by piñon and juniper growth as well as the local topography. For simplicity, we labeled each provenience *A* to *I*, with *H* and *I* being the control sites. Figure 2 shows the location of each of these proveniences, with Table 1 giving the distance of each site from the road per Figure 2, the total area of masonry on each site, and the total ***initial*** sherd count in each 2 meter by 2 meter area. Note that, while other locales in the complex have experienced human impact, these sites qualified for analysis based on that fact that a statistically meaningful amount of ceramics could be counted.

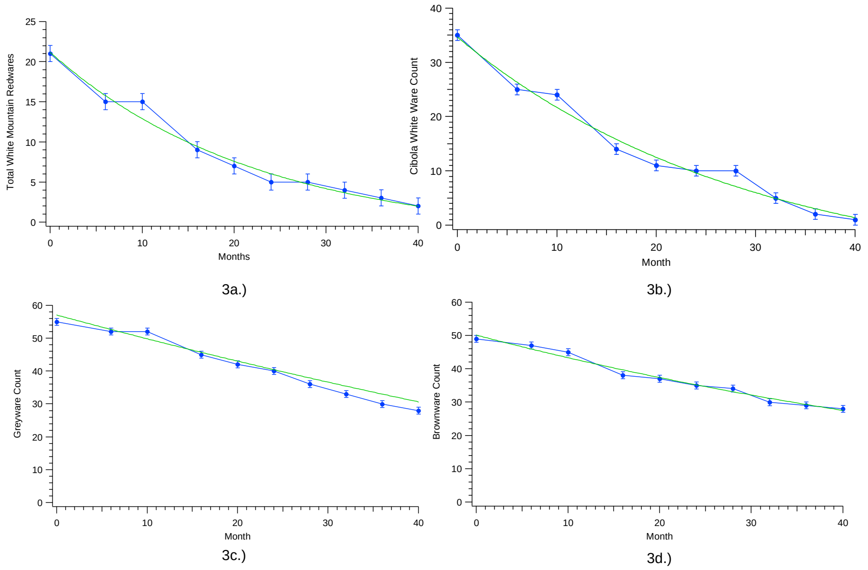
TABLE 1.

Site	**Perpendicular Distance from Road (m)**
A	35
B	50
C	110
D	230
E	405
F	650
G	1110
H	45
I	340

Distance of each site studied from access on the dirt road. The two control sites fall at intermediate distances from the road as compared to the other sites showing human impact.

III Results

Figures 3 to 5 show ceramic counts for Sites *A*, *D*, and *G*. In each plot in each figure, we show the variation of White Mountain Redwares, Cibola White Wares, grey utility ware and brown ware. The horizontal axis has units of months, while the vertical axis is an integer number. Each curve in the figure shows raw data and a curve fit, to be described below. Several features of the curves can be understood by appealing to Figure 6, the White Mountain Redware (WMR) plot appearing in Figure 3a. In this figure, the count contained 23 WMR sherds at the start of the research, with an ever decreasing ceramic count after that point. Two locations on the raw data curve show flat portions: ?a? the region from month 6 to 10 and b the region from month 24 to 28. We note that each of these periods coincides with incidences of high precipitation, making the middens where collection would occur inaccessible to all but the most determined human traffic. Nearly every ceramic curve illustrates this type of behavior for these months. This result implies, somewhat counter intuitively, that erosion sufficient to remove sherds from the survey rectangles remained insubstantial during the period of this research. This trend lends further credence to the idea that the impacts observed here reflect human removal of ceramics.



3a.)

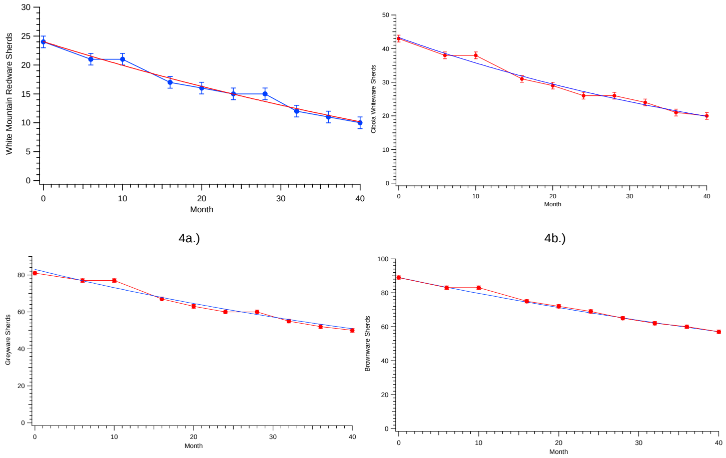
3b.)

3c.)

3d.)

Figure 3.)

Figure 3. Ceramic distributions as a function of time for Site *A*. The figure shows White Mountain Redwares, Cibola Whitewares, grey utility ware, and brownware.

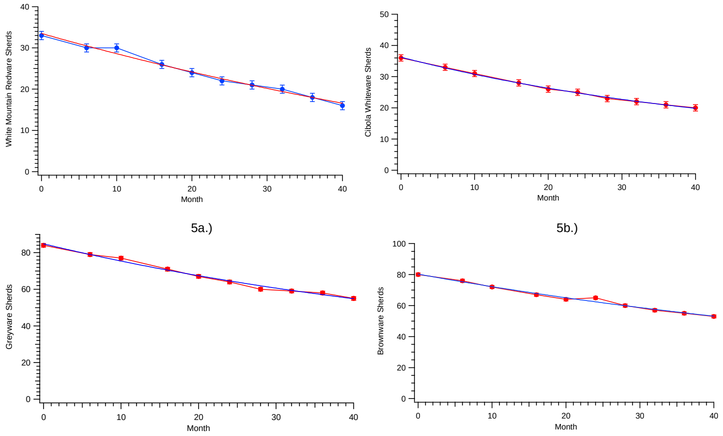


4a.) 4b.)

4c.) 4d.)

Figure 4.)

Figure 4. Ceramic distributions as a function of time for Site *D*. The figure shows White Mountain Redwares, Cibola Whitewares, grey utility ware, and brownware.



5a.) 5b.)

5c.) 5d.)

Figure 5.)

Figure 5. Ceramic distributions as a function of time for Site *G*. The figure shows White Mountain Redwares, Cibola Whitewares, grey utility ware, and brownware.

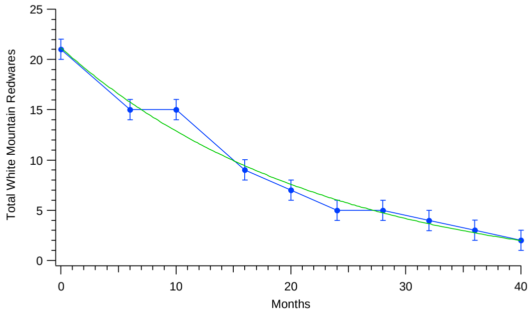


Figure 6.)

Figure 6. Temporal distribution for White Mountain Redware on Site A. Note the constant overall decrease in sherd amount, as well as the “plateaus” corresponding to periods of inaccessibility for the area.

We note the most distressing feature of this distribution, again, as depicted in Figure 6 for site A, common to that of all the decorated wares: The ceramic count decreased, for WMRs, from an initial value of 23 to a final value of 2, a factor of 11.5, or a 1,150% decrease. Figure 3 shows that Cibola White Wares decrease from 35 to 1, a huge drop. However, utility wares show a less dramatic impact. Grey utility wares drop over the same period from 55 to 28, and brown wares from 49 to 28. Such a change cannot but skew the ceramic distribution as understood via surface counts and thus drastically alter our view of an archaeological site based upon surface ceramic counts alone. If one were, for example (Rooney, 1996) to tabulate statistics concerning the percentage of decorated ceramics on a site, the initial statistics *prior* to human collection would lead one to believe that the decorated ceramics in the 4 square meter area composed ~36% of the distribution. Unfortunately, after human collection, we would interpret the same area as having a 5% decorated assemblage and equal amounts of grey and brown wares. The situation and the interpretation thereof dramatically changes. Clearly, one must interpret results gained from impacted sites with some degree of caution before building elaborate theories based upon ceramic classes and the relative ratios of various ceramic components. As an example, Table 2 shows the initial amounts and percentages of each type of ceramic on each site as well as the final percentage after the monitoring period ended. Decorated ceramics pay the greatest penalty in terms of overall reduction. This pattern argues for recreational rather than profession collection of sherds. A professional would conceivably strive for a representative ceramic collection, removing representative amounts of each ceramic type.

TABLE 2

Site	**White Mountain Redware** (Initial %/Final%)	**Cibola Whiteware** (Initial %/Final%)	**Grey Utility Ware** (Initial %/Final %)	**Brown Utility Ware** (Initial %/Final %)
A	13/3.4	21/1.7	34/47	30/47
B	10.5/3.8	17.5/3.9	38.6/49.4	33.3/49.4
C	14.8/8.1	21.4/11.6	26.9/33.7	36.8/46.5
D	10.1/7.3	18.1/14.6	34.1/36.5	37.6/41.6
E	11.6/9.7	16.6/13.8	34.4/35.4	37.3/40.9
F	9.6/7.9	16.9/15	34.7/36.4	38.7/40.7
G	14.1/11.1	15.5/13.9	36/38.2	34.3/36.8
H	12.9/13.1	18/18.9	37/36.6	32/31.4
I	15.5/15.6	16.4/17.3	34.9/35	33.2/32

Initial percentages of each type of ceramic on each site as well as the final percentage after the monitoring period ended. Decorated ceramics show the greatest impact throughout the study.

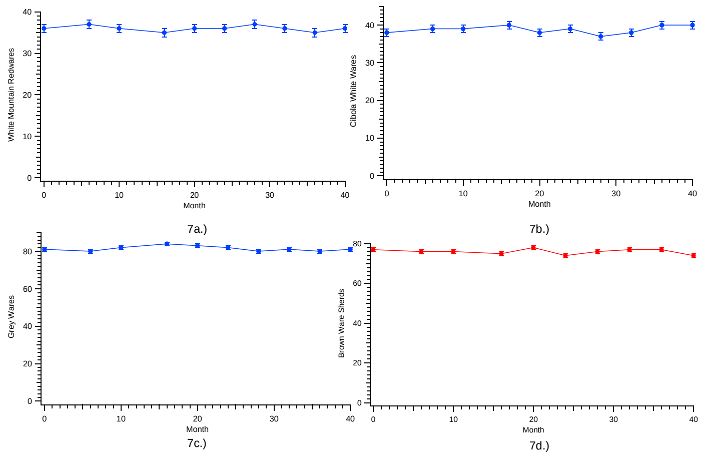
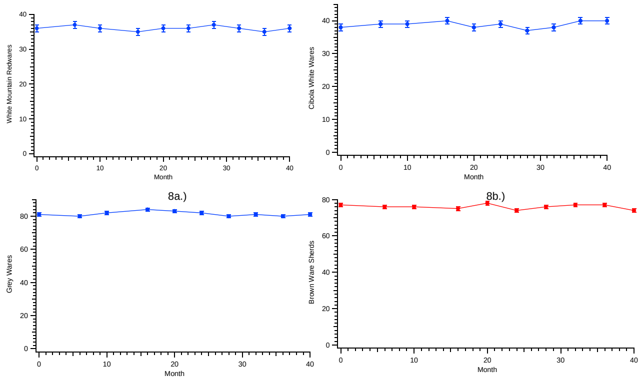


Figure 7.)

Figure 7. Temporal sherd variation for control Site H. Note that the sherd count remains nearly constant, reflecting the lack of human traffic.

Figure 7 shows the ceramic counts for "control siteH" and Figure 8 that for "control site I". One clearly sees that the ceramic counts remain relatively flat as compared to the case for the sites subjected to human impact. Again, the topographical and geological setting for these sites conforms closely to that for sites A-G, the main difference being visibility to a casual observer without an intuition for site placement. These plots reemphasize the statement that the decrease in ceramic counts on sites A-G stems from human collecting and not from erosion or animal impacts.



8a.) 8b.)

8c.) 8d.)

Figure 8.)

Figure 8. Temporal sherd variation for control Site I. Again, note that the sherd count Remains nearly constant, reflecting the lack of human traffic.

IV Discussion

Figures 3 to 5 each show the raw data, as well as a curve fit to each data set. In fact, the best fit to each curve consists of an exponential decay function. One can understand this phenomenon as follows: Let $N_j(t)$ represent the amount of any ceramic type within the 4 square meter test area. We posit that the ceramics of each type *j* decay exponentially with time, leading to an equation of the form (see for example, Boyce and DiPrima)

$$\frac{dN_j(t)}{dt} = -\alpha_j N_j(t). \qquad 1.)$$

Equation 1 is a simple, first order, linear ordinary differential equation. Mathematically, the equation states that the rate of decrease of the number of ceramics of type N_j is proportional to the number of ceramics of that type on the site. In other words, the more ceramics there are on any given locale, the more ceramics people collect.

$$N_j(t) = N_j(0)e^{-\alpha_j t}, \qquad 2.)$$

The proportionality constant can be determined by curve fitting the data to an exponential, the solution to equation1. That is, for any time *t*, where $N_j(0)$ is the amount of ceramic material of type *j* when the counting or monitoring begins, in other words, the initial value. α_j is the decay constant, modeling how the ceramic distribution evolves in time.

One notes also that each individual ceramic type, when compared between sites, shows a change in decay with distance from easy access. Figure 9 depicts this trend by plotting the exponential decay term, α_j, as a function of distance for each ware found in the survey. Each curve shows the raw data and a best fit, a “double exponential” function of the form.

$$\alpha_j(x) = \lambda_{j0} + \lambda_{j1}e^{-\delta_{j1}x} + \lambda_{j2}e^{+\delta_{j2}x}. \qquad 3.)$$

This form of equation plays a critical role in the modeling of predator-prey relationships. Future work could further address the issue of whether collectors of archaeological artifacts fit the role of a predator, with the artifact being the prey. The important feature of this equation is that the farther one is from easy access, the fewer sherds are collected. However, in this case, the decay is a spatial rather than temporal variation.

One can now combine these equations, 2 and 3 simply as:

$$N_j(x,t) = N_j(0)e^{-(\alpha_j(x)t)}, \qquad 4.)$$

Where now, $N_j(0)$ is the initial ceramic distribution for site *j* a distance *x* from access. Thus, we have a mathematical formulation for the variation in both time and space of surface ceramics subjected to human collecting. By knowing the amount of time that surface assemblages have been subjected to human impact and the distance these sites lie from some access point, one can predict how the distributions vary spatially and temporally.

This work provides a powerful predictive tool in several aspects. First, suppose one wants to understand the impact of human traffic on a series of sites in a similar situation to that of the Newton Site Complex. Given the distance of each site from access (trail, road, etc.) and the amount of time the site will be exposed to human contact, if all other environmental factors are equal, the change of the surface assemblage can be easily estimated as a function of time and distance using equations 2 and 3 and estimated decay constants. The decay factors can be estimated using the results above, keeping in mind that topography and other factors could make the situation either better or worse that what is predicted in this paper. Such a strategy can prove useful for the location of trails or roads in new areas.

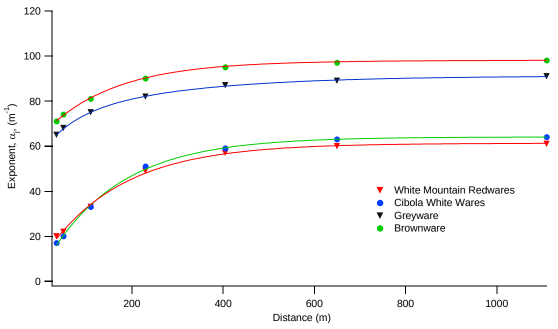


Figure 9.)

Figure 9. Spatial variation of ceramic counts with distance.

One can also employ these tools in an effort to reconstruct, or at least estimate, ceramic distributions subject to a known collection episode of definite duration and location. Suppose the likelihood of finding ceramic type *j* in a given area on a site at time *t* and distance *x* is *l(x,t)*. *l(x,t)* is merely the ceramic distribution at time *t* and distance *x* when one begins to collect data. Then, the overall probability of finding type *j* at a time *T* months ago and at a distance *X* from access, **before human impact**, would be,

$$p_j(x,t,X,T) = l_j(x,t)e^{(\alpha_j(X)T)}. \qquad 5.)$$

Equation 5 merely states that the original probability of finding ceramic type *j* would be the current likelihood of finding that ceramic increased by the amount that the distribution is estimated to have changed over time. Given adequate confidence in the ceramic distributions, one can then reconstruct the initial surface assemblages, neglecting the effects of the environment such as erosion and animal damage. Note, however, that if a site has been as heavily impacted as several of the sites documented in this paper, such a procedure could lead to extreme stochastic behavior given the exponential character of the equations coupled with small sample size. This fact again suggests further research in the area of both Bayesian statistics and stochastic variables for interpretation of surface assemblages. A key factor in using this estimation technique would be finding nearby similar sites left relatively pristine by human collection.

IV Conclusions

In this paper we have shown how ceramics decay over time on sites subject to human collection. We note that decorated wares suffer the greatest, an unsurprising result. Further, we note that sites farther from access suffer the least, while the most visible sites take the greatest impact, again an unsurprising result. This technique provides a valuable tool for cultural resource planners, as well as a cautionary example for those involved in field work. One cannot, at least without the stipulations detailed above, place too great a confidence in surface artifact counts. However, as shown in equation 5, all may not be lost if further undisturbed data can be obtained about an area. Provided un-impacted sites of similar size and age exist in an area under study, these results suggest that ceramic distributions can be reconstructed to a certain extent.

V Acknowledgements

The author wishes to thank the Bureau of Land Management, Albuquerque Field Office, for the opportunity to conduct this research. The author also owes a debt of gratitude to Brenda Wilkinson, Rory Gauthier, John Rooney, Tony Lutonsky, Gretchen Obenauf, and Donna Dudley.

References

Banning, E. B., A. L. Hawkins, and S. T. Stewart
2006 Detection Functions for Archeological Survey, American Antiquity, 71 (4), 2006.

Boyce, William and Richard DiPrima
1977 *Elementary Differential Equations*, John Wiley & Sons, New York, New York.

Frisbie, Ted
1972 *Awanu*, page 73-76.

Marshal, Michael P. , John R. Stein, Richard W. Loose, and Judith E. Novotny
1979 *Anasazi Communities of the San Juan Basin*, Public Service Company of New Mexico and the Historic Preservation Bureau, Planning Division, Department of Finance and Administration of the State of New Mexico.

Marshall, Michael P., and Henry J.Walt
1984 *Rio Abajo: Prehistory and History of a Rio Grande Province*, Historic Preservation Division, Santa Fe, New Mexico.

Powers, Robert J. and Janet D. Orcutt, Eds.
1999 *The Bandelier Archaeological Survey: Volume II*, Intermountain Cultural Resources Management, Professional Paper No. 57.

Rooney, John R.
1996 The Pueblo III Period in the Eastern San Juan Basin and Acoma-Laguna Area, in *The Prehistoric Pueblo World A. D. 1150 – 1350*, Michael A.Adler, ed.

Varien, Mark D.
1999 *Sedentism and Mobility in a Social Landscape*, University of Arizona Press, Tucson, AZ.

Wozniak, Frank E., and Marshall, Michael P.
2000 The Prehistoric Cebolla Canyon Community: An Archaeological Class III Inventory of 320 Acres of BLM Land at the Mouth of Cebolla Canyon, Office of Contract Archaeology, University of New Mexico.

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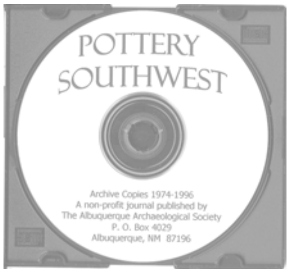

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