THE POTTERY OF POTTERY MOUND

A Study of the 1979 UNM Field School Collection, Part 2: Ceramic Materials and Regional Exchange

By

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Maxwell Museum Technical Series No. 12
University of New Mexico

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E-mail: hfranklin12@comcast.net

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Maxwell Museum of Anthropology
MSC01, 1050, 1 University of New Mexico
Albuquerque, New Mexico 87131-0001
www.unm.edu/~maxwell

Accepted for publication in 2009.

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ACKNOWLEDGMENTS

The author wishes to thank several individuals for their help and encouragement in this research, in particular Dave Phillips, Kari Schleher, Peter McKenna, David Snow, Linda Cordell, and Bruce Huckell. Funds for petrographic analysis was provided by the Maxwell Museum of Anthropology, University of New Mexico.

Chapter 1

INTRODUCTION

The late prehistoric site of Pottery Mound (LA 416) is in the lower valley of the Rio Puerco, a tributary of the Rio Grande (Figure 1). Archaeologically, the site is part of the Middle Rio Grande District and dates to the Pueblo IV or Classic period. Based on four tree ring dates from early excavations (Hibben 1975; P. Schaafsma 2007), the village was founded about A.D. 1325–1350. Glaze A rims are by far the most common, as is typical of early glazeware pueblos in the district (C. Schaafsma 2007; Voll 1961). In the absence of later forms, such rims suggest a date range of A.D. 1325–1450. Only a few Glaze B rims have been found at the site, but again that is typical of local occupations. Pottery Mound has yielded moderate amounts of Glaze C (A.D. 1450–1490). About 50 examples of Glaze D (1490–1525) rims, identified by David Snow and myself, suggest a greatly reduced population after 1490. Recent AMS radiocarbon dates from the later upper levels of a 1979 stratigraphic unit support the argument that the site was occupied in the late 1400s (Cordell et al. 2008; Franklin 2008b).

Two studies laid the foundations for modern analysis of the glazeware pottery that dominates the site. H. P. Mera (1933, 1935, 1940) established a basic chronology for local glaze wares through his survey of major sites and by documenting changes in rim forms. Kidder and Shepard's (1936) examination of Pecos Pueblo pottery included the first thorough materials analysis of such pottery (Shepard 1936). Other studies provide the specific context for the current analysis. Luhrs (1937) dated Pottery Mound and documented nearby sites. Between 1954 and 1958, Frank Hibben directed four field schools at the site, followed by grant-funded research (in 1960–1961) and then by "salvage" excavations using volunteer crews (Hibben 1955, 1960, 1975, 1986; see also Ballagh and Phillips 2006, 2008). Hibben's reports included almost nothing about the site's pottery, but Voll (1961) and Brody (1964) provided important early reports on that material. Later, Garrett (1976) undertook the first petrographic study of pottery from the site.

In 1979, the UNM field school returned to Pottery Mound, this time under the direction of Linda Cordell (1980a, 2004; Cordell et al. 2008). While supervised by Kit Sargeant, the field school students excavated a stratigraphic unit with 17 levels and recovered a large, well-documented sample of pottery and other remains. The 1979 sample is especially valuable because Hibben discarded earlier, more limited stratigraphic samples after the sherds were "typed," and because of his reliance on fairly lax provenience control techniques. The current report, along with my previous one (Franklin 2007), is based on the assemblage from Cordell's 1979 stratigraphic unit.

After many years of neglect, the site's pottery has become a subject of widespread interest (Eckert 2003, 2007, 2008; Franklin 2007, 2008b; C. Schaafsma 2007; P. Schaafsma 2007). Two of the recent studies examined sherds from Cordell's 1979 test, but for different purposes. Eckert (2003) was primarily concerned with reconstructing social interactions within the village, and found evidence of internal differentiation ascribable to the presence of immigrants from the west. My initial work (Franklin 2007) defined and illustrated glazeware types in some detail, and evidence of temporal changes in types and rim forms.

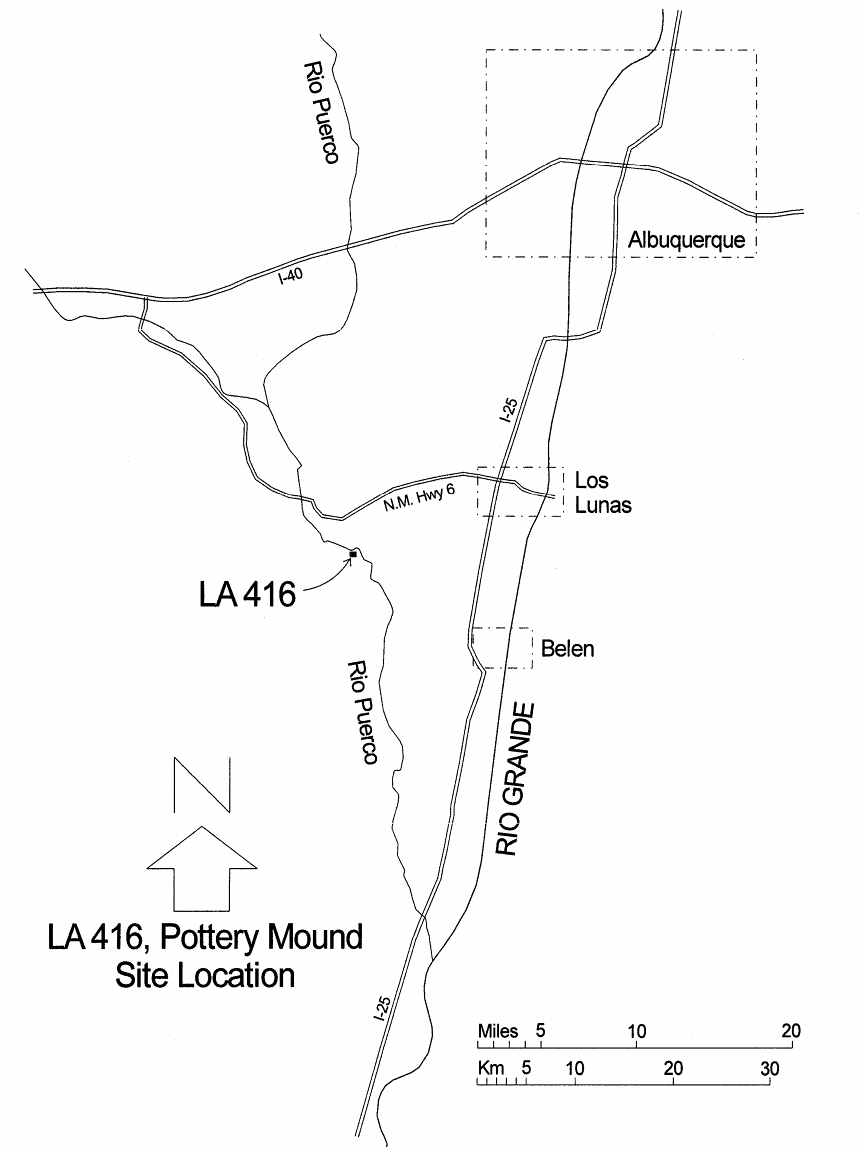

Figure 1. Location of Pottery Mound.

Research Goals

Part 2 of my study focused on analysis of materials used by Pottery Mound potters. The major concern was identifying sources of the clays and tempering materials. Following up on binocular microscope analysis by Eckert (2003), the present study included binocular microscope inspection of most of the roughly 38,000 potsherds from the 1979 test. Similarly, following up on petrographic studies by Garrett (1976) and more recently by Eckert (2003), 40 petrographic slides were prepared and were analyzed by Kari Schleher (this volume).

Beyond the sourcing of clays and tempers used by the Pottery Mound's potters, there is the question of non-local pottery. This includes identifiably "intrusive" pottery brought in from districts with visibly different ceramic traditions, as well as "local" Rio Grande glazeware pottery that is superficially similar to that produced at Pottery Mound, but differs in terms of paste and temper. The "local" pottery thus includes Rio Grande Glaze Wares made in other settlements of the middle Rio Grande district, as well as ceramics from the Galisteo Basin and Tonque districts to the northeast. The closest off-site sources present a problem, however. Due to the use of similar basaltic tempers and red-firing clays between Albuquerque and Socorro, it remains difficult to separate production of similar types within the middle Rio Grande district.

The value of separating pottery produced at Pottery Mound from that produced elsewhere should be obvious. Of particular interest are questions such as:

1. What materials were employed by local potters in producing glaze wares and utility wares, and where were such materials found?

2. How much pottery was brought to Pottery Mound, and from where did it come? Also, what was the relative importance of each source of imported pottery?

3. Can we quantify the intensity of interaction with other Pueblo districts?

This study will attempt to provide at least some answers to these questions.

Source-area studies also have an indirect bearing on other research topics. For example, they have implications for the cultural makeup of Pottery Mound resident population, including the possibility of diverse geographic origins. This in turn affects conclusions about the internal diversity of customs and social affiliations (Eckert 2003). Nonetheless, and as intriguing as they are, questions of migration and internal social organization will not be addressed in this report, based as it is on a sample from a single place within the site.

For those not familiar with Rio Grande Glaze Ware, comprehensive descriptions may be found in the handbook from the Eighth Southwest Ceramic Seminar (1966), in Snow (1982), and in Wilson (2005). Discussions of these types at Pottery Mound may be found in Brody (1964), Eckert (2003, 2007, 2008), Franklin (2007), C. Schaafsma (2007), and Voll (1961).

Source-Area Theory

The principles for identifying pottery production locations in the Southwest were formulated by Anna O. Shepard (1936, 1942, 1963, 1965). Working with pottery from Pecos Pueblo, Shepard made detailed identifications of constituent materials matched those with sources in the local environment (Kidder and Shepard 1936). In turn, the materials studies yielded useful information on production methods, resource use, and the movement of ceramics. Shepard's basic method has been used successfully ever since. Examples of later contributions to source-area theory and methods include Arnold (1985) and Rice (1987), who began to correlate ceramic attributes with human behavior.

Following in Shepard's footsteps, Helene Warren (1969, 1970, 1976, 1979) and Elizabeth Garrett (1976) used petrographic techniques to reveal paste and temper characteristics of local and foreign pottery, during ancillary studies for major archaeological projects. Warren never published on Pottery Mound itself, but did write about the Lower Puerco (Warren 1982a, 1982b). Garrett conducted the first study of petrographic thin-sections of the site's pottery, albeit of a small sample (Garrett 1976).

Traditional Pueblo potters typically collect the raw materials for their pots from sources near their villages. Until recently, gathering of clay, tempering materials, etc. was done on foot. Today, even when travel is by motor vehicles, traditional sources are still typically used—and have been used, and even monopolized, for generations. Absent evidence to the contrary, it is safe to assume that prehistoric potters also made use of materials found at a convenient distance from their settlements.

Archaeologists rely too heavily on such assumptions, however. Unless specimens are obviously foreign, the issue of non-local origins rarely comes up. Instead, "locally produced" becomes the default identification, which is rarely tested. Nonetheless, collection and technical study of potters' materials is required to verify assumptions of "local manufacture" or to distinguish pottery from elsewhere in the same basic ceramic tradition. It is surprising how few archaeological studies have taken the time to investigate the local environment with a view toward identifying material sources and correlating those with archaeological assemblages.

Even when body clays and tempering are assumed to be local, slip clays and pigments may not be. Such materials are needed in smaller quantities than body clays and temper, so transportation over large distances is less of a concern. Suitable slip clays and pigments also tend to be rarer than paste clays and tempering materials, which are almost ubiquitous in the Southwest. Specifically, the paints used on Pueblo IV glaze wares required specific concentrations of lead ore (galena) and often copper ore (malachite, cuprite, chalcopyrite, etc.) (Kelley 1977; Northrup 1959), minerals not directly available to potters in most of the glazeware production sphere. Instead, such minerals were mined at a few locations and traded over established networks (see Bice et al. 2003; Habicht-Mauche et al. 2000; Herhan 1995; Huntley et. al. 2007). Similarly, slip clays are not needed in large quantities but sources with just the right properties can be rare. In the case of Pottery Mound, for example, vessels were often slipped white in imitation of pottery from the Acoma-Zuni area, but there is no local source for such clay.

A number of researchers have commented on the unusual amount of imported pottery at Pottery Mound (Brody 1964; Eckert 2003; Franklin 2007; C. Schaafsma 2007; Voll 1961). Still, the importation of finished pottery remains incompletely documented. It is now also evident that we must look at the importation of raw materials such as paint pigments and slip clays. The current study therefore endeavored to locate potters' materials in the immediate vicinity of Pottery Mound. These were then tested and compared to finished ceramics presumably made at the site. Source-area theory holds that if a match is found between a locally available material and local pottery, the raw materials were *probably* used in local ceramic production. Such matches do not prove the utilization of the raw materials, however, even if they are shown to be identical. There is always the possibility that due to widespread environmental uniformity, similar clays and tempers were utilized by other communities in the area. The basaltic temper of the Middle Rio

Grande district is one example of a widely available resource that was utilized by numerous pottery-making pueblos. Still, the “principle of parsimony” may be invoked; given the proven proximity of matching clay and temper materials, local production may be assumed until evidence to the contrary is found.

Negative results are equally important, and certainly less ambiguous. That is, pottery not matching local materials must have been made elsewhere.

Analysis Methods

As was the case with Part 1 of this report (Franklin 2007), the data reported here derive from an analysis of 38,429 potsherds, which is every sherd from the 1979 stratigraphic test that could be located. During the analysis, major tempering materials were recorded for 11,402 sherds, using a binocular microscope. The subset selected for microscopic examination included all rim sherds, and also all body sherds except for those from Agua Fria Glaze-on-red and Pueblo IV style plain gray. The latter two categories were so numerous that the rim sherds alone provided a sample that was more than adequate. Hence, major temper type is known for a very large sample. The temper information was recorded on analysis sheets, which were entered into a Microsoft Access database. Data were then moved into Excel spreadsheets for presentation. Forms and codes used during the analysis are included in Part 1 of the report.

A sample of 40 sherds was later selected for petrographic work. The sample was designed to include all of the major temper types revealed during the binocular microscope examination. Kari Schleher analyzed the petrographic samples in order to confirm or refine the rock temper types identified using the binocular microscope. Binocular identification may not be as precise as petrographic study, but large samples can be processed. Petrographic methods are more refined and detailed, but are expensive and time-consuming, and thus best limited to small samples. Combining the two approaches gave the best overall coverage.

Meanwhile, clays were collected from around the site. Samples of the clay were worked as an impressionistic test of their suitability, and were fired to indicate variations in final color. A Munsell color chart was used to compare refired potsherds with fired clays samples.

Chapter 2

CLAYS

Pottery Mound is on an alluvial plain of deep Quaternary silts, sands, and clays (New Mexico Geological Society 1982). The bank of the Rio Puerco exposes these sediments to a depth of about 11 meters at Pottery Mound, and to greater or lesser depths elsewhere. Figure 2 shows the river bank and the strata revealed within it. The site sits on a massive deposit of red clay, which alternates with layers of silt, sand-loam, and thin layers of other clays. As these sediments erode, clay is naturally sorted by rain and stream action and deposited (along with clay particles freshly transported downstream) on the flats along the river bottom. Slightly different color combinations result from the natural sorting and mixing.

Figure 2. Exposed sediments at Pottery Mound.

As part of the current study, I endeavored to locate all available potters' materials in the immediate vicinity of Pottery Mound—and to test them and compare them to the finished ceramics presumably made at the site. Source area theory (Chapter 1) holds that if a match is found between a locally available material and the local pottery, local materials were *probably* used in ceramic production. Such matches do not prove the utilization of the identified materials, even if they are shown to be identical. There is always a possibility, for example, that specific raw materials were widely distributed and utilized by other villages in the area. The extensive availability of basalt in the middle Rio Grande region is one such example. Here the principle of parsimony is invoked to make the claim that if a vessels paste and temper match local sources, it is more likely to be a local vessel than an import.

Clay samples were collected during four field trips made with the permission of the ranch manager. An effort was made to examine all potential clay sources within about 1 km of the site. Clay was collected from the wall of the river bank and from secondary deposits on the flood plain. For purposes of comparison, the study also examined a sample of Acoma clay given by a potter by Frank Hibben, and now at the Maxwell Museum.

The sampling locations are indicated in Table 1 and some of these spots can be seen in Figures 2 through 8. The photos illustrate that most of the clay in the primary alluvial deposits are brick-red, though small deposits of tan-yellow clay are also present in the cut banks. Along the surface of the floodplain, the mixed and redeposited clays are gray to gray-green or tan-yellow.

Table 1. Sampling Locations for Clay.
(GPS readings; UTM Zone 13S, 1927 NAD)

Sample No.	Location	Description
1	E 322865, N 3846783	Red clay from alluvial slope just below site
2	E 322948, N 3846775	Dried red clay washed out from cut bank below site
3	E 323036, N 3846746	Gray redeposited clay on floodplain of Puerco
4	E 323131, N 3846748	Light gray clay in the cut bank, near the jetty jacks
5	E 323067, N 3846805	Gray-green redeposited clay on floodplain of Puerco
6	E 323082, N 3846820	Dark red clay from cut bank of Rio Puerco
7	E 323096, N 3846809	Yellow-tan clay from lens in tributary wash east of site

Analysis Methods

The pastes of the potsherds in the collection were examined using a binocular microscope. Tempers were examined with the microscope. Major temper categories were recorded on analysis sheets and entered into the analysis database (see Chapter 4).

Refiring (oxidation) analysis was then carried out on all seven samples of clay, as well as on a sample of 21 large sherds of inferred local Rio Grande Glaze Ware of several types. Sherd selection was based on the presence of apparently local basalt temper. Each sherd sample was broken in half. One half was kept as a control, while the other was refired to the same temperature and atmosphere as the raw clay samples. Procedures were based on (citations). Sherds were fired in an oxidizing atmosphere, at a consistent 900 degrees C, thus exceeding the temperatures of prehistoric firings. Clay samples were also fired at 900 degrees C, with a few of the samples also being fired at 750 degrees C. Firings took place in an electric kiln provided by Peter J. McKenna.

Figure 3. Sample Site No. 2: clay washed out from base of cut bank.

Figure 4. Sample Site No. 3: gray clay on the Puerco floodplain.

Figure 5. Sample Site No. 4: light gray clay in the Puerco floodplain.

Figure 6. Sample Site No. 5: gray-green clay from the Puerco floodplain.

Figure 7. Sample Site No. 6: dark red clay from the Rio Puerco cut bank.

Figure 8. Dried gray-green clay on the Rio Puerco floodplain.

The resulting fired briquettes of clay samples and refired sherds allow comparison of colors based on uniform firing conditions, correcting for smudging during use as well as differences in conditions during the original potters' firings. The color comparisons were based on a Munsell Soil Color Chart.

Refiring Results: Sherds

Table 2 lists the Munsell colors of the sherds, and Figure 9 shows the 21 sherds of the refiring sample. There was little color change in the pastes of the glazeware sherds, despite slip variations. These sherds were already well oxidized by their original firing, and prior to refiring their colors were fairly consistent, 2.5 YR 6/8 or 2.5 YR 5/8 (red or light red). The clays used in the glazeware sherds therefore appear to have a common origin.

In terms of Munsell values, the five plain utility sherds were somewhat darker and more yellow in cross-section before refiring than were the glazeware sherds. This is probably due to deliberately incomplete oxidation during the original firing (the potters were continuing a grayware tradition) and also to soot penetration during cooking over fires.

Table 2. Refired Sherds.
(Color readings were taken from the brightest part of each cross-section, ignoring the carbon core.)

Sample No.	Pottery Type	Temper	Paste Color Before Firing	Paste Color After Firing
1	Agua Fria Glaze-on-red	Black basalt	2.5 YR 6/8	2.5 YR 6.8
2	Agua Fria Glaze-on-red	Intermediate igneous	2.5 YR 6/8	2.5 YR 6/8
3	Agua Fria Glaze-on-red	Red-gray basalt	2.5 YR 5/8	2.5 YR 6/8
4	Agua Fria Glaze-on-red	Red-gray basalt	2.5 YR 5/8	2.5 YR 5/8
5	Agua Fria Glaze-on-red	Intermediate igneous	2.5 YR 6/8	2.5 YR 6/8
6	Agua Fria G/r, orange slip	Black basalt	2.5 YR 6/8	2.5 YR 6/8
7	Pottery Mound GP, orange slip	Intermediate igneous	2.5 YR 6/8	2.5 YR 6/8
8	San Clemente GP, cream slip	Black basalt	2.5 YR 6/8	2.5 YR 6/8
9	San Clemente GP, cream slip	Intermediate igneous	2.5 YR 5/8	2.5 YR 6/8
10	San Clemente GP, cream slip	Basalt and sand	2.5 YR 5/8	2.5 YR 6/8
11	San Clemente GP, cream slip	Intermediate igneous	2.5 YR 5/8	2.5 YR 6/8
12	San Clemente GP, chalky slip	Black basalt	2.5 YR 5/8	2.5 YR 6/8
13	San Clemente GP, chalky slip	Black basalt	2.5 YR 6/8	2.5 YR 6/8
14	San Clemente GP, chalky slip	Intermediate igneous	2.5 YR 6/8	2.5 YR 6/8
15	San Clemente GP, chalky slip	Intermediate igneous	2.5 YR 5/6	2.5 YR 6/8
16	Agua Fria G/r, orange slip	Intermediate igneous	2.5 YR 6/8	2.5 YR 6/8
17	Plain utility	Black basalt	5 YR 6/6	2.5 YR 5/8
18	Plain utility	Black basalt	7.5 YR 6/6	2.5 YR 5/8
19	Plain utility	Basalt and sand	7.5 YR 6/4	5 YR 6/8
20	Plain utility	Black basalt	10 YR 6/6	5 YR 6/8
21	Plain utility	Red basalt	7.5 YR 5/4	2.5 YR 6/8

Figure 9. Refired sherds. Show by rows, with Sample No. 1 is at the upper left and No. 21 at the lower right. In each pair, the left half of the broken sherd was not refired.

After refiring, the plain utility sherds were lighter and redder. Two that remained slightly darker (5 YR 6/8) than the rest of the samples (see Table 2) may have been more heavily affected by use over a fire, so that refiring was not sufficient to remove all the carbon that penetrated the vessel wall. Otherwise, refired colors for the utility sherds match those of the local glazeware sherds quite closely. Thus, the utility sherds could have been made from the same clays used to make the local glaze wares.

Refiring Results: Clays

Table 3 shows refired colors of the eight clay samples (seven from the Pottery Mound area, one used by Acoma potters). Figure 10 shows the briquettes before firing, Figure 11 shows the briquettes after firing to 900 degree C, and Figure 12 shows samples 3, 4, 5, and 7 after the separate firing to 750 degrees C.

Table 3. Colors of Eight Clay Samples, Before and After Firing.

		Clay Color		
Sample No.	**Plasticity**	**Air Dry**	**Fired to 900º C**	**Fired to 750º C**
1	good but gritty	5 YR 6/6	2.5 YR 6/8	
2	quite good	7.5 YR 7/4	2.5 YR 6/8	
3	good but lumpy	10 YR 6/3	5 YR 7/6	5 YR 7/6
4	excellent	10 YR 7/3	5 YR 7/6	5 YR 6/6
5	excellent	10 YR 7/3	5 YR 7/6	5 YR 6/6
6	very good	5 YR 6/4	2.5 YR 6/8	
7	good	2.5 YR 7/2	7.5 YR 7/6	7.5 YR 6/6
8	excellent	2.5 Y 7/0	2.5 Y 8/0 (pure white)	

Figure 10. Numbered clay samples (briquettes) before firing.

Figure 11. Numbered clay samples (briquettes) after firing to 900 degrees C.

Figure 12. Numbered clay samples (briquettes) after second firing to 750 degrees C. The lower-fired samples are in the lower row, while the samples fired to 900 degrees C are in the upper row.

Through firing, all samples became more red as measured by their Munsell values, as well as higher in chroma (saturation) and value (lightness) The reddest clays, from the Rio Puerco cut bank (Sample Nos. 1, 2, and 6) all fired to 2.5 YR 6/8, light brick-red. The redeposited clays, which were more gray to begin with (Sample Nos. 3–5), fired more yellow, but still somewhat red (5 YR 7/6). Sample 7, from a yellowish lens in a tributary wash, yielded a reddish yellow (7.5 YR 7/6) when fired. Thus, a range of colors—brick red, yellow-olive, and reddish yellow—was obtained from the collected clays.

To check whether samples would yield different colors if fired to a lower temperature, additional material from Sample Nos. 3–5 and 7 (those that were not brick-red) was formed into a second set of briquettes and fired at 750 degrees C. As Table 3 and Figure 12 indicate, there is little difference in color based on firing temperature. The Munsell hue remained the same, did the chroma. The samples fired at 750 degrees are one row (value) darker on the Munsell chart than the higher-fired samples (instead of 7/6, they fired to either 7/6 or 6/6). Thus, a lower temperature firing, even in an oxidizing atmosphere, may not have brought out the brightest colors the local clays could produce. Still, the differences were small, possibly small enough to be of no consequence to the potters.

Comparison of Oxidized Sherds to Fired Clays

Do the colors of local potsherds match those of local clays, when both are fired to the same temperature, in the same atmosphere? The answer is yes. Color is only one ceramic attribute, of course, but that attribute indicates that the sampled local clays could have been utilized in pottery making.

The glazeware sherds with ”local" basalt temper consistently refired to 2.5 YR 6/8 or 5/8 (Table 2), across named types. Visually, they match the red-firing clays from along the Rio Puerco (Table 3). Clay Samples 1, 2, and 6, were all collected directly from the wall of the Puerco cut bank; all three samples fired to 2.5 YR 6/8. Thus, the red clays that underlie Pottery Mound were the source of the body clay for the vast majority of the locally produced decorated pottery.

The plain utility sherds with basaltic tempers refired to the same colors as the local glaze wares (2.5 YR 5/8 or 6/8), or to slightly darker and more yellow colors (5 YR 6/8) (Table 2). The brick-red firing clay in Samples 1, 2, and 6 could thus have also been used to make much of the local utility pottery. For the slightly darker, more yellow refired sherds, the results are equivocal. Refiring may have failed to eliminate all of the carbon impurities in the sherds, but it is also possible that some clay was mined from fresh deposits along the Rio Puerco floodplain (Clay Samples 3, 4, and 5). These clays fired to 5 YR 7/6 or 5 YR 6/6, comparing closely to the 5 YR 6/8 of two plain utility sherds (Nos. 19 and 20). It does seem that the darker plainware sheds can be accounted for, for one of those two reasons. In summary, the clay bodies of the local glazeware and plainware pottery occur within a small color range consistent with clays available at or near the site.

Slip Clays

Clays were also used as slips and in painted decorations on polychrome vessels. A dark red slip appears on Agua Fria, San Clemente, and some Pottery Mound vessels. A yellow or tan slip was employed on Cieneguilla Glaze-on-yellow and on some Kuaua and Pottery Mound Glaze Polychrome vessels. An olive-colored slip appeared on some Pottery Mound and Kuaua Glaze Polychrome vessels. In addition, a thin chalky-white slip was used on some San Clemente, Kuaua, and Pottery Mound Glaze Polychrome vessels (see Part 1 of this report).

Could these slips have been made from refined forms of the local clays? The red slip so common as slip on Agua Fria and San Clemente, and used as paint on some Kuaua and Pottery Mound vessels, matches the color of the brick-red clays in the Puerco bank (2.5 YR 6/8).

Yellow slips were far less common at Pottery Mound, and yellow-firing clays may have been less common in the local deposits, but some yellow-tan or reddish-yellow clay was available to potters. When fired, Clay Sample No. 7 (7.5 YR 7/6) comes close to a yellow slip color. Also, mixing of red with yellow-red clays may have yielded the orange slip used on about half of the Agua Fria Glaze-on-red at the site.

As for the olive, tan, and buff slips seen on Pottery Mound Glaze Polychrome, these may have derived from the redeposited clays left by flooding along the Rio Puerco. These clays (Samples 3, 4, and 5) yielded colors ranging from buff to tan to olive, thus duplicating the range seen on the "browner" examples of Pottery Mound Glaze Polychrome. More generally, the employment of four or even five colors on a single surface of Pottery Mound Glaze Polychrome vessels suggests a deliberate use of all available clays, and possibly the mixing of those clays to yield new color combinations.

The one slip that does not match local clays is the thin, chalky white slip found on some examples of San Clemente, Kuaua, and Pottery Mound Glaze Polychrome. The parent material does not occur naturally near Pottery Mound, nor should it: such clay is derived from the Cretaceous formations that form so much of the surface of the Colorado Plateau, providing light gray paste clays and white to off-white slips to potters from Mesa Verde to Chaco Canyon and southward to Acoma (NMGS 1982). Acoma and Zuni potters use this very white-to-gray clay in their vessels today, as they have since Pueblo IV times. Indeed, vessels with white-firing clay bodies stand out at Pottery Mound, allowing us to identify vessels imported from Pueblo IV communities of the Acoma-Zuni area (see Part 1 of this report).

Although no such Cretaceous beds exist at or near Pottery Mound, and chalky white slips appear on local examples of late Glaze A and Glaze C pottery. The bodies of those vessels have basalt temper and brick-red paste visually matching the local materials. I have concluded that these pieces were made at Pottery Mound, but utilized a slip clay imported from somewhere in the Acoma-Zuni area. Clay Sample No. 8 supports this conclusion. Provided by an Acoma potter to Frank Hibben, and found in his collections, the sample is gray-white in its raw state. When fired, it becomes white and chalky.

Pottery Mound villagers may have traveled to suitable outcrops of Cretaceous clay, the nearest ones being about 80 km (50 miles) to the northwest. Or they could have received the slip clay from Acoma via trade. In the latter case, the slip clay may have been part of the network that brought so many Acoma-Zuni and Hopi vessels to Pottery Mound. It is also likely that other, more perishable goods were transported along the same routes, even though we have no direct evidence of those goods.

Study of potters' materials and tools will contribute to our knowledge of local pottery making, as the collections from Pottery Mound are finally examined in detail, and through new surface finds. The site surface includes chunks of hematite and limonite, possibly used in pottery making (or as pigments for wall murals, or both). Chunks of white calcite have also been found; while this material could conceivably be converted into a paint, I doubt that such a paint would survive firing. Instead we suspect that the white paint on local pottery was imported Cretaceous clay, a material that might not survive archaeologically.

A Note on Glaze Paints

Another non-local material was, of course, the minerals needed for glaze paint. The ingredients for such paint included ground lead ore as a flux, along with ground pigments such as copper or manganese ore. Once likely source for the lead ore at Pottery Mound is the Cerrillos Hills mines near Santa Fe, but potters also used lead from the Magdalena mining district west of Socorro. The sources of Pottery Mound lead flux and mineral pigments are not yet known. Neither do we know whether the raw ores were imported, or processed into pigment before they reached Pottery Mound. Considerable research is being done on the composition and origins of glaze paints, so we may soon know more about Pottery Mound's paints than we do at the moment.

Summary

Oxidation analysis of clays and sherds from Pottery Mound has yielded a few conclusions.

1. The local potters had access to an abundance of suitable clay, including of different textures and colors.

2. Glazeware sherds with local basaltic tempers (based on visual examination) consistently refire to a brick-red color (2.5 YR 6/8) This hold true regardless of pottery type. The original firings were also in highly oxidizing atmospheres, although not for long enough to burn out the carbon cores. The typical sherd body color at the site matches that of several fired samples of local clays.

3. Plain utility ware sherds from the site are sooted from use over fires, and may not have been fired in a thoroughly oxidizing atmosphere. After refiring, most reveal the same brick-red color as the glazeware sherds. Most of the utility ware vessels thus appear to be made from the same clays used in decorated pieces. A few may have been made from redeposited clays collected from the active floodplain of the Rio Puerco. All in all, the refired pottery with basaltic temper matches against clay sources within 1 km of the site.

4. Slip clays present a more complicated picture. The red, orange, tan, buff-yellow, and olive slips seen on local glazeware vessels can be matched to colors of fired samples of local clays. The use redeposited clays from the floodplain, together with the mixing of clays to obtain new combinations, can account for the range of colors just listed.

5. The clay used for "chalky white" slips cannot be found locally. This was most likely obtained through visits to the Acoma area, or through trade connections, requiring 80 km of foot travel. The chalky white slips occur on many vessels that are locally made, based on their clay and temper.

Chapter 3

TEMPER

The potters who made Rio Grande Glaze Ware preferred rock-based temper, especially that from igneous rock. Whether found as a fine sand or ground to the proper consistency, tempers can be traced back to their sources in many cases, and give us a “fingerprint” we can match to production locations.

In the U.S. Southwest, few settlements were at any distance from suitable clays and tempering materials. “Sources of convenience” were almost always employed by potters. In this chapter I look at the tempers utilized by Pottery Mound potters, along with tempers that indicate imports.

Identification Methods

Anna O. Shepard emphasized the use of petrography in her work at Pecos Pueblo with A. V. Kidder (Kidder and Shepard 1936). Thereafter, she undertook a regional study of glazeware temper (Shepard 1942)—a ground-breaking effort that began to break down the region into “districts,” each dominated by a specific rock or potsherd temper. As the region's potters had relied mainly on various types of igneous rock as, Shepard’s approach proved fruitful. Following in her footsteps, Helene Warren (1969, 1970, 1979, 1981a) demonstrated the utility of petrographic methods in identifying ceramic production areas. Her work with the distinctive temper from Tonque Pueblo (Warren 1969) illustrated what could be learned from intensive study of a single assemblage. More recent work has been able to correlate additional rock tempers with their pueblos (or at least their districts) of origin (e.g., Habicht-Mauche 1993; Nelson and Habicht-Mauche 2006; Schleher and Boyd 2005). At Pottery Mound specifically, Betty Garrett (1976) studied the major types and determined that the principal tempers being used were various kinds of basalts. More recently, Eckert (2003) included petrographic analysis in her study of the Pottery Mound glaze wares and their cultural implications.

Part 1 of this report includes identification of basic temper ingredients for a large sample of sherds, utilizing a binocular microscope. Nonetheless, we always planned to analyze a smaller sub-set of the sherds using a petrographic microscope. The latter would serve as a check on the identifications made with the binocular scope, and specific mineral ingredients could be identified with greater accuracy. Beyond that, the specificity of petrographic methods allow more exact matches between sherd tempers and potential source rocks in the area. The petrographic work was carried out by Kari Schleher, a graduate student at UNM (Appendix A). Here I will again summarize her results, and integrate them with my own results using a the binocular scope. Photographs of petrographic samples are included in the CD in the back pocket.

The Sample

Petrographic analysis is expensive and time-consuming, so small sample sizes are mandatory. A sample of 40 sherds was selected from the 1979 materials and from the general site surface. This sample was not random, nor was it large enough for statistical manipulation. Instead it was designed to represent of the major glazeware types at Pottery Mound thought to be of local origin. The sample also included utility sherds, likewise thought to be locally produced. Sherds were identified as locally produced based on their visible paste and temper.

The sample also included eight sherds that appeared to be non-local, again based on visual inspection. The non-local sherds included two with mica schist temper and six with what appeared to be hornblende latite temper.

All 40 sherds first selected with the aid of the binocular scope. The pottery types and the results of the two examinations, binocular and petrographic, are shown in Table 4. Four hand specimens of igneous rock from the site surface were also submitted to Schleher for identification. These were thought to be likely examples of rock materials utilized by the Pottery Mound potters.

Expectations from the Binocular Examination

The prior binocular microscope work (see Part 1 of the report) indicated that two major kinds of rock temper were present in the locally made pottery, the latter being identified by its brick red paste. The major tempers included a vesicular (vitric or vitrophyric) basalt (Figure 13) and a darker, harder (intergranular or diabase) basalt (Figure 14).

A third, minor igneous temper type consisted of quartz, feldspar, and occasional amphiboles (hornblende or augite). No mica was present in this temper, which was termed “intermediate igneous rock” (i.e., an andesite or diorite) (Figure 15). Mica temper was present in sherds from imported vessels, however (Figure 16). Local potters clearly preferred crushed igneous rock.

Sherd temper was quite rare (Figure 17). In some cases, the “sherd” temper may have be bits of caliche incorporated during processing of other rock tempers. Sand temper (Figure 18), possibly derived from sandstone, was also rare.

Results of the Petrographic Study

The petrographic study tended to confirm the preliminary results of the binocular examination. Schleher identified two major basalt types in the glazeware sherds. The first, vitropheric basalt, is the equivalent to my “vesicular” basalt. She describes it as “Dominated by needle-shaped plagioclase crystals floating in a glassy groundmass, often with vesicles. This is basalt with fine-grained dark glass and plagioclase feldspar microlaths in the glassy matrix. It contains pale yellow green augite, some of which is altering to red-brown iddingsite. Some olivine.”

Table 4. Petrographic Results.

(Petrographic identifications by K. Schleher; binocular microscope identifications by H. Franklin.
No. 29 is missing due to breakage.)

No.	Pottery Type	Major Rock Type	Secondary Rock Type/Texture	Source	Binocular ID	Agreement
1	Agua Fria G/r	Vitrophyric basalt	Intergranular basalt	local	Vesicular black basalt	yes
2	Agua Fria G/r	Vitrophyric basalt	Many individual quartz grains, most likely sand	local	Intermediate igneous rock	partial
3	Agua Fria G/r	Vitrophyric basalt	Intergranular basalt	local	Vesicular red-gray basalt	yes
4	Agua Fria G/r	Vitrophyric basalt	Intergranular basalt, granite porphyry	local	Vesicular red-gray basalt	yes
5	Agua Fria G/r	Vitrophyric basalt	Some fragments closer to intergranular basalt	local	Intermediate igneous rock	no
6	Agua Fria G/r	Intergranular/ophitic basalt	Individual quartz grains, most likely sand	local	Dense black basalt	yes
7	Pottery Mound GP	Vitrophyric basalt	Intergranular basalt	local	Vesicular black basalt	yes
8	San Clemente GP	Vitrophyric basalt	Intergranular basalt	local	Vesicular black basalt	yes
9	San Clemente GP	Vitrophyric basalt	Many individual quartz grains, most likely sand	local	Intermediate igneous rock	no
10	San Clemente GP	Vitrophyric basalt	Individual quartz grains, most likely sand	local	Vesicular basalt plus sand	yes
11	San Clemente GP	Vitrophyric basalt	Intergranular basalt	local	Intermediate igneous rock	no
12	San Clemente GP	Vitrophyric basalt	Intergranular basalt	local	Vesicular black basalt	yes
13	San Clemente GP	Vitrophyric basalt	Intergranular basalt	local	Vesicular black basalt	yes
14	San Clemente GP	Intergranular/ophitic basalt	Individual quartz grains, most likely sand	local	Intermediate igneous rock	partial
15	San Clemente GP	Intergranular/ophitic basalt	Individual quartz grains, most likely sand	local	Intermediate igneous rock	partial
16	Agua Fria G/r	Intergranular/ophitic basalt	Individual quartz grains, most likely sand	local	Intermediate igneous rock	partial
17	Plain utility	Vitrophyric basalt	Intergranular basalt. Paste is very glassy.	local	Vesicular black basalt	yes

Table 4. Petrographic Results.
(Petrographic identifications by K. Schleher; binocular microscope identifications by H. Franklin.
No. 29 is missing due to breakage.)

No.	Pottery Type	Major Rock Type	Secondary Rock Type/Texture	Source	Binocular ID	Agreement
18	Plain utility	Vitrophyric basalt	Paste is very glassy	local	Vesicular black basalt	yes
19	Plain utility	Vitrophyric basalt	Paste is very glassy	local	Vesicular basalt plus sand	yes
20	Plain utility	Vitrophyric basalt	Paste is very glassy	local	Vesicular black basalt	yes
21	Plain utility	Vitrophyric basalt	Paste is very glassy	local	Vesicular red basalt	yes
22	Pottery Mound GP	Vitrophyric basalt	Intergranular basalt	local	Intermediate igneous rock	no
23	Kuaua GP	Intergranular/ophitic basalt	Individual quartz grains, most likely sand	local	intermediate igneous rock plus basalt	yes
24	Cieneguilla G/y	Augite monzonite		San Marcos Pueblo	Intermediate igneous rock	yes
25	Pottery Mound GP	Vitrophyric basalt		local	Fine basalt plus intermediate igneous rock	yes
26	San Clemente GP	Vitrophyric basalt	Individual quartz grains, most likely sand	local	Vesicular basalt plus intermediate igneous rock	yes
27	Red glazeware jar rim	Vitrophyric basalt	other materials, including very large—unidentified	local	Vesicular basalt plus intermediate igneous rock	yes
28	Agua Fria G/r	Vitrophyric basalt		local	Vesicular basalt plus intermediate igneous rock	yes
30	San Clemente GP	Vitrophyric basalt	Individual quartz grains, most likely sand	local	Red vesicular basalt plus white fragments	yes
31	San Clemente GP	Intergranular/ophitic basalt		local	Intermediate igneous rock	no
32	Cieneguilla G/y	Augite monzonite		San Marcos	Intermediate igneous rock	partial

Table 4. Petrographic Results.

(Petrographic identifications by K. Schleher; binocular microscope identifications by H. Franklin. No. 29 is missing due to breakage.)

No.	Pottery Type	Major Rock Type	Secondary Rock Type/Texture	Source	Binocular ID	Agreement
				Pueblo		
33	Clapboard corrugated	Mica schist		Tijeras Area	Schist	yes
34	Clapboard corrugated	Mica schist	Granite?	Tijeras Area	Metamorphic rock with schist	yes
35	Espinoso GP	Hornblende latite	Sherd/unmixed clay	Tonque Pueblo	Hornblende latite	yes
36	Espinoso GP	Hornblende latite		Tonque Pueblo	Hornblende latite	yes
37	Espinoso GP	Hornblende latite		Tonque Pueblo	Hornblende latite	yes
38	Espinoso GP	Hornblende latite		Tonque Pueblo	Hornblende latite	yes
39	Espinoso GP	Hornblende latite		Tonque Pueblo	Hornblende latite	yes
40	Espinoso GP	Hornblende latite		Tonque Pueblo	Hornblende latite	yes

Figure 13. Vitric basalt temper in a plain gray utility sherd.

Figure 14. Dark hard basalt (diabase) temper in a plain gray utility sherd.

Figure 15. Intermediate igneous rock temper in a red-slipped glazeware sherd.

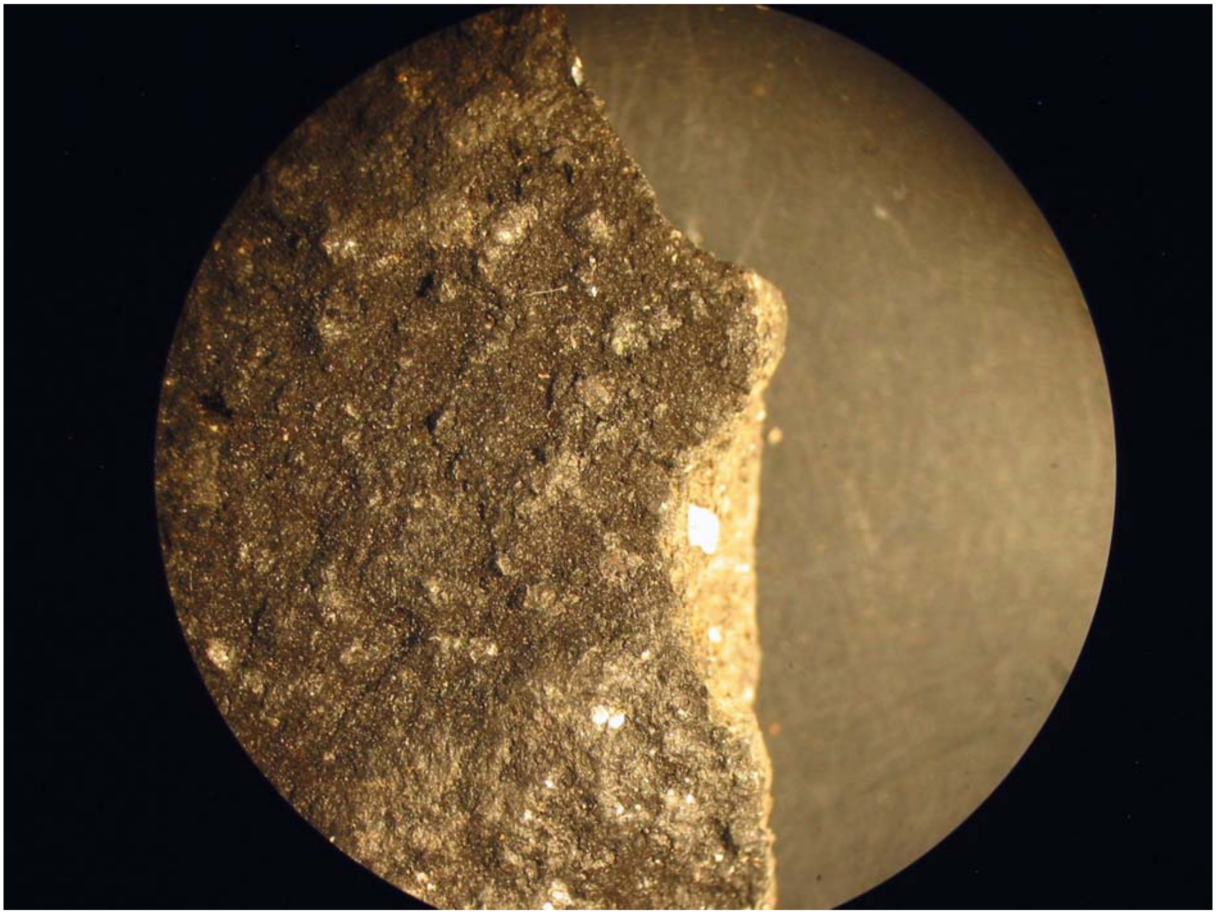

Figure 16. Mica schist temper in a sherd of plain gray utility ware.

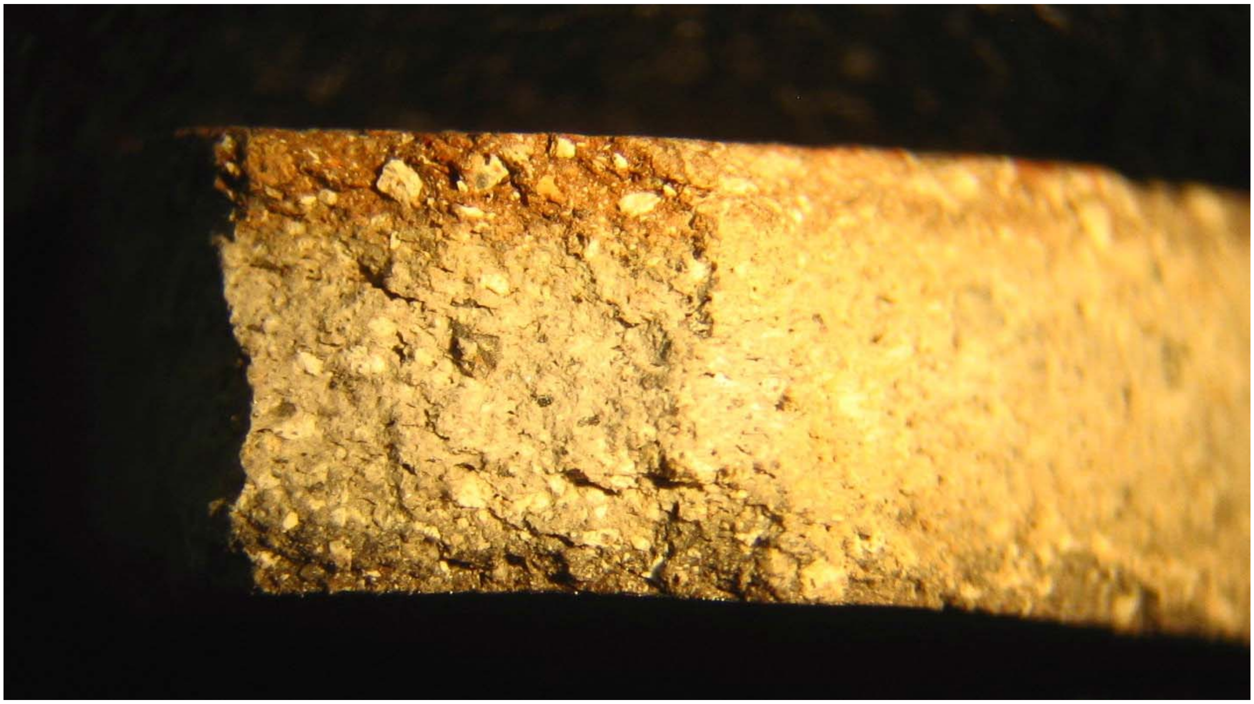

Figure 17. Sherd temper in a sherd of San Clemente Glaze Polychrome.

Figure 18. Sand temper in a sherd of plain gray utility ware.

Schleher identified the second basalt (seen through the binocular microscope as a dark basalt, perhaps dolerite or diabase) as intergranular/ophitic basalt. She describes the mineralogy as "Dominated by plagioclase and augite with small amounts of glass between small olivine crystals. This holocrystalline basalt has intergrown phenocrysts of plagioclase feldspar and augite."

My third category, "intermediate igneous rock," was not confirmed by petrographic study. Instead, this material consists of specimens including intergranular/ophitic basalt, with various amounts of local sand mixed in. The sand may or may not have been added intentionally. This combination results in a mineralogical suite that includes quartz and additional feldspar in addition to the minerals of the dark "intergranular" basalt already described. While under binocular inspection it resembles rock of the andesite-diorite class, in reality it is a combination of sand and dense, dark basalt.

Thus, the most common temper (as identified by both methods) is vitrophyric (vessicular) basalt; it accounts for 23 of 31 of glazeware and plainware sherds thought to be local. The second most common temper is a dark, hard intergranular/ophitic basalt, listed as the primary temper in six of the 31 local specimens. Mixtures of these two tempers, as well as mixtures involving basalt and sand (intentionally introduced or not), are very common.

Two non-local sherds of Cieneguilla Glaze-on-yellow were identified as having augite monzonite. This is typical of vessels produced at San Marcos Pueblo, and indicates trade with that glazeware-making town. These two samples were described as containing intermediate igneous rock during the binocular examination.

Petrographic study confirmed the initial binocular identifications of other sherds as non-local. The mica schist in two corrugated sherds is though to derive from schistose metamorphic rocks that outcrop in Tijeras Canyon. The sherds are thus from vessels most likely produced at Tijeras Pueblo. Six sherds of Espinoso Glaze Polychrome had hornblende latite tempter, as indicated during binocular examination and confirmed during petrographic study. Schleher believes that the six sherds were from pots made at Tonque Pueblo—a level of specificity not achieved during binocular examination. The evidence to date indicates that yellow paste is foreign to Pottery Mound, and that Espinoso Glaze Polychrome was never produced at the site.

Four sherds indicate a clear disagreement between the two analysts and their methods; all involved the identification of "intermediate igneous rock" that was actually due to the mixture of rock with sand. Five sherds indicate partial agreement, in that use of the binocular scope allowed the analyst to identify either the primary or the secondary rock ingredient, but not both. In general, the binocular scope cannot provide the detailed identifications of rock tempers possible through petrographic study. It does appear, however, that major rock types can be identified with the binocular scope, with sufficient accuracy to allow general characterizations of tempering materials.

Sources of Temper

Rock suitable for tempering clay does not occur near the site. Instead, the site sits on alluvial deposits consisting of clay, silt, and sand. Potsherds were always available at the site and could be ground into temper, yet this approach was entirely avoided by local potters. Potsherd temper may be even less common than indicated by binocular examination, if caliche was in fact inadvertently included during processing of basalt.

As the preceding sentence suggests, Pottery Mound potters derived their temper almost exclusively from two kinds of basaltic rock. The closest source for these rocks are the Hidden Mountain formation, which outcrops as mesas and bluffs 8 km (5 miles) northwest of Pottery Mound. Eckert (2003) also suggested this formation as the possible source of basaltic temper.

The Hidden Mountain formation includes vesicular and non-vesicular basalts, gabbros, diabase, dacites, and andesite porphyries. The underlying sedimentary deposits include red and yellow sandstone (some of which was also brought to Pottery Mound, but not for use as pottery temper). The Hidden Mountain deposits include the two materials used as glazeware temper: the vitrophyric (vesicular) basalt and the darker, harder intergranular/ophitic basalt. Both were readily available to people from Pottery Mound. The vitrophyric basalt is the more common rock geologically, which may account for its popularity as glazeware temper. In summary, the exposed basaltic rocks in the Hidden Mountain formation match the popular rock tempers used at Pottery Mound.

Basaltic flows area present to the east as well, across the Rio Puerco Valley, at a similar distance. These flows may have been visited by prehistoric potters, but we have been unable to examine them thus far.

Raw Materials on the Site Surface

The surface of Pottery Mound is littered with debris of all kinds (Figures 19 and 20). Ground stone fragments are abundant; the materials represented by these tool fragments include vesicular basalt, dark hard intergranular basalt, and sandstone. All three rock types were available at outcrops at or near Hidden Mountain (Figures 21 and 22).

Four hand specimens of possible rock temper were collected from the site as part of the current study. Two were vitrophyric (vesicular) basalt and two were the darker, denser intergranular/ ophitic basalt (Table A.4). Schleher agrees with my assessment that the hand specimens match the two major tempers found in the local glazeware and plainware sherds. It may well be that these materials, so common across the surface of the site, were the actual source of pottery temper. If so, they began life as grinding tools, and were reduced to pottery temper after breaking or becoming too worn for use.

Figure 19. Sandstone, rhyolite, and diabase basalt fragments on the site surface.

Figure 20. Mano fragments of vitric and diabase basalt and sandstone on the site surface.

Figure 21. Vitric basalt and scoria on the surface of Hidden Mountain.

Figure 22. Sandstone at Hidden Mountain. This material outcrops below the basalt.

Chapter 4

VARIATIONS IN TEMPER BY POTTERY TYPE AND UNIT LEVEL

The current study examined the cross-sections of all of rim sherds from the 1979 test, along with many of the body sherds. The only body sherds not examined in this fashion were Agua Fria and plain gray body sherds, for which large samples of rims were available. Table 5 shows all pottery types by the original analysis temper code. Tables 6 and 7 compress the temper codes into larger, behaviorally more meaningful groups. Fourteen temper categories were used (see Part 1 of this Report), probably more than are needed to identify meaningful variations in local pottery. In this chapter they will be referred to as “temper codes,” to distinguish them from the “type codes.”

Temper Code 1 indicates crushed sherds. temper

Codes 2, 3, and 4 all indicate vesicular (vitric) basalt, differing only in color (red, gray, or black). The color variations now strike me as meaningless, as the color varies widely even in the same outcrop. Likewise, the categories vitrophyre (Temper Code 5), latite porphyry with olivine (Temper Code 9), and fine-grained gray basalt (Temper Code 12) are variants on a theme. All are hard, dark basalt and might refer to diabase, dacite, gabbro, basalt porphyry, or intrgranular basalt (see Schleher, this volume). Schleher’s “intergranular/ophitic” basalt clearly correlates to my Temper Codes 5, 9, and 12.

Based on the petrographic study, the category “intermediate igneous rock” (Temper Code 8) cannot be sustained. Instead, this category represents a mixture of dark, hard (“intergranular”) basalt mixed with local sand (or crushed sandstone). The basalt component may not exist as a geological entity; it may instead represent rocks picked up from the site surface. In the rest of this study, Sorting Code 8 will be referred to as “basalt mixtures.”

So few examples of purely sand- or sandstone-tempered pottery (Temper Codes 6 and 7) were seen in the collection, it is doubtful that they represent a significant level of purposeful behavior. Sand was available along the Rio Puerco and in local arroyos, while fragments of sandstone tools could be picked up on the site. Admittedly, discarded pieces of sandstone are less common on the site than discarded pieces of basalt, reflecting the local geology.

Temper Code 13 indicates calcium carbonate (caliche) as well as basalt. Many basaltic rocks at Hidden Mountain have crusts of white caliche on them.

Temper Code 14 refers to tuff, a temper type confined to intrusive biscuit wares. Finally, small amounts of mica-tempered utility pottery were identified; all are verified intrusives, probably from the Tijeras Canyon area.

Table 5. Pottery Type by Dominant Temper Type.
(See end of table for key to temper codes.)

Pottery Type	Type Code	Total	Temper ID?		Temper Code											
			No	Yes	1	2	3	5	6	8	9	10	11	12	13	Rare
Unidentified	999	14	1	13	6	1	1			5						
Red Mesa B/w	10	5		5	1				4							
Puerco-Escavada B/w	11	2		2												TC99=2
Socorro B/w	12	76		76	60	1			4	3	7					TC99=1
Chupadero B/w	13	3		3	2						1					
Santa Fe B/w	15	3		3	1					1				1		
Biscuit A (Abiquiu)	25	22		22	2				8	6						
Biscuit B (Bandelier)	30	20		20					7	1						
Red/tan	71	2		2		1				1						
Unpainted Portions of Rio Grande Glaze Ware																
Exterior red, interior red or orange	91	6704	5954	750	5	294	170	2	49	199	27	1		2		TC7=1
Exterior red, interior white or cream	92	165	137	28	1	17	4			5	1					
Ext. white or yellow, int. white or yellow	93	220	173	47		16	9		2	12	7			1		
Exterior red, interior tan, orange, or olive	96	70	66	4						4						
Plain red or orange	97	1002	998	4		2				1	1					
Rio Grande Glaze Ware, Typed Sherds																
Glaze A NFS	100	8	1	7		3			1	1	2					
Los Padillas GP	101	2		2		1				1						
Arenal GP	105	15		15	2	6	3		2	2						
Los Padillas-Arenal GP	106	1		1				1								
Agua Fria G/r (red slip)	110	4575	3003	1572	14	791	285		27	446	5			1		TC4=2; TC7=1
Agua Fria G/r (orange slip)	111	3075	1971	1104	1	590	185		20	304	3				1	
Agua Fria GP	112	3		3		2				1						
San Clemente GP (red ext.., chalky white int.)	115	434	3	431	8	243	55		5	111	7			1		TC7=1

Table 5. Pottery Type by Dominant Temper Type.
(See end of table for key to temper codes.)

Pottery Type	Type Code	Total	Temper ID?		Temper Code											
			No	Yes	1	2	3	5	6	8	9	10	11	12	13	Rare
San Clemente GP (red ext., creamy white int.)	116	1077	24	1053	1	567	147	2	30	300	6					
San Clemente GP (chalky white ext., red int.)	117	772	18	754	6	454	57		9	202	26					
San Clemente GP (creamy white ext., red int.)	118	118	2	116	1	83	11			20	1					
San Clemente GP (white or cream both sides)	119	69		69		31				28	10					
Cieneguilla G/y	120	777		777	6	352	227	1	11	165	15					
Cieneguilla Glaze Poly.	121	16		16		3	2		1	2	8					
Pottery Mound GP (generic)	125	12		12		10				2						
Pottery Mound GP (orange-buff-olive slip)	126	509	1	508	1	349	68		1	72	16					TC7=1
Pottery Mound GP (chalky white slip)	127	175		175	2	93	6		5	56	10			3		
Pottery Mound GP red/white	130	1		1		1										
Largo G/y	201	8		8	1					5	2					
Espinoso Glaze Poly.	301	1		1						1						
Kuaua Glaze Polychrome	302	16		16	1	3	7			5						
Glaze D NFS	400	2		2							2					
San Lazaro Glaze Poly.	401	4		4		2					2					
Unknown late glaze	640	1		1						1						
Total		11671	5023	6648	44	3584	1053	4	112	1725	115	0	0	5	1	
Percent				100.0%	0.7%	53.9%	15.8%	0.1%	1.7%	25.9%	1.7%	0.0%	0.0%	0.1%	0.0%	
Utility Ware																
Clapboard Corrugated	701	51		51	1	23	4		2	6	2	12	1			
Indented Corrugated	705	122		122	8	53	11	1	6	17	20	6				
Obliterated Corrugated	706	152		152	6	61	10		11	22	10	25	1	4	2	
Plain gray (no mica)	710	17426	14674	2752	20	1751	451	12	134	265	56	31	6	18	7	

Table 5. Pottery Type by Dominant Temper Type.
(See end of table for key to temper codes.)

Pottery Type	Type Code	Total	Temper ID?		Temper Code											
			No	Yes	1	2	3	5	6	8	9	10	11	12	13	Rare
Plain gray (micaceous)	715	10		10								7	3			
Los Lunas Smudged	725	27		27	6				12	6		1	1			TC14=1
Sapawe Micac. Washboard	730	1		1									1			
Unknown plain utility	799	20		20					1	3	16					
Total Rio Grande utility		17809	14674	3135	41	1888	476	13	166	319	104	82	13	22	9	
Percent				100.0%	1.3%	60.2%	15.2%	0.4%	5.3%	10.2%	3.3%	2.6%	0.4%	0.7%	0.3%	
Acoma-Zuni Area																
Gallup B/w	805	1		1	1											
Kwakina Glaze Poly.	810	2		2	2											
Acoma-Zuni glaze ware	830	350	1	349	328	4			2	1	13					
unident. Acoma-Zuni glaze	831	1		1	1											
Cibola-Acoma utility	740	47		47	43			1	2		1					
Acoma corrugated	750	1		1	1											
Total Acoma-Zuni		402	1	401	376	4	0	1	4	1	14	0	0	0	0	
Percent				100.0%	93.8%	1.0%	0.0%	0.2%	1.0%	0.2%	3.5%	0.0%	0.0%	0.0%	0.0%	
Hopi Area																
Jeddito B/y	850	94		94	75				16							TC99=3
Sikyatki G/p	860	17		17	12				2							TC99=3
Generic Hopi yellow	870	111		111	90				16		1					TC99=4
Hopi plain utility	880	9		9	7				2							
Hopi corrugated	881	8		8	4				4							
Total Hopi		239	0	239	188	0	0	0	40	0	1	0	0	0	0	
Percent				100.0%	78.7%	0.0%	0.0%	0.0%	16.7%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	
	Totals	38429	27027	11402												

Temper Type Key: 1 = potsherd; 2 = black or gray vesicular basalt; 3 = red vesicular basalt; 4 = black and red mix, vesicular basalt; 5 = vitrophere (shiny black); 6 = quartz sand; 7 = sandstone; 8 = intermediate igneous rock (andesite-diorite); 9 = latite porphyry with olivine; 10 = schist rock (not flakes); 11 = mica flakes (muscovite or biotite); 12 = fine-grained gray rock (diabase?); 13 = fine white material (usually found on basalt); 14 = volcanic tuff; 99 = unknown or none visible. Temper not recorded on Agua Fria G/r body sherds, unpainted glazeware body sherds, and plain utility body sherds.

Table 6. Pottery Types by Dominant Temper Group.
(Condensed from data in Table 5. "Igneous Rock" may include basalt.)

	Major Temper Category and Numbered Temper Types										
	Type Code	**All Sherds**	**Sherds with Temper ID**	**Sherd**	**Vesic. Basalt**	**Diabasic Basalt**	**Igneous Rock***	**Sand, Sandst.**	**Mica, Schist**	**Tuff**	**Un-ident.**
				1	**2, 3, 4**	**5, 9, 12, 13**	**8**	**6, 7**	**10, 11**	**14**	**99**
Unidentified	999	14	13	6	2		5				
Unpainted portions of Rio Grande Glaze Ware sherds											
Ext. red, int. red or orange	91	6704	750	5	464	31	199	50	1		
Ext. red, int. white or cream	92	165	28	1	21	1	5				
Each side white or yellow	93	220	47		25	8	12	2			
Ext. red, int. tan, orange, olive	96	70	4				4				
Red or orange	97	1002	4		2	1	1				
Rio Grande Glaze Ware, typed sherds											
Glaze A, not further specified	100	8	7		3	2	1	1			
Los Padillas Glaze Polychrome	101	2	2		1		1				
Arenal Glaze Polychrome	105	15	15	2	9		2	2			
Los Padillas-Arenal Glaze Poly.	106	1	1			1					
Agua Fria G/R (red slip)	110	4575	1572	14	1078	6	446	28			
Agua Fria G/R (orange slip)	111	3075	1104	1	775	4	304	20			
Agua Fria Glaze Polychrome	112	3	3		2		1				
San Clemente Glaze Poly. (red ext., chalky white int.)	115	434	431	8	298	8	111	6			
San Clemente Glaze Poly (red ext., creamy white int.)	116	1077	1053	1	714	8	300	30			
San Clemente Glaze Poly (chalky white ext., red int.)	117	772	754	6	511	26	202	9			
San Clemente Glaze Poly (creamy white ext., red int.)	118	118	116	1	94	1	20				
San Clemente Glaze Poly (white or cream, both sides)	119	69	69		31	10	28				
Cieneguilla Glaze-on-yellow	120	777	777	6	579	16	165	11			
Cieneguilla Glaze Polychrome	121	16	16		5	8	2	1			
Pottery Mound Glaze	125	12	12		10		2				

Table 6. Pottery Types by Dominant Temper Group.
(Condensed from data in Table 5. "Igneous Rock" may include basalt.)

	Type Code	All Sherds	Sherds with Temper ID	Major Temper Category and Numbered Temper Types							
				Sherd	**Vesic. Basalt**	**Diabasic Basalt**	**Igneous Rock***	**Sand, Sandst.**	**Mica, Schist**	**Tuff**	**Un-ident.**
				1	**2, 3, 4**	**5, 9, 12, 13**	**8**	**6, 7**	**10, 11**	**14**	**99**
Polychrome (generic)											
Pottery Mound Glaze Poly. (orange to buff to olive slip)	126	509	508	1	417	16	72	2			
Pottery Mound Glaze Poly. (chalky white slip)	127	175	175	2	99	13	56	5			
Pottery Mound Glaze Polychrome, red-on-white	130	1	1		1						
Largo Glaze-on-yellow	201	8	8	1		2	5				
Espinoso Glaze Polychrome	301	1	1				1				
Kuaua Glaze Polychrome	302	16	16	1	10		5				
Glaze D, generic	400	2	2			2					
San Lazaro Glaze Polychrome	401	4	4		2	2					
Unknown late glaze	640	1	1				1				
Total, Rio Grande Glaze Ware		19832	7481	50	5151	166	1946	167	1	0	0
Percent of identified sherds			100.0%	0.7%	68.9%	2.2%	26.0%	2.2%	0.0%	0.0%	0.0%
Black-on-White (eastern) and Red-on-Tan Types											
Red Mesa Black-on-white	10	5	5	1				4			
Puerco-Escavada B/W	11	2	2								2
Socorro Black-on-white	12	76	76	60	1	7	3	4			1
Chupadero Black-on-white	13	3	3	2		1					
Santa Fe Black-on-white	15	3	3	1		1	1				
Biscuit A (Abiquiu) B/W	25	22	22	2			6	8		6	
Biscuit B (Bandelier) B/W	30	20	20				1	7		12	
Red-on-tan	71	2	2		1		1				
Total, B/W (eastern) and R/tan		133	133	66	2	9	12	23	0	18	3
Percent of identified sherds			100.0%	49.6%	1.5%	6.8%	9.0%	17.3%	0.0%	13.5%	2.3%
Acoma and Zuni Area Sherds											
Gallup Black-on-white	805	1	1	1							

Table 6. Pottery Types by Dominant Temper Group.

(Condensed from data in Table 5. "Igneous Rock" may include basalt.)

	Major Temper Category and Numbered Temper Types										
	Type Code	**All Sherds**	**Sherds with Temper ID**	**Sherd**	**Vesic. Basalt**	**Diabasic Basalt**	**Igneous Rock***	**Sand, Sandst.**	**Mica, Schist**	**Tuff**	**Un-ident.**
				1	**2, 3, 4**	**5, 9, 12, 13**	**8**	**6, 7**	**10, 11**	**14**	**99**
Kwakina Glaze Polychrome	810	2	2	2							
Acoma-Zuni glaze ware	830	350	349	328	4	13	1	3			
Unidentified Acoma-Zuni glaze	831	1	1	1							
Cibola-Acoma utility	740	47	47	43		2		2			
Acoma corrugated	750	1	1	1							
Total, Acoma-Zuni area		402	401	376	4	15	1	5	0	0	0
Percent of identified sherds			100.0%	93.8%	1.0%	3.7%	0.2%	1.2%	0.0%	0.0%	0.0%
Hopi Area Sherds											
Jeddito Black-on-yellow	850	94	94	75				16			3
Sikyatki Polychrome	860	17	17	12				2			3
Generic Hopi yellow	870	111	111	90		1		16			4
Hopi plain utility	880	9	9	7				2			
Hopi corrugated	881	8	8	4				4			
Total, Hopi		239	239	188	0	1	0	40	0	0	10
Percent of identified sherds			100.0%	78.7%	0.0%	0.4%	0.0%	16.7%	0.0%	0.0%	4.2%
Rio Grande Area Utility Ware											
Clapboard Corrugated	701	51	51	1	27	2	6	2	13		
Indented Corrugated	705	122	122	8	64	21	17	6	6		
Obliterated Corrugated	706	152	152	6	71	16	22	11	26		
Plain gray (no mica)	710	17426	2752	20	2202	93	265	135	37		
Plain gray (micaceous)	715	10	10						10		
Los Lunas Smudged	725	27	27	6			6	12	2	1	
Sapawe Micaceous Washboard	730	1	1						1		
Unknown plain utility	799	20	20			16	3	1			
Total, Rio Grande area utility		17809	3135	41	2364	148	319	167	95	1	0
Percent of identified sherds			100.0%	1.3%	75.4%	4.7%	10.2%	5.3%	3.0%	0.0%	0.0%
Grand Total		38429	11402								

Table 7. Rio Grande Glaze Ware, Pottery Types and Variants by Dominant Temper Group.
(Condensed from Table 6. Not all temper types included, so temper types do not add up to 100 percent.)

Pottery Type (Code)	Temper Group (Codes)											
	Potsherd (1)		Vesicular Basalt (2–4)		Diabase Basalt (5, 9, 12, 13)		Igneous, Probably Basalt (8)		Sand, Sandstone (6, 7)		Totals	
	No.	Pct.	No.	Pct.	No	Pct.	No	Pct.	No	Pct.	No	Pct.
Los Padillas Glaze Polychrome (101) and Arenal Glaze Polychrome (105)	2	11.1%	10	55.6%	1	5.6%	3	16.7%	2	11.1%	18	100.0%
Agua Fria Glaze-on-red (110, 112)	14	0.9%	1080	68.6%	6	0.4%	446	28.3%	28	1.8%	1574	100.0%
Agua Fria Glaze-on-orange (111)	1	0.1%	775	70.2%	4	0.4%	304	27.5%	20	1.8%	1104	100.0%
Cieneguilla Glaze-on-yellow and Glaze Polychrome (120, 121)	6	0.8%	583	73.6%	24	3.0%	167	21.1%	12	1.5%	792	100.0%
San Clemente Glaze Polychrome, red ext., chalky white int. (115)	8	1.9%	298	69.1%	8	1.9%	111	25.8%	6	1.4%	431	100.0%
San Clemente Glaze Polychrome, red ext., creamy white int. (116)	1	0.1%	714	67.8%	8	0.8%	300	28.5%	30	2.8%	1053	100.0%
San Clemente Glaze Polychrome, chalky white ext., red int. (117)	6	0.8%	511	67.8%	26	3.4%	202	26.8%	9	1.2%	754	100.0%
San Clemente Glaze Polychrome, creamy white ext., red int. (118)	1	0.9%	94	81.0%	1	0.9%	20	17.2%	0	0.0%	116	100.0%
San Clemente Glaze Polychrome, white on both surfaces (119)	0	0.0%	31	44.9%	10	14.5%	28	40.6%	0	0.0%	69	100.0%
Pottery Mound Glaze Polychrome (125, 126)Tan, buff, or olive slip	1	0.2%	427	82.1%	16	3.1%	74	14.2%	2	0.4%	520	100.0%
Pottery Mound Glaze Polychrome, chalky white slip (127)	2	1.1%	99	56.6%	13	7.4%	56	32.0%	5	2.9%	175	100.0%
Total	42		4622		117		1711		114		6606	

Utility Ware Temper

Plain gray utility made by local potters comprises 2,752 rim sherds. As might be expected, native basalts (Temper Codes 2, 3, and 4) predominate (80 percent). Dense, dark (intergranular) basalt (Temper Codes 5, 7, and 12) occurs in 86 sherds (3 percent). Sherds with mixed basalts and sand/sandstone (Temper Code 8) number 265 (10 percent). Sand/sandstone without basalt (Temper Codes 6 and 7) was seen in 135 sherds (5 percent). Potsherd temper exists, but is extremely rarely in utility sherds.

Clearly, vesicular basalt was the preferred tempering material. All other basalts and basalt-sand/sandstone mixtures amount to less than 20 percent (by sherd count) of utility ware tempers.

On occasion, plain gray utility sherds have mica flakes or micaceous schist as temper (see Schleher, this volume). Thirty-seven of the plain gray sherds fit this description, and 10 additional sherds were visibly micaceous on their surfaces.

Gray wares with surface treatments (clapboard, indented, and smeared-indented) are considered to pre-date Pottery Mound, which was established about 1325. It is possible, however, that corrugated pottery was still being made, on an occasional basis, as late as then. In other words, the tail end of the textured utility ware tradition seems to have overlapped with production of the first glaze wares. Tempers of the textured utility types are much the same as those for plain gray vessels. Vitric basalt occurs in 162 (50 percent) of the 325 sherds of this group The second most common temper is dark hard intergranular basalt (37 sherds). Again, a few sherds show basalt-sand/sandstone mix (45 sherds), just sand/sandstone, or crushed sherds.

On the whole, therefore, temper frequencies for utility sherds resembled those of the painted wares. There is one major exception to this statement: the three textured utility types include 45 sherds with micaceous temper (13.8 percent of 325 textured sherds). Combined with the 47 plain gray sherds with mica flake or micaceous schist temper, or with visible mica on their surface, the assemblage includes 92 sherds with a non-local temper. In these sherds the mica or schist is never mixed with basalt, which would suggest that the vessels were being imported, not the temper. The most likely source of such pottery, geologically speaking, is the Sandia mountains. Specifically, the vessels may have come from Tijeras Pueblo, whose occupation overlapped substantially with that of Pottery Mound (Cordell 1980b).

If trade with Tijeras Pueblo (or at least the Tijeras area) accounts for the micaceous vessels, that trade was stronger in early Pueblo IV times than later. This assertion is based on the fact that mica-schist tempers were more common in the (early) textured gray utility ware sherds than in the (on the average, later) plain gray utility wares. Occupation at Tijeras Pueblo ceased about 1425, at which time Pottery Mound’s source of micaceous vessels may have ended.

Non-local and Pre-glaze Types

A few sherds of Socorro Black-on-white and Los Lunas Smudged were found, but are nonetheless intriguing. During the Late Coalition (Pueblo III) period, these types were common in sites along in the lower Rio Puerco and in the adjacent Rio Grande valley. Usually they occur at small pit house villages, and their presence at Pottery Mound suggests an earlier village nearby, or even beneath Pottery Mound. Along with Los Lunas Smudged, Socorro Black-on-white is characterized by fine sand and potsherd tempers (Table 5). Of the 76 sherds in the assemblage, 70 are sherd-tempered; seven show some basalt in addition to the sherd and sand.. In this case the basalt is ground very fine. On the whole, the temper in Socorro Black-on-white and Los Lunas Smudged does not resemble that in the later glaze wares. Introduction of glazeware technology affected pastes and tempers as well as surface decorations and firing practices.

The few pieces of Red Mesa, Puerco-Escavada, and Gallup Black-on-white are even earlier, and must represent heirloom pieces or potsherds collected as curios. The original vessels were made somewhere in the larger Cibola-Chaco cultural sphere, as is confirmed by their sherd and sand/sandstone temper.

Santa Fe Black-on-white, a Pueblo III type common north of Albuquerque. is surprisingly rare at Pottery Mound. In effect, the site lies south of the range of carbon-painted pottery. The few examples in the collection are tempered with sherd and crushed igneous rock.

Biscuit Ware, traded in from the north, typically has fine yellow paste and fine particles of tuff or rhyolite. Here, 42 sherds fit that description (Code 14 in Table 4), however, there is a fair amount of sand and even rock fragments in some sherds. This may be typical of southern Biscuit Ware production, in the vicinity of Cochiti and Santo Domingo.

Pottery imported from the Acoma-Laguna district is a salient part of the Pottery Mound assemblage (see Part 1 of this report). In fact, pottery from the Acoma and Zuni districts constitutes the largest group of imported wares. A key factor in the identification of this group is temper, usually crushed sherds; Table 4 shows crushed sherds as the dominant temper in 376 of 401 Acoma-Zuni pieces. Crushed igneous rock (dark, fine bits of basalt, and minute red fragments) and sand/sandstone also occur. This is quite unlike the temper used at Pottery Mound and, along with fine white paste, is a key to distinguishing local vessels from their Acoma-Zuni counterparts. Surface inspection is not enough: although some sherds of local pottery are distinguishable from Pinnawa Glaze-on-white, Kwakina Polychrome, and Kechipawan Polychrome (and their Acoma "Alpha-Beta" equivalents) based on surface characteristics alone, many are not. Instead, the surface attributes of local vessels (including, in some cases, a chalky white slip) were intended to mimic Acoma-Zuni products (especially in the case of San Clemente Glaze Polychrome). This is why I examined a fresh break on all such sherds.

Because early archaeological studies did not routinely examine paste and temper, they seem to have underestimated the numbers of Acoma-Zuni intrusives. The frequent imports from the Acoma and Zuni districts, together with local production of "imitation" wares, must be culturally significant, as has been discussed by Eckert (2003) and will be reviewed below.

Pottery Mound has long been known for the occurrence of Hopi pottery. It is easily identified from its surface traits and fine yellow paste. The observed temper was almost exclusively very fine fragments of crushed sherds or sand (or both) (Table 5). It has been claimed that the paste clay was "self-tempered" and required no additional non-plastic ingredients.

Small amounts of corrugated utility pottery from Acoma, Zuni, and Hopi were also identified (Table 5). The 48 Acoma-Zuni utility sherds have the same tempers (sherd, quartz sand) and fine white paste as their painted counterparts. Similarly, the 17 pieces of Hopi plain and corrugated utility vessels have the fine temper (sherd, sand) and fine yellow paste as the Hopi painted sherds.

Local Glaze Ware Tempering Materials

Table 6 shows the Rio Grande Glaze Ware types according to major temper groups, the latter combining the original temper categories. Temper was identified for 7,481 sherds—but not for Agua Fria Glaze-on-red body sherds, as there was a large sample of rim sherds for this type. For Rio Grande Glaze Ware as a whole, vesicular basalt (of various colors) was by far the favorite temper (68.9 percent of the sherds for which temper was identified). The darker hard basalts, including diabasic or intergranular-ophitic basalt, were used only 2.2 percent of the time. Igneous rock (Code 8), which probably represents a mixture of dark basalt with sand/sandstone, is present in 26.0 percent of the local glaze wares. Together, these three igneous or mixed igneous-sand-sandstone tempers account for about 97 percent of the local glazeware sherds. Smaller numbers of sherds with sherd temper (0.7 percent), sand/sandstone temper (2.2 percent), and mica temper (with rounding, 0.0 percent), complete the temper inventory. Clearly, the use of various basalts dominates glazeware tempering practice at Pottery Mound, while mixtures of basalts with sand/sandstone were also common. Sherds dominated by sherd, pure sand, or mica temper occurred only rarely.

A separate tabulation of secondary or minor temper ingredients showed that the secondary temper was most often either potsherd or sand. It is not clear whether potters chose to mix tempering materials, or whether secondary ingredients such as sherd, sand, or sandstone temper were unintentional. At Pottery Mound, the abundant broken pottery and ubiquitous sand might lead these materials to be included unintentionally as ceramic pastes were being prepared.

Table 7 breaks down the sample in terms of named pottery types. The earliest types (Los Padillas and Arenal Glaze Polychrome) total only 18 sherds but two are sherd-tempered and two are sand/sandstone tempered. If such a small sample can be trusted, these tempers were somewhat common in the earliest glazeware vessels even though they were quite rare in later types.

Turning to more common temper types, the Agua Fria Glaze-on-red Glaze-on-orange samples have nearly identical percentages of those types. Vesicular basalt values are 68.6 and 70.2 percent. The values for basalt with sand/sandstone are 27.5 and 28.3 percent. All other temper groups were rare. Sandstone temper dominates in only 1.8 percent of the Agua Fria sherds, dark hard basalts dominate in only 0.4 percent of the sherds of that type, and sherd temper dominates in about 1 percent of the sherds of both Agua Fria varieties.

The figures for Cieneguilla Glaze-on-yellow and Cieneguilla Glaze Polychrome differ little from those for Agua Fria. As Table 7 shows, the Cieneguilla sherds have the same preference for vesicular basalt temper (73.6 percent) and for a mix of basalt and sand/sandstone (21.1 percent).

Sherds with dark, hard basalt and sand/sandstone temper are rarer, and fewer than 1 percent of the Cieneguilla sherds have sherds as their primary temper.

San Clemente Glaze Polychrome was broken down into five varieties, based on decorated surfaces and slip types, but as a whole, San Clemente resembles the other Rio Grande Glaze Ware types in terms of temper (Table 7). The dominant temper is vesicular basalt. Mixes including basalt rank second. Sherds with sand/sandstone temper are uncommon, as are sherds with temper purely of dark, hard basalt or sherds. Thus, taken as a whole, San Clemente shows the same basic temper preferences as Agua Fria and Cieneguilla.

Table 7 reveals modest temper variations within San Clemente, based on slip placement and white slip color. San Clemente Glaze Polychrome with red exterior slip and white interior slip was were coded as Types 115 and 116. The same type with white exterior slip and red interior slip was coded as types 117 and 118. Table 7 does not reveal large differences in temper based on those two slip arrangements. Code 118 is somewhat aberrant in terms of temper percentages, but involves a much smaller sample. Code 119, which indicates San Clemente with white slip on both surfaces, is a smaller sample still (69 sherds) but involves the same temper types, in the same rank order, as the other four varieties.

The San Clemente varieties were also examined by the type of white slip used, "creamy" or "chalky white." It is tempting to think of chalky white slip as a "foreign" trait within local glazeware production at Pottery Mound. This slip material had to be imported, probably from the Acoma-Zuni area, where potters made use of a similarly chalky white slip. The pattern of exterior white surfaces and interior red surfaces might be an inspiration from the same area. Given possible western-derived slip styles and materials, and heavy Acoma and Zuni reliance on potsherd temper, we might expect potsherd temper to be more common in local sherds with the chalky white slips. Nonetheless, the data for Codes 115 and 117 (chalky slip), versus those for Codes 116 and 118 (creamy slip), indicate no meaningful difference in temper based on the color or quality of the white slip. Potsherd temper dominates in less than 2 percent in all groups. If local potters were sometimes imitating Acoma-Zuni vessels with chalky white slips, as seems likely, they were imitating the visible qualities of those vessels, not the temper. Again, based on paste and temper results, these specimens were locally manufactured at Pottery Mound. Eckert (2003) also discusses local copies of Western types.

Pottery Mound Glaze Polychrome displays the same paste and tempers as the rest of the local Rio Grande Glaze Ware vessels. Once again, the dominant temper is vesicular basalt. Sherds with mixed basalt and sand/sandstone temper or with hard, dark basalt temper are less common, and sherds with mostly sand/sandstone temper or potsherd temper are rare. Pottery Mound Glaze Polychrome was divided by slip type, as had been done for San Clemente. In this case, the chalky white slip variety was compared to the tan-buff-olive slip variety. No obvious differences in temper emerged in Table 7. Again, the slip variant could not be linked to temper variation.

In summary, no major temper differences emerged among the Rio Grande Glaze Ware types. The same rank order of temper preference prevails for all of the types. A preference for basalt-dominated temper is a consistent theme, but lesser use of basalt-sand-sandstone mixtures, sandstone temper, and potsherd temper (in that order) was also evident. Nor does there seem to be any strong correlation between temper types and the slip-based variants of San Clemente and

Pottery Mound Glaze Polychrome. While superficial aspects of these varieties can be related to decorative styles at Acoma and Zuni to the west, at least in some cases, the red paste and the preference for basalt temper clearly mark the vessels as a local product. This consistency of practice across the local glazeware types suggests the sharing of temper recipes and manufacturing methods across the local community of potters.

Temper by Excavation Level

The issue of temper changes through time was also examined stratigraphically, by combining the local glazeware types by level (Table 8). Based on this approach, there were no major changes in temper through time. Vesicular basalt (Codes 2, 3, and 4) was dominant in all levels. The next most common group was basalt mixed with sand/sandstone, followed by hard dark basalt. (Some sample sizes are small, in each of Levels 15–17, the totals for Rio Grande Glaze Ware sherds with identified temper are less than 100.)

The minor use of potsherd temper peaks in the lowest levels (15 and 16), at about 2.6 percent of local glazeware. This pattern agrees with the trend suggested in Table 6, of potsherd temper being more common in earlier types than in late ones. Similarly, the use of sand/sandstone temper peaks in Level 16, at 15.2 percent of the sample, so this practice also appears to diminish through time.

Potsherd temper, never common, may have been slightly more popular during the early part of the occupation—possibly reflecting derivation of the local glazeware tradition from potsherd-tempered St. Johns and Heshotauthla Polychrome. Also, we should probably keep checking whether potsherd temper is more common in local vessels with chalky white slips, reflecting the transmission of a bundle of practices from the Acoma-Zuni area. Nonetheless, the basic patterns noted for temper in the Rio Grande Glaze Ware sherds as a whole also pertain to each of the constituent pottery types, and apply across the levels of the 1979 stratigraphic test.

Table 8. Rio Grande Glaze Ware: Temper Codes by Level.
(Percentages are of total recorded. See end of table for temper type key.)

Level	Total	Total Recorded	Temper Code										
			1	2	3	4	5	6	7	8	9	12	13
0	133	120		81	9			1		26	2	1	
				67.5%	7.5%			0.8%		21.7%	1.7%	0.8%	
1	1893	763	9	498	73		1	5		143	33		1
			1.2%	65.3%	9.6%		0.1%	0.7%		18.7%	4.3%		0.1%
2	2151	1116	3	649	194		2	29		211	25	3	
			0.3%	58.2%	17.4%		0.2%	2.6%		18.9%	2.2%	0.3%	
3	833	617	4	238	188			13	1	165	8		
			0.6%	38.6%	30.5%			2.1%	0.2%	26.7%	1.3%		
4	857	510	2	306	85			3		110	4		
			0.4%	60.0%	16.7%			0.6%		21.6%	0.8%		
5	1108	595	2	389	51			4	1	137	11		
			0.3%	65.4%	8.6%			0.7%	0.2%	23.0%	1.8%		
6	510	303	1	176	24					95	7		
			0.3%	58.1%	7.9%					31.4%	2.3%		
7	316	191	3	129	12					42	5		
			1.6%	67.5%	6.3%					22.0%	2.6%		
8	408	255		138	50					65	2		
				54.1%	19.6%					25.5%	0.8%		
9	511	417	4	148	121			41		100	2	1	
			1.0%	35.5%	29.0%			9.8%		24.0%	0.5%	0.2%	
10	923	435	2	255	48			1	1	122	6		
			0.5%	58.6%	11.0%			0.2%	0.2%	28.0%	1.4%		
11	722	349	5	129	82			1		126	6		
			1.4%	37.0%	23.5%			0.3%		36.1%	1.7%		
12	550	222		99	35					87	1		
				44.6%	15.8%					39.2%	0.5%		
13	456	456	5	237	31			1		180	2		
			1.1%	52.0%	6.8%			0.2%		39.5%	0.4%		
14	112	111		69	4					37	1		
				62.2%	3.6%					33.3%	0.9%		

Table 8. Rio Grande Glaze Ware: Temper Codes by Level.
(Percentages are of total recorded. See end of table for temper type key.)

Level	Total	Total Recorded	Temper Code										
			1	2	3	4	5	6	7	8	9	12	13
15	77	77	2	25	10					40			
			2.6%	32.5%	13.0%					51.9%			
16	79	79	2	16	20			12		29			
			2.5%	20.3%	25.3%			15.2%		36.7%			
17	31	31		2	16	2	1	1		9			
				6.5%	51.6%	6.5%	3.2%	3.2%		29.0%			
Total	11670	6647	44	3584	1053	2	4	112	3	1724	115	5	1
Percent			0.7%	53.9%	15.8%	0.0%	0.1%	1.7%	0.0%	25.9%	1.7%	0.1%	0.0%

Temper type key: 1 = potsherd; 2 = black or gray vesicular basalt; 3 = red vesicular basalt; 4 = mixed black and red vesicular basalt; 5 = vitrophere (shiny black); 6 = quartz sand; 7 = sandstone; 8 = intermediate igneous rock (andesite-diorite); 9 = latite porphyry with olivine; 10 = schist rock (not flakes); 11 = mica flakes (muscovite or biotite); 12 = fine-grained black rock (diabase?); 13 = fine white material (usually found on basalt); 14 = volcanic tuff ; 99 = unknown or none visible.

Chapter 5

RESOURCE PROCUREMENT AND EXCHANGE

Exchange networks are a matter of continuing archaeological interest, as is evident in recent volumes concerning the Pueblo II and III periods (Adler 1996) and the Pueblo IV period (Adams and Duff 2004; see also Habicht-Mauche et. al. 2006; Mills and Crown 1995). The results of the current study reflect Pottery Mound's involvement in the exchange networks of the Pueblo IV or Classic Period.

Ceramic Raw Materials

For pottery, one obvious import is the chalky white slip sometimes used on glazeware vessels. the clay for this slip was most likely obtained from outcrops in the Acoma area. Minerals for glaze paints were also imported, either as raw material or as prepared pigments. More than half a century ago, Anna Shepard revealed the nature of the glaze paints at Pecos, and then in the Rio Grande area (Kidder and Shepard 1936; Shepard 1942). Recent studies include examination of paint recipes (for example, Herhahn 1995) and identification of lead sources based on stable isotope ratios (for example, Habicht-Mauche et. al. 2000, 2002).

Two key constituents of the glaze paint, lead (galena) and copper ores, have sources in New Mexico. These sources include the Cerrillos Hills near Santa Fe (Bice et. al. 2003), the Ortiz mountains, the Sandia and Manzano Mountains, and the Socorro-Magdalena mining district (Huntley et. al. 2007). At the sources used by prehistoric people, mining often continued in historic times and in some cases still goes today.

For any of the imported raw materials used in pottery making, transportation to Pottery Mound involved distances of at least 50 km, and possibly 150 km or more. Residents of the village could have traveled to the sources to obtain what they needed, but the distances involved suggest that ceramic raw materials were more often obtained through exchange networks.

Non-local Ceramics

The sample of more than 38,000 sherds from the 1979 stratigraphic test allow a detailed sense of pottery importation at Pottery Mound. Table 9 divides the sherds from the test into two basic categories: local and non-local. Table 10 extracts and summarizes the Table 9 data on non-local pottery. In these tallies all of the Rio Grande Glaze Ware is listed as "local." Based on paste and temper, Agua Fria Glaze-on-red, Cieneguilla Glaze-on-yellow, and San Clemente, Pottery Mound, and San Lazaro Glaze Polychrome were produced at Pottery Mound, although the widespread use of similar basalts and red-firing clays in the southern part of the Rio Grande glazeware district means that some vessels could have been produced in nearby pueblos.

Table 9. Local Versus Non-local Pottery.

Type	Code	Count	Percent (Subgroup)	Percent Dec./Util.	Total
Local Glaze Wares					
Unpainted red	91	6704	33.8%	32.6%	17.4%
Unpainted, red and white slips	92	165	0.8%	0.8%	0.4%
Unpainted, white slip both sides	93	220	1.1%	1.1%	0.6%
Unpainted, orange and red slips	96	70	0.4%	0.3%	0.2%
Unpainted, NFS (not further specified)	97	1002	5.1%	4.9%	2.6%
Glaze A, NFS	100	8	0.0%	0.0%	0.0%
Los Padillas Glaze Polychrome	101	2	0.0%	0.0%	0.0%
Arenal Glaze Polychrome	105	15	0.1%	0.1%	0.0%
Los Padillas-Arenal Glaze Polychrome	106	1	0.0%	0.0%	0.0%
Agua Fria Glaze-on-red, red slip	110	4575	23.1%	22.3%	11.9%
Agua Fria Glaze-on-red, orange slip	111	3075	15.5%	15.0%	8.0%
Agua Fria Glaze Polychrome	112	3	0.0%	0.0%	0.0%
San Clemente Glaze Polychrome, red exterior, chalky white interior	115	434	2.2%	2.1%	1.1%
San Clemente Glaze Polychrome, red exterior, creamy white interior	116	1077	5.4%	5.2%	2.8%
San Clemente Glaze Polychrome, chalky white exterior, red interior	117	772	3.9%	3.8%	2.0%
San Clemente Glaze Polychrome, creamy yellow exterior, red interior	118	118	0.6%	0.6%	0.3%
San Clemente Glaze Polychrome, white or creamy yellow on both surfaces	119	69	0.3%	0.3%	0.2%
Cieneguilla Glaze-on-yellow	120	777	3.9%	3.8%	2.0%
Cieneguilla Glaze Polychrome	121	16	0.1%	0.1%	0.0%
Pottery Mound Glaze Polychrome, NFS	125	12	0.1%	0.1%	0.0%
Pottery Mound Glaze Polychrome, tan, buff, or olive slip	126	509	2.6%	2.5%	1.3%
Pottery Mound Glaze Polychrome, chalky white slip	127	175	0.9%	0.9%	0.5%
Pottery Mound Glaze Polychrome, red on white decoration	130	1	0.0%	0.0%	0.0%
Kuaua Glaze Polychrome (in part)	302	16	0.1%	0.1%	0.0%
Glaze D, NFS	400	2	0.0%	0.0%	0.0%
San Lazaro Glaze Polychrome	401	4	0.0%	0.0%	0.0%
Unknown late glaze	640	1	0.0%	0.0%	0.0%
Total, Local Painted		19823	100.0%		
Non-Local Painted Wares					
Gallup Black-on-white	805	1	0.1%	0.0%	0.0%
Red Mesa Black-on-white	10	5	0.7%	0.0%	0.0%
Puerco-Escavada Black-on-white	11	2	0.3%	0.0%	0.0%
Socorro Black-n-white	12	76	10.5%	0.4%	0.2%
Chupadero Black-on-white	13	3	0.4%	0.0%	0.0%
Santa Fe Black-on-white	15	3	0.4%	0.0%	0.0%

Table 9. Local Versus Non-local Pottery.

Type	Code	Count	Percent (Subgroup)	Percent Dec./Util.	Total
Biscuit A (Abiquiu Black-on-gray)	25	22	3.0%	0.1%	0.1%
Biscuit B (Bandelier Black-on-gray)	30	20	2.8%	0.1%	0.1%
Sankawi Black-on-cream	71	2	0.3%	0.0%	0.0%
Red-on-tan	83	4	0.6%	0.0%	0.0%
Largo or Espinoso Glaze Polychrome, Galisteo area	201, 301	9	1.2%	0.0%	0.0%
Kwakina Glaze Polychrome, Zuni area	810	2	0.3%	0.0%	0.0%
Acoma-Zuni glaze ware, NFS	830	350	48.5%	1.7%	0.9%
Acoma-Zuni glaze ware, NFS	831	1	0.1%	0.0%	0.0%
Jeddito Black-on-yellow, Hopi area	850	94	13.0%	0.5%	0.2%
Sikyatki Polychrome, Hopi area	860	17	2.4%	0.1%	0.0%
Painted Hopi yellow ware, NFS	870	111	15.4%	0.5%	0.3%
Total, Non-Local Painted		722	100.0%		
Total, Painted		20545		100.0%	
Local Utility Wares					
Clapboard corrugated	701	51	0.3%	0.3%	0.1%
Indented corrugated	705	122	0.7%	0.7%	0.3%
Obliterated/smeared corrugated	706	152	0.9%	0.9%	0.4%
Plain gray utility	710	17426	98.1%	97.5%	45.3%
Unknown plain utility	750	1	0.0%	0.0%	0.0%
Unknown plain utility	799	20	0.1%	0.1%	0.1%
Total, Local Utility		17772	100.0%		
Non-Local Utility					
Plain gray utility, micaceous paste	715	10	9.8%	0.1%	0.0%
Los Lunas Smudged	725	27	26.5%	0.2%	0.1%
Sapawe Micaceous Washboard	730	1	1.0%	0.0%	0.0%
Cibola-Acoma plainware	740	47	46.1%	0.3%	0.1%
Hopi utility, plain	880	9	8.8%	0.1%	0.0%
Hopi utility, corrugated	881	8	7.8%	0.0%	0.0%
Total, Non-Local Utility		102	100.0%		
Total, Utility Wares		17874		100.0%	
Unidentified		10			0.0%
Grand Total:		38429			100.0%

Table 10. Non-local Pottery by Zone of Origin.
(Condensed from Table 9)

Type	Code	Count	Percent of Subtotal	Percent of Total
Rio Grande Area				
Gallup Black-on-white	805	1	0.5%	
Red Mesa Black-on-white	10	5	2.7%	
Puerco-Escavada Black-on-white	11	2	1.1%	
Socorro Black-on-white	12	76	41.1%	
Chupadero Black-on-white	13	3	1.6%	
Santa Fe Black-on-white	15	3	1.6%	
Biscuit A (Abiquiu Black-on-gray)	25	22	11.9%	
Biscuit B (Bandelier Black-on-gray)	30	20	10.8%	
Sankawi Black-on-cream	71	2	1.1%	
Glazeware from the Galisteo area	201, 301	9	4.9%	
Red-on-tan	83	4	2.2%	
Plain gray utility, micaceous paste	715	10	5.4%	
Los Lunas Smudged	725	27	14.6%	
Sapawe Micaceous Washboard	730	1	0.5%	
Subtotal		185	100.0%	22.5%
Acoma-Zuni Area				
Kwakina Glaze Polychrome, Zuni area	810	2	0.5%	
Acoma-Zuni glaze ware, NFS	830	350	87.5%	
Acoma-Zuni glaze ware, NFS	831	1	0.3%	
Cibola-Acoma plain ware, NFS	740	47	11.8%	
Subtotal		400	100.0%	48.5%
Hopi Area				
Jeddito Black-on-yellow	850	94	39.3%	
Sikyatki Polychrome	860	17	7.1%	
Painted Hopi yellow ware, NFS	870	111	46.4%	
Hopi utility, plain	880	9	3.8%	
Hopi utility, corrugated	881	8	3.3%	
Subtotal		239	100.0%	29.0%
Total		824		100.0%

Coalition period sherds do appear in the collection, coming either from a lower, unexcavated component at Pottery Mound or from other, nearby sites. Coalition period sites are known to be present in the lower Puerco drainage, based on pipeline surveys in the 1950s and the later survey reported by Eidenbach (1982). The main decorated type on the local Coalition period sites is Socorro Black-on-white, and 76 sherds of that type were identified from the 1979 stratigraphic test. Other whiteware sherds are from Cibola White Ware types, traceable to the greater Cibola-Chaco district to the northwest. They include small amounts of Red Mesa, Puerco-Escavada, and Gallup Black-on-white. These Pueblo II to Pueblo III imports demonstrate that Coalition period residents of the middle Rio Grande region had ties to western groups long before the Classic period developments at Pottery Mound.

For the Classic period, Tables 9 and 10 indicate what was long suspected: the major sources of imported pottery lay to the west. Glazeware pottery traceable to the Acoma-Zuni area includes Kwakina, Pinnawa and Kechipawan Polychrome from Zuni (Huntley 2008) and their letter equivalents from Acoma. Collectively, they include 353 painted sherds, or 61 percent of all sherds from non-local painted wares. Hopi types, including Sikyatki Polychrome and Jeddito Black-on-yellow, amount to another 222 (39 percent) imported painted sherds. Thus, wares from Western Pueblo areas account for 81 percent (575 sherds) of all intrusive painted ware from the 1979 test. Utility ware sherds from Acoma-Zuni (47 sherds) and Hopi (17 sherds) raises the total from Western Pueblo sources to 639 sherds (Table 9). It is striking that utility pottery accompanied painted wares being moved to Pottery Mound from those western sources. Eckert (2003) obtained similar results. The data strongly suggest the existence of social networks that linked local residents to distant western partners.

The Largo (Glaze B) series and Espinoso Glaze Polychrome (Glaze C) were brought in from the Galisteo Basin or other areas to the north. A distinctive yellow paste and intermediate igneous rock tempers mark them as imports (Table 4). Such imports are numerically quite minor, however. Indeed, ceramic imports from the northern glaze production area amount to less than 0.01 percent of the Rio Grande Glaze Ware collection from the 1979 test.

The communities of the Pajarito plateau, the Bandelier area, and the lower Chama River produced distinctive pottery known as Biscuit Ware (Wilson 2005). Divided into Biscuit A (Abiquiu Black-on-gray) and Biscuit B (Bandelier Black-on-gray), these carbon-painted types were contemporary with Pottery Mound, but only 44 Biscuit Ware sherds occur in this sample (6.2 percent of the imported decorated sherds). Again, ceramic imports from the north were much less common than imports from the west.

Movement of pottery out of Pottery Mound is beyond the scope of this “site-centric” study, but Pottery Mound Glaze Polychrome was most likely produced only at its namesake site and has been found in small quantities at sites along the Rio Grande south of Albuquerque, including at Valencia Pueblo (LA 953) (Franklin 1997) and Abeytas Pueblo. Given the apparent heavy glazeware production at Pottery Mound, we can expect that considerable amounts of that pottery were exported to trading partners. The only unique Pottery Mound product that we are sure of, Pottery Mound Glaze Polychrome, evidently did not “travel widely,” however.

One potential avenue for future research is to determine the specific mechanisms for ceramic movement to and from Pottery Mound. The simplest mechanism would have been travel by members of the village. A minimum of travel was required to plant, tend, and harvest crops, for hunting and foraging, and for collection of raw materials for pottery and other crafts—but these would not have sufficed to allow exchanges over distances of 50 km or more. Instead, informal one-on-one trading partnerships and family relations probably linked members of different Pueblo communities into social and economic relationships.

A second mechanism for exchange may have the gathering of people, including from distant communities, during ceremonial occasions. Today’s Pueblo feast days combine religious observances, the renewal of social ties, and scheduled occasions for the exchange of goods. Much of the Puebloan exchange process visible in the archaeological record may have focused on these kinds of occasions (see Graves and Spielmann 2000; Potter 2000; Spielmann 1998a). Modern Pueblo feast days have some potential archaeological correlates. Even though food preparation and service is done mostly with modern vessels and utensils, much traditionally made pottery is displayed for sale or exchange with visitors.

More formal trading networks, over established routes, offered a third means of exchange, and one more likely to be successful over large distances. Pottery Mound’s connections to a larger trade system are indicated by a copper bell fragment found in the 1979 test (Maxwell Museum Cat. No. 79.17.3). Five Casas Grandes sherds (found during Hibben’s excavations) and a few sherds of incised red ware, from somewhere in Mexico (from the site surface), further indicate long-distance contact to the south. Still, not one of the 38,000-plus sherds from the 1979 test pit was from Mexico, indicating how intermittent and low-volume that connection was.

Of course, the spread of ideas, religious beliefs (such as the katsina movement), and iconography could have gone hand in hand with the exchange of items. Archaeologist see the Pueblo IV period as a time when religious movements, with themes promoting social integration, spread across the Pueblo world (e.g., Crown 1994, Spielmann 1998b). Although not directly visible, such movement could be reflected in various media, including pottery. At Pottery Mound, “intrusive” or “foreign” features on the local pottery rarely appear as a package; in most cases, they were selected and integrated into design work that was otherwise typical of the Rio Grande area. Crotty (1995, 2007) sees much the same process in kiva murals; that is, elements from Western Pueblo sources were incorporated into essentially local decorative entities. The implications of this piecemeal borrowing of clearly “outside” ideas remains to be seen.

Chapter 6

SUMMARY AND CONCLUSIONS

Established between 1325 and 1350, Pottery Mound thrived during Glaze A times, until about A.D. 1425–1450. The ceramic evidence suggests that the village then declined in population. Recently obtained radiocarbon dates from the 1979 stratigraphic test suggest a lingering occupation until almost A.D. 1500 (Franklin 2008b).

Examination of more than 38,000 sherds (from the stratigraphic unit excavated in 1979, as part of a field school directed by Linda Cordell) was completed in 2006. Changes in ceramic types and rim forms are discussed in Part 1 of the report (Franklin 2007). As that part of the report indicates, local glazeware rim forms do not follow the neat Glaze A–Glaze E sequence defined by Mera. This discrepancy is probably due to Mera's basing his system on sites in the northern part of the glazeware production area—while Pottery Mound is in the southern part of that production area, where the stylistic trajectory was somewhat different. In particular, "A" rims continued to be made alongside nominally later rim forms, and "B" rims were rarely made.

Clays and tempers used by local potters were available at or near Pottery Mound. Pottery Mound sits on clay beds, which provided raw material for adobe walls as well as for ceramic vessels. Eckert (2003:62) noted the local availability of clay and commented on the redness of oxidized paste in sherds from local vessels. The present study expanded on Eckert's work by documenting actual clay sources at or near the site. The most obvious source is the thick bands of dark red to brick red clays underlying the site. At present the Rio Puerco has banks up to 10 m tall, revealing an endless supply of such clay. It varies in quality but is easy to obtain.

The Rio Puerco carries a heavy sediment load during floods, and sorts and deposits clays from upstream shale deposits. Organic matter from decaying leaves and brush add to color variations in the floodplain clays. Occurring in scattered patches, these clays yield brown to olive colors. The only color of slip clay not obtainable locally was white. The nearest known source of white slip clay was the Acoma area, at a minimum distance of about 65 km.

For the most part, local slip clays match those employed on locally polychrome vessels. Pottery Mound Polychrome, the peak of local ceramic artistry, involved up to six colors on a surface: red, yellow, tan, olive, and white, plus the black glaze paint. Only the chalky white slip and the black glaze paint would have required materials from distant sources.

The current study included refiring of a sample of Rio Grande glazeware and utility ware sherds, matched to refired briquettes of local clays. The clay most commonly used for ceramic pastes was the abundant dark red or brick red clay available at the site. Such clay was used for paste for all of the major local glazeware types, including Agua Fria Glaze-on-red, Cieneguilla Glaze-on-yellow, and San Clemente and Pottery Mound Glaze Polychrome. The few San Lazaro Glaze Polychrome sherds in the sample also appear to contain the same red clay (and basalt temper) as earlier types, suggesting a remnant population (and limited ceramic production) into early Glaze D times. Other local clays were found to match colors used as slips (i.e., yellow, tan, and olive).

In summary, local clays account for the known dominant paste clay in vessels, as well as for all of the slip clay colors except white. Recent replication experiments demonstrate that these clays are suitable for pottery-making using traditional methods (Figure 23).

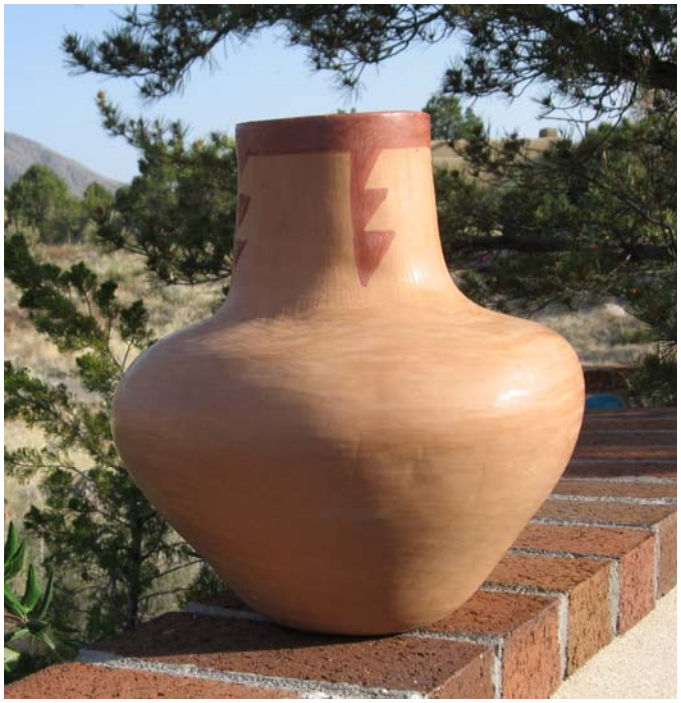

Figure 23. Modern pot made with clay from Pottery Mound.
Artist: Diane Wounded Horse Wade (Isleta Pueblo).

During the analysis, major tempering materials of a large sample were studied under the binocular microscope on most of the large sample. Following this, a sample of 40 sherds of glazeware and utility ware were studied by Schleher (Appendix A) to verify the binocular identification and to further specify geographic origins for recognized temper categories.

At Pottery Mound, more than 90 percent of the local glaze and utility wares are tempered with basalt. That basalt varies, both in local outrcops deposits and in the pottery. At one end of the spectrum is light, “bubbly” material variously termed vesicular, vitric, or scoriatious basalt. This material varies in color from red to gray to black, both in hand specimens and in pottery temper viewed with a binocular microscope. With such a microscope, the holes are often visible in the temper. At the opposite end of the spectrum are darker, harder basalts, which are denser and heavier and lack holes. Whether classified as olivine basalt, diabase, intergranular basalt, or possibly gabbro, such rock is available at Hidden Mountain.

Garrett (1976), Eckert (2003), and Schleher (Appendix A) discuss the mineralogy of the basalt. The basic conclusion to draw from the various studies is that a considerable variety of basaltic rock is found within easy collecting range from Pottery Mound, and that the same range of rock materials was used in the vast majority of local glazeware and utility vessels. When secondary temper is present in the glazeware sherds, it consists of small amounts of sand or sandstone, intermediate igneous rocks (diorite, andesite, latite, syenite), or crushed potsherds. Outcrops of sandstone occur below the lava flows at Hidden Mountain, and to the northeast across the Puerco drainage. Sand occurs along the Rio Puerco and other drainages next to and near the site.

Intermediate igneous rocks are actually rare in the area, and most likely represent imports from the north. Use of such rock types was common in the Galisteo Basin (Warren 1979; Schleher 2007), and at Arroyo Hondo (Habicht-Mauche 1993). A specific variety, “hornblende latite,” is characteristic of vessels made at Tonque (Warren 1979), and similar rock was used in the Galisteo Basin. Augite monzonite, which has been studied by Schleher (2007), appears rarely in the glazeware sherds at Pottery Mound. The intermediate igneous rock temper area may have extended west to the Cochiti district (Warren 1979) and south to the Albuquerque area (Franklin 2008a, Schleher 2008). When specific intermediate igneous rock types are identified with a binocular scope, petrographic verification is always required.

Utility pottery from the site is tempered with the materials seen in the local glazeware sherds, and basalts again dominate the assemblage. The few utility ware sherds with sand or sandstone may also represent local production. The only major difference from the glazewares is the few utility sherds that contain either mica flakes or micaceous schist as temper. In such specimens, this the only tempering material; it is never mixed with basalt or other local materials. Furthermore, mica and schist are completely absent from the local area. The closest natural sources are in the Sandia and Manzano ranges, some 65 to 80 km distant. Micaceous plainware is found at many contemporary pueblos along the Rio Grande, and Warren (1981b) discussed their origin. Large percentages of mica-tempered plainware were recently identified at Montaño Bridge (LA 33223) in Albuquerque (Franklin 2008a). The production zone is poorly defined, but the potters of Tijeras Pueblo made utility pottery (and some decorated pottery) with mica temper, schist temper, or both (Warren 1980, 1981b). For now, mica/mica schist tempered utility pottery found along the lower Rio Puerco should be considered imports from the Sandia-Manzano area.

Early in the history of the site, potsherd and sand/sandstone temper may have been slightly more common, reflecting temper preferences in types ancestral to Rio Grande Glaze Ware. The study otherwise found no major differences in temper in local glazeware types, or through time. Instead, pottery production reflects continuity of practice through multiple generations of potters.

Imported pottery is one of Pottery Mound’s hallmarks. Based on actual counts of large samples (Eckert 2003; Franklin 2007), it is finally possible to have an accurate sense view of what was imported, in what quantities, and from which sources. The imports are dominated by Western Pueblo wares, in particular painted and utility wares from the Acoma-Zuni area. Kwakina, Pinnawa, and Kechipawan Polychrome must have arrived continuously at Pottery Mound during most of its existence. The Acoma-Zuni wares have distinctive paste and temper, and are readily distinguishable from local Pottery Mound glazeware vessels by examining sherd breaks cross through a binocular microscope. In contrast, the Acoma-Zuni surface designs and even rim forms are similar enough to Rio Grande types (particularly San Clemente Glaze Polychrome) that it is easy to mistake sherds from distant sources for local ones. The current study indicates that the amount of Acoma-Zuni imports was underestimated in early tallies.

Hopi pottery is more easily spotted, and its abundance at Pottery Mound (relative to Rio Grande sites in general) has been noted by many investigators. The Hopi pottery at Pottery Mound was carried an estimated 400 km, so it is not surprising that such sherds are less common than sherds from the Acoma-Zuni area. Even so, the amount of Hopi pottery at the site is remarkable, as is the presence of Hopi utility pottery in addition to Hopi painted wares. Together, the 639 specimens from the Acoma, Zuni, and Hopi districts indicate strong connections to the west.

In addition to obtaining ceramic vessels from the Western Pueblos, the local villagers appear to have mimicked Western Pueblo pottery (especially in the production of San Clemente Glaze Polychrome). The obvious example is the use of imported white slip clays to produce white-surfaced vessels, despite using paste clays that fired red in the presence of oxygen. Moreover, the local potters seem to have copied certain layouts and rim forms from their western counterparts.

It is possible that the Western Pueblo "influence" on the Pottery Mound ceramic assemblage extended beyond importation and copying, to include actual migration of people from the Acoma, Zuni, or Hopi districts (or possibly from all three) (see Eckert 2003, 2007, 2008). The issue is beyond the scope of the current study, however.

Pottery was also imported from contemporary pueblos to the east and north, but in small numbers compared to what was brought in from the west. Only 42 Biscuit Ware sherds were identified out of the tens of thousands of sherds from the 1979 stratigraphic test. This might be surprising, given the large communities of Biscuit Ware-producing potters north of Santa Fe, but those communities do not seem to have interacted much with other Pueblo areas. In addition, the study identified a few pieces of plain and corrugated utility pottery with micaceous schist temper. These were made in settlements in the Sandia and Manzano mountains (including the best-known village, Tijeras Pueblo). Almost none of the glazeware pottery at Pottery Mound was mica-tempered, so pottery itself may not have been the goal of the exchange between the site and the villages of the Sandia-Manzano area. Instead, products from that area may have been carried to Pottery Mound in the utility jars.

Despite Frank Hibben's sense that Pottery Mound had strong Mesoamerican ties, the only evidence of such ties from the 1979 stratigraphic unit was a copper bell fragment.

With its emphasis on typology and ceramic paste and temper, the current study (along with Eckert's work) provides a basis for more technical approaches to Pottery Mound pottery. At the least, additional technical approaches could include at least three aspects: (1) identification of sources for the imported white slip clay, (2) studies of the recipes for locally made glaze paint, and (3) source studies of the lead in the glaze paint, based on stable isotope analysis. Meanwhile, it is clear that the broad ritual relationships suggested by Pottery Mound's kiva murals are also indicated in its pottery. Additional study of the site and its pottery can only strengthen our understanding of a site whose role in the middle Rio Grande region may have been unique.

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Appendix A

PETROGRAPHIC ANALYSIS OF POTTERY MOUND CERAMICS

Kari L. Schleher

The petrographic analysis of 39 sherds and 4 rock samples from Pottery Mound had two research goals.

1. Identify materials added as temper to Pottery Mound ceramics, in order to determine local versus non-local production.

2. Compare the petrographic data to the identifications made by Hayward Franklin, who used a binocular microscope.

Background

Prehistoric potters of the Northern Rio Grande region used specific rock types as temper, even though other rock types are available in each region (Erskine and Smith 1993). Based on petrographic analysis of glaze-painted ceramics, researchers have documented multiple areas of production (Habicht-Mauche 1993; Nelson and Habicht-Mauche 2006; Shepard 1942; Warren 1969, 1970, 1979, 1981a). Four major production zones—the Galisteo Basin, the Santo Domingo Basin, the Cochiti Basin and Bernalillo area, and the Southern Pajarito Plateau—are dominated by specific temper types. Glaze-paint ceramics made by potters of the Galisteo Basin tend to be tempered with latite/monzonite. Santo Domingo Basin pots were tempered with intergranular basalt. Cochiti Basin and Bernalillo area pots were tempered with vitrophyric basalt. Southern Pajarito Plateau pots were tempered with rhyolitic tuff. Previous researchers have also shown that within the Galisteo Basin, ceramics made at San Marcos Pueblo (LA 98) can be distinguished by their augite latite/monzonite temper (Habicht-Mauche 1993:83). Potters at Tonque Pueblo (LA 240), just west of the Galisteo Basin in the Albuquerque District (Eckert and Cordell 2004:38), seem to have preferred hornblende latite (Warren 1969, 1979). The preference for a specific temper within production locales allows us to tie ceramics found at Pottery Mound back to regions of production—or to specific villages, in the cases of San Marcos and Tonque Pueblos.

Researchers have used different names for similar rock types (Table A.1). I use the names found in Nelson and Habicht-Mauche (2006) and in Habicht-Mauche (1993), based on the most recent research on ceramic temper materials in the area. Pottery Mound, on the Rio Puerco west of Los Lunas, falls closest to the Albuquerque-Bernalillo production area. Based on the previous studies cited above, I expected basalt temper to dominate the locally produced pottery. My study made use of four reference samples from the site surface. Rock Samples 1 and 4 were intergranular/ophitic basalt, and Rock Samples 2 and 3 were vitrophyric basalt.

Table A.1. Temper Types by Area.
(From Schleher and Boyd 2005)

Area	Habicht-Mauche 1993; Nelson and Habicht-Mauche 2006	Warren 1969, 1979	Shepard 1942, 1965
Zia/Santo Domingo Basin	Intergranular basalt	San Felipe basalt	Crystalline basalt
San Marcos Pueblo	Augite latite/monzonite	San Marcos latite	Andesite
Galisteo Basin	Various augite and/or hornblende latite porphyries		Andesite
Tonque Pueblo	Hornblende latite ash	Tonque latite	Andesite
Pajarito Plateau	Rhyolite tuff	Rhyolite tuff	Devitrified tuff
Bernalillo-Cochiti Area	Vitrophyric basalt	Scoria basalt	Vitric basalt
Estancia Basin (Abó Pueblo)	Syenite	Syenite	

Methods

The 39 sherd sample was selected by Hayward Franklin, to include examples of each of the temper types he documented through binocular analysis. Samples PM 1 through PM 21 are from the 1979 test and samples PM 22 through PM 40 are from a surface collection. A portion of each sherd was removed using a circular saw and sent to Quality Thin Sections, Tucson to be made into thin sections for analysis. Sample PM 29 was not returned by QTS due to problems encountered during production of the thin section.

I performed the petrographic analysis in the petrography laboratory in the Department of Anthropology, University of New Mexico, using a Nikon LABOPHOT2-POL petrographic microscope. All minerals present in each thin section were identified and recorded. Rock type was then assigned on the basis of percentages of different minerals and textures of those minerals, following *Atlas of Igneous Rocks and their Textures* (MacKenzie et al. 1982). The rock types identified during the analysis are listed and defined in Table A.2, and examples are shown in Figures A.1–A.6.

Results

The results from the ceramic thin sections are presented in Table 4 (main text). Comparative rock samples are described in Table A.4. As I expected, the dominant temper material is a vitrophyric basalt, which is locally available. The second most common material is intergranular/ophitic basalt. This material type is similar to Rock Samples 1 and 4, collected from the site surface, also suggesting local production of ceramics with this temper type.

Table A.2. Descriptions of Rock (Temper) Types.

Rock Type	Definition
Intergranular/ophitic basalt	Dominated by plagioclase and augite, with small amounts of glass, between small olivine crystals. This holocrystalline basalt has intergrown phenocrysts of plagioclase feldspar and augite.
Vitrophyric Basalt	Dominated by needle-shaped plagioclase crystals floating in a glassy groundmass, often with vesicles. This is basalt with fine-grained dark glass and plagioclase feldspar microlaths in the glassy matrix. It contains pale yellow green augite, some of which is altering to red-brown iddingsite. Some olivine.
San Marcos augite latite/monzonite	Weathered, coarse-grained rock fragments of equal amounts of potassium feldspar and plagioclase, also augite and magnetite and occasional hornblende and/or biotite
Mica schist	Contains phenocrysts of quartz with smaller phenocrysts of muscovite and biotite mica.
Hornblende latite	Fine-grained rock fragments of equal amounts of potassium feldspar and plagioclase, well-defined crystals and hornblende throughout, also augite and occasionally biotite

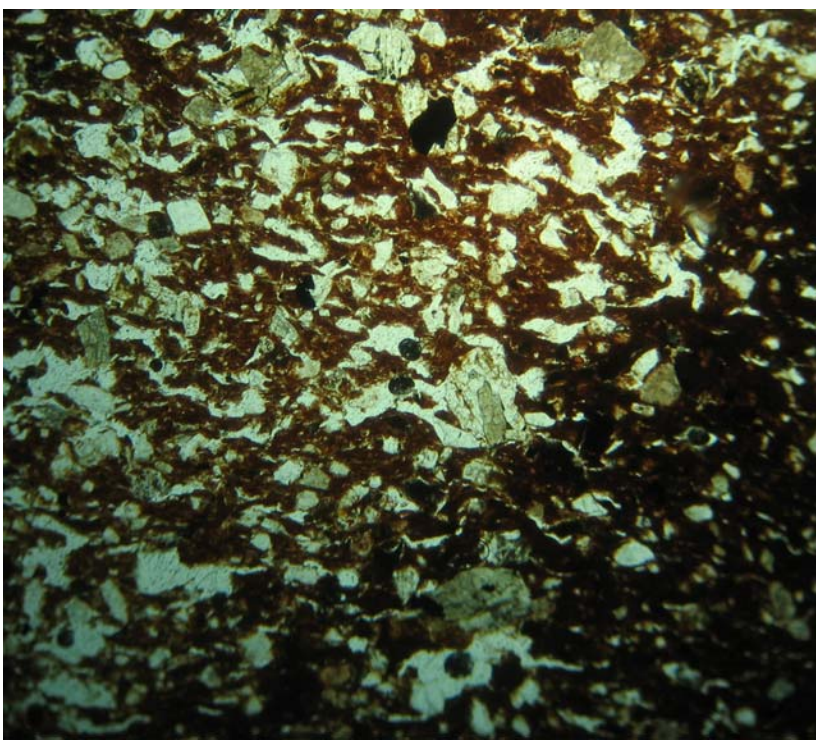

Figure A.1. Intergranular-ophitic basalt in PM 14.

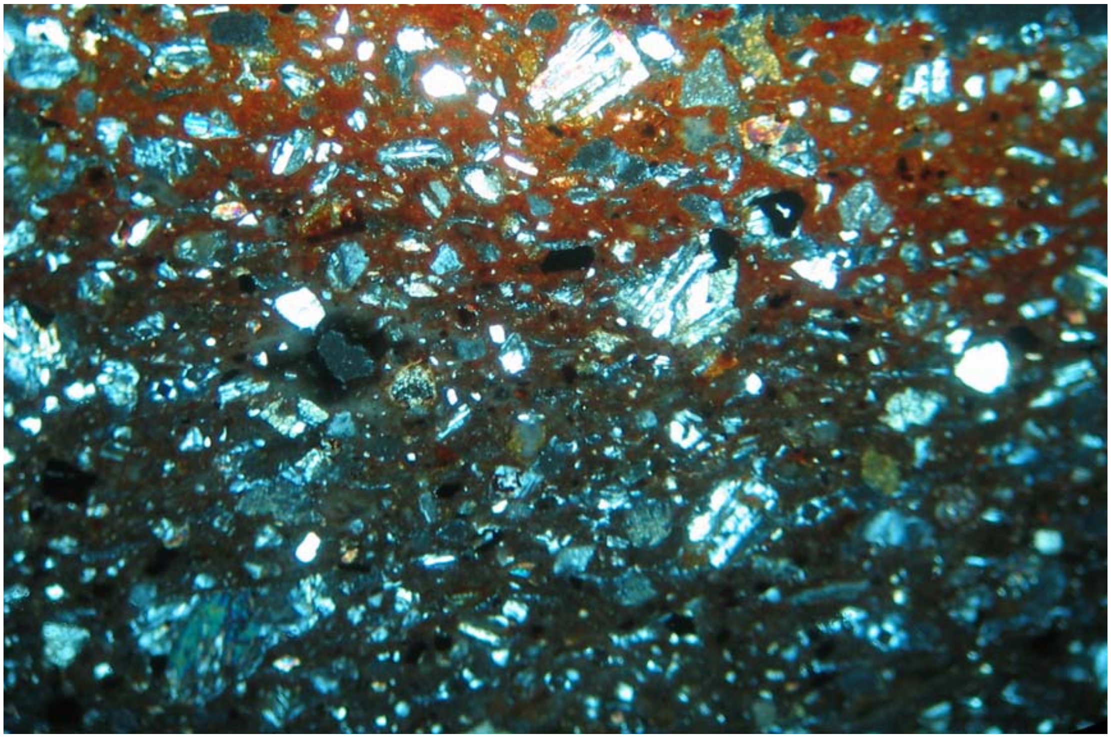

Figure A.2. Intergranular-ophitic basalt in PM 16.

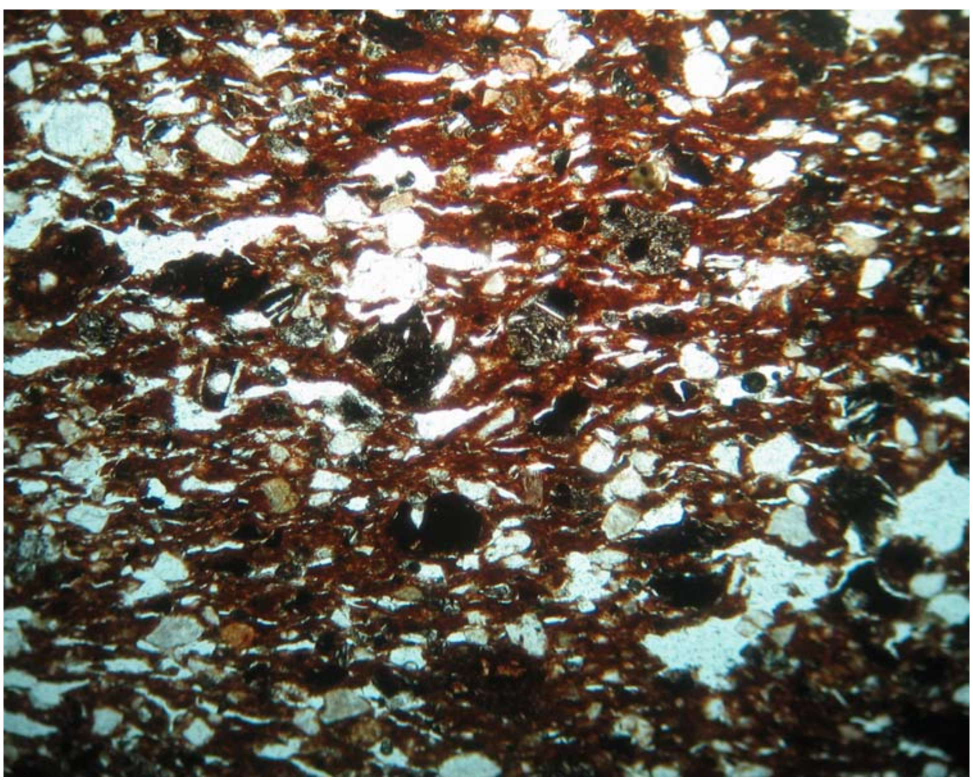

Figure A.3. Vitrophyric basalt in PM 5.

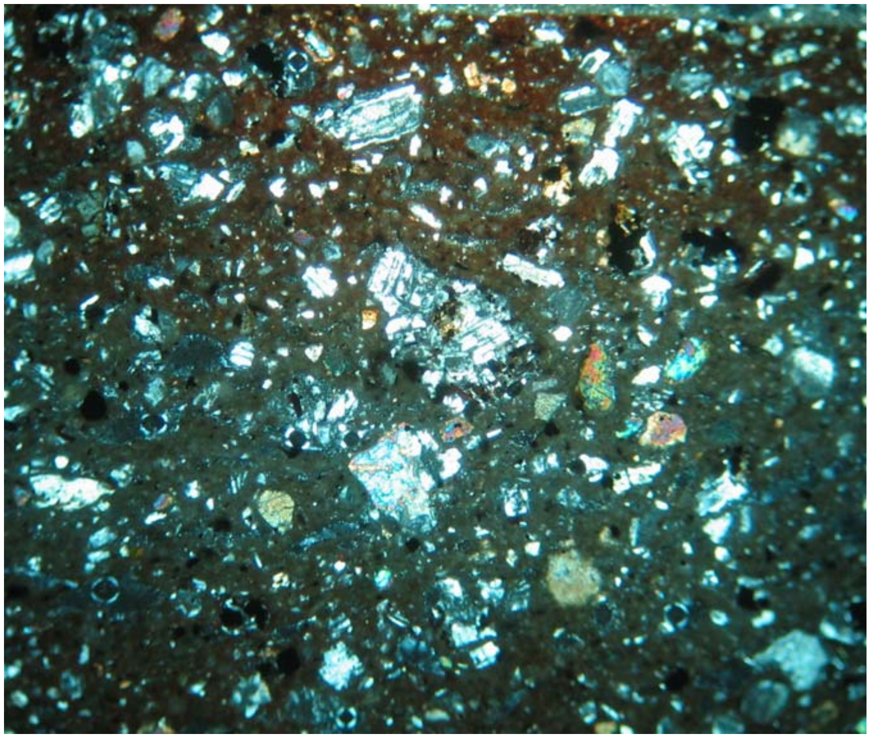

Figure A.4. Augite monzonite in PM 24.

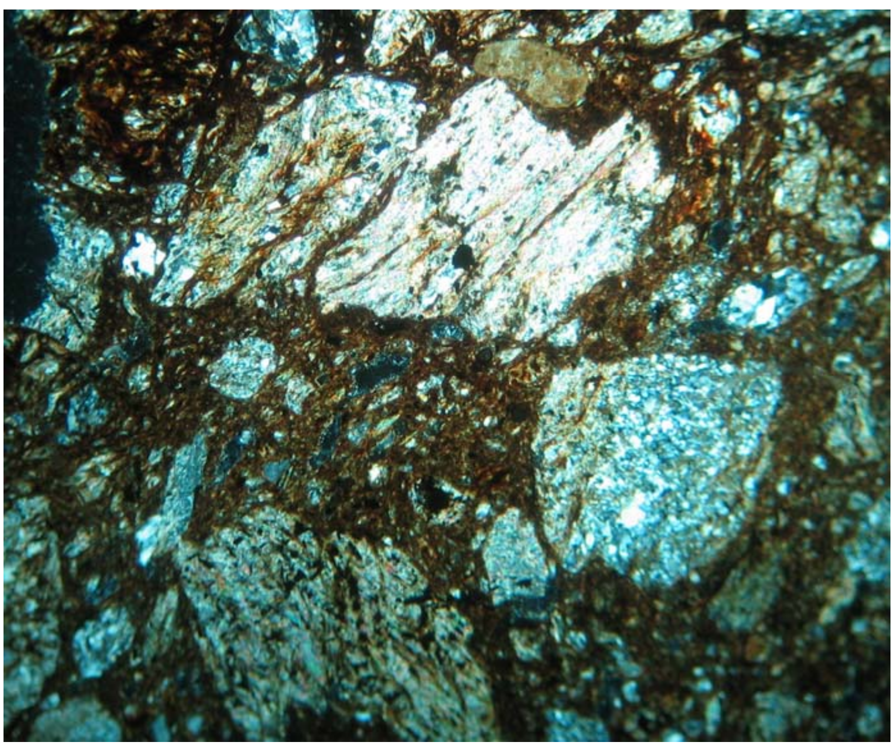

Figure A.5. Mica schist PM 33.

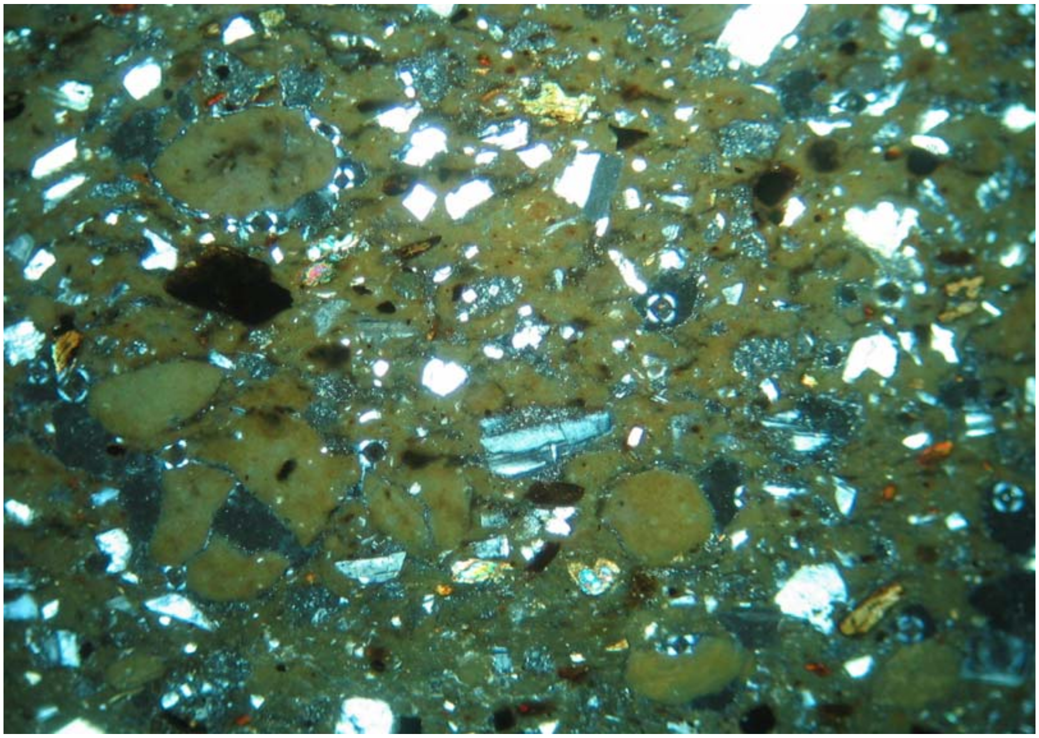

Figure A.6. Hornblende latite in PM 35.

Trade wares were also identified by the petrographic analysis. Two sherds contain San Marcos augite latite/monzonite, six sherds contain hornblende latite (used at Tonque Pueblo), and two sherds contain mica schist, which is characteristic of the Tijeras Area.

The comparison of the binocular and petrographic temper identifications is very close, with all but seven binocular identifications matching the petrographic results. For the problematic binocular identifications, most of the petrographic data showed mixed temper materials in the sherds. To provide an example, the temper in PM 2 was identified as intermediate igneous rock during the examination with a binocular microscope; petrographic study showed that the sherd was tempered with vitrophyric basalt and quite a bit of quartz sand. This mix made the temper look lighter in color, and more similar to an intermediate igneous rock, than if only vitrophyric basalt had been present.

Appendix B

LIST OF DIGITAL PHOTOGRAPHS

The following photographs may be found on the compact disk at the back of the report.

Folder: Photographs of Tempers through the Binocular Microscope

1. Plain utility ware, dark basalt temper
2. Plain gray ware, dark basalt temper
3. Plain gray ware, vitric basalt temper
4. Plain gray ware, black and red vesicular basalt temper
5. Plain gray ware, intermediate igneous rock temper
6. Red-slipped glaze ware, intermediate igneous rock temper
7. Plain utility ware, sand temper
8. Red-slipped glaze ware, sand temper
9. San Clemente Glaze Polychrome, sherd temper
10. Plain gray ware, mica temper
11. Plain gray ware, sand and schist temper

Folder: Schleher's Photographs of Thin Sections

Folder: Sample PM 1, vitrophyric basalt temper (four photographs)
Folder: Sample PM 5, vitrophyric basalt temper (six photographs)
Folder: Sample PM 14, intergranular basalt temper (six photographs)
Folder: Sample PM 16, intergranular basalt temper (four photographs)
Folder: Sample PM 24, augite monzonite temper (six photographs)
Folder: Sample PM 33, mica schist temper (four photographs)
Folder: Sample PM 34, mica schist temper (eight photographs)
Folder: Sample PM 35, hornblende latite (six photographs)
Folder: Sample PM 40, hornblende latite (two photographs)

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