1-1-2002

Variation in decorated Tusayan Gray Ware pottery at the Yamashita-3 site

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VARIATION IN DECORATED TUSAYAN

GRAY WARE POTTERY AT THE

YAMASHITA-3 SITE

by

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Bachelor of Science
University of New Mexico
1994

A thesis submitted in partial fulfillment
of the requirements for the

Master of Arts in Anthropology
Department of Anthropology
College of Liberal Arts

Graduate College
University of Nevada, Las Vegas
May 2002

UMI Number: 1411196

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

UNLV

Thesis Approval
The Graduate College
University of Nevada, Las Vegas

April 19, 2002

The Thesis prepared by

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Entitled

Variation in Decorated Tusayan Gray Ware Pottery at the Yamashita-3 Site

is approved in partial fulfillment of the requirements for the degree of

Master of Arts in Anthropology

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

Examination Committee Member

Graduate College Faculty Representative

1017-53

ABSTRACT

Variation in Decorated Tusayan Gray Ware Pottery at the Yamashita-3 Site

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This thesis characterizes variability in sand-tempered decorated Tusayan Gray Ware pottery at the Yamashita-3 site in the lower Moapa Valley. Attributes included in this analysis reflect geologic source materials used to make pottery, and stylistic variables that mirror decisions made by individual potters. Evaluation of these characteristics will aid future researchers in identifying the degree to which manufacture of decorated Tusayan Gray Ware pottery was standardized in the Virgin region. The results of this analysis indicate that most characteristics of decorated Tusayan Gray Ware pottery display little variation, indicating that the manufacture of this pottery was standardized. Two aspects of decorated Tusayan Gray Ware pottery, vessel lip form and the number of clay sources used in manufacture exhibit a great deal of variability, implying a lesser degree of standardization in manufacture.

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ACKNOWLEDGMENTS

The research conducted for this thesis would not have been possible without the aid and support of my thesis committee Chairperson, Dr. Margaret M. Lyneis, the other members of my committee, Dr. Vicky Cassman, Dr. Karen Harry, and Dr. Richard Orndorff. I am also grateful to Dr. Kelly A. Hays-Gilpin, of Northern Arizona University's Department of Anthropology, Phil Geib of Northern Arizona University's Navajo Nation Archaeology Department, and Peter J. Pilles Jr., of the Coconino National Forest, all of who took the time to examine and discuss the pottery from the Yamashita 3 site. I am indebted to Anne R. Baldwin and J. Michael Bremer of the Santa Fe National Forest for providing me with the opportunity to work in beautiful settings with fantastic archaeology during the course of my studies. Tracy Murphy at the Museum of Northern also deserves thanks for allowing me periodic access to the pottery type collections at the museum. Susan Edwards supplied funding for one of the radiocarbon dates at the Yamashita 3 site. Finally, I am most grateful for the patience and support of my husband, Andy Coriell, and the insight and encouragement of my friend Alysia Abbott.

CHAPTER 1

INTRODUCTION

Arguments about social and economic relationships between prehistoric puebloan populations in the North American Southwest are often based on knowledge of pottery production and distribution. In many regions, where pottery source materials have been adequately identified and elements of standardization in production noted, delineation of prehistoric socioeconomic relationships has been successful. Discussion of prehistoric socioeconomic relationships between Ancestral Puebloan populations in the Virgin region is hampered by a paucity of available information related to local pottery production. Sand-tempered pottery is especially problematic because of difficulty in identifying the geologic source materials of this pottery, and because the qualities that define this pottery vary throughout the region.

Problem Statement

This thesis characterizes the variability in a collection of 310 sand-tempered decorated Tusayan Gray Ware, Virgin Series pottery sherds recovered at the Yamashita-3 site in the Moapa Valley, part of the Lowland Virgin area. Attributes included in this study reflect standardization in manufacture, and include those that inform about geologic source materials and those that reflect stylistic choices made by individual potters. Examination of compositional attributes specific to sand-tempered black-on-gray pottery in the Virgin

Lowlands allows identification of the potential number of source materials used in pottery manufacture. Characterization of stylistic attributes such as vessel form, lip form, and painted decoration allows assessments of standardization in production to be made. While the sample included in this analysis is too small to make conclusive statements about standardization in manufacture and specialized craft production in the Virgin area, characterizing variability in sand-tempered decorated pottery at the Yamashita-3 site will aid future researchers in addressing these issues, contribute to the refinement of the pottery typology in the Virgin region, and aid future researchers in delineating Ancestral Puebloan socioeconomic relationships.

Summary of Thesis Content

Chapter 2 provides background information related to Ancestral Puebloan occupation of the Virgin region, and summarizes existing studies of pottery found in the region. Chapter 3 presents the problem statement and relevance of this research. The methodology employed during analysis is outlined in Chapter 4, along with the rationale for choosing the variables included in the analysis. Chapter 5 contains the results of the analysis, and a discussion of the results and a few concluding statements are provided in Chapter 6.

CHAPTER 2

LITERATURE REVIEW

Ancestral Puebloans of the Virgin Area

Ancestral Puebloan populations in the Virgin area were the western-most puebloan group in the prehistoric North American Southwest (Figure 1) (Aikens 1966, Cordell 1997). Lyneis (1995) divides the Virgin culture area into three physiographically and environmentally distinct sub-regions (Figure 2). The Plateaus sub-region is comprised of the Colorado Plateau, or Grand Staircase, north of the Grand Canyon. The St. George Basin sub-region is in southwestern Utah, and the Lowland Virgin area extends from the St. George Basin into southeastern Nevada (Lyneis 1995:203-204). This Lowland sub-region includes the Muddy and Virgin River drainages, and houses the western extent of Ancestral Puebloan settlement in the region.

While period dates differ, Ancestral Puebloan occupation follows the temporal sequence of the Pecos Classification (Fairley 1989:106, Lyneis 1995:208), with occupation beginning during the Basketmaker II period (around 300 B.C.) and ending sometime between A.D. 1225 and 1250 (Fairley 1989:140, Lyneis 1995:217) during the early to middle Pueblo III period. Ancestral Puebloan settlement in the Lowland Virgin area is dispersed for the duration of occupation. Inhabitants practiced a mixed economy, in caves and rock shelters. By the onset of the Pueblo I period (A.D. 800 – 1000) pithouses are accompanied by oval storage cists "arranged end-to-end in arcs or curves"

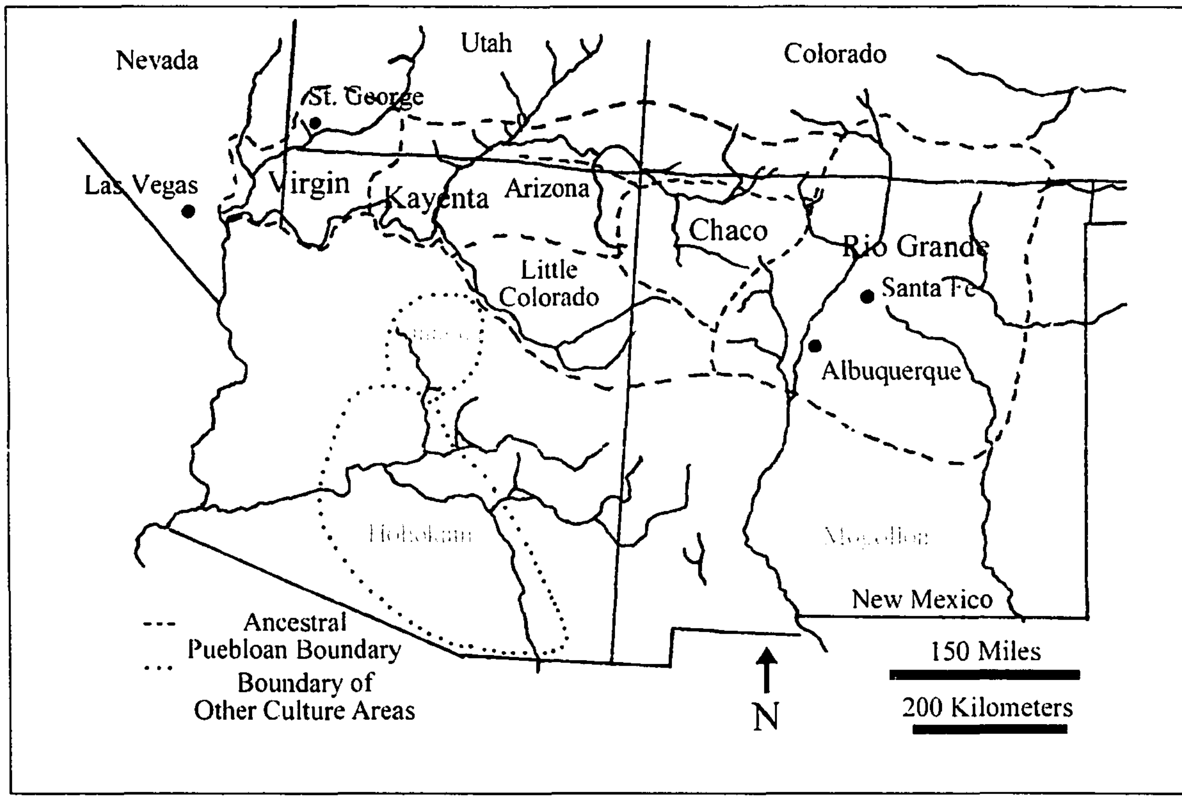

Figure 1: Location of Virgin Anasazi Culture Area (after Lyneis 1995).

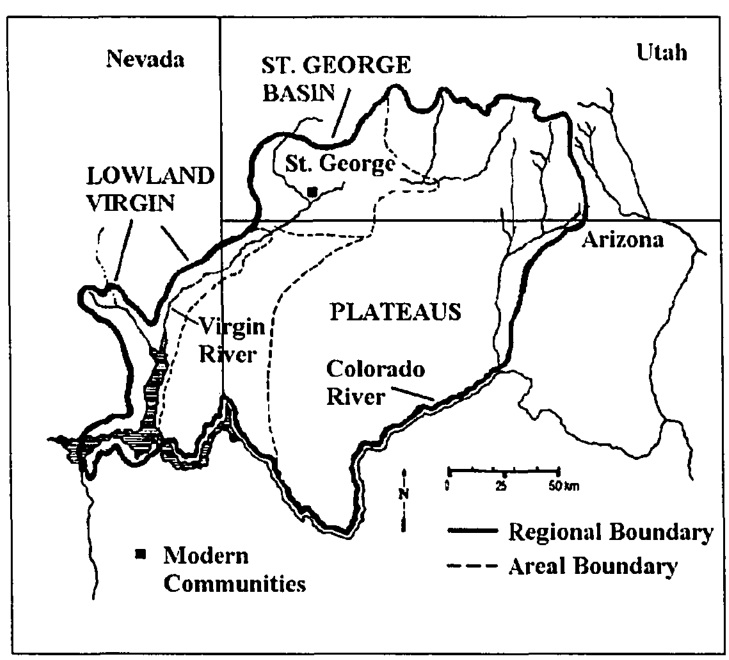

Figure 2: Virgin Anasazi Culture Area with Regional Subdivisions (after Lyneis 1995).

(Lyneis 1995:211). Residential units are accompanied by chipped and ground stone artifacts, and temporally diagnostic pottery types such as Boulder Gray, Logandale Gray, and Washington Black-on-gray are common (Clark 1984:46).

Human populations and exchange peak during the Pueblo II period in the Lowland Virgin area, as evidenced by increases in the number of habitation sites, and the abundance of imported pottery, turquoise, and shell. Lyneis distinguishes between Early (A.D. 1000 – 1050) and Late (A.D. 1050 – 1150) Pueblo II periods in the Lowland Virgin area (Lyneis 1995:213). The Early Pueblo II period is marked by the appearance of St. George Black-on-gray pottery, but Pueblo I architectural and settlement trends continue unchanged (Lyneis 1995:213). The Late Pueblo II transition is characterized by surface adobe habitation rooms "incorporated into a curving alignment of storage rooms that defined and sheltered a courtyard" (Lyneis 1995:213 – 215). Pithouses continue to be part of the architectural repertoire in parts of the area. Diagnostic pottery types found in the Lowlands during this period include North Creek Black-on-gray, and an abundance of corrugated utility wares. Pottery made in the Uplands sub-region such as Moapa Gray and Black-on-gray Wares, and Shivwits Plain constitute between 30 and 48 percent of pottery assemblages at this time (Allison 2000, Lyneis 1995:229), and pottery imported from the San Juan and Kayenta areas such as San Juan Red Ware, Tsegi Orange Ware, and Black Mesa Black-on-white (Lyneis 1992:15) appear in low frequencies.

The Pueblo III period begins around A.D. 1150 in the Lowlands. Late Pueblo II trends continued during the Pueblo III period, but courtyards are almost completely enclosed by habitation and storage units, and the frequency of imported pottery declines. The Lowlands are abandoned by Ancestral Puebloan groups by A.D. 1225 (Lyneis 1995:217).

History of Research in the Lowland Virgin Area

The aim of archaeological research in the Lowland Virgin area prior to the 1960s was the identification of the pueblo world's western extent, and the salvage of archaeological materials that would be inundated by Lake Mead. European settlers and explorers in the region report evidence for prehistoric salt mines, ruins, and irrigation canals as early as 1827, and the region was visited by archaeologists such as A. V. Kidder, H. P. Mera, and N. C. Nelson between 1900 and 1920 (Shutler 1961:1).

M. R. Harrington initiated excavations at the Main Ridge site (26Ck 2148) near the mouth of the Virgin River in 1925 with assistance from the Museum of the American Indian Heye Foundation of New York. In 1929, Hayden (1930) published the results of excavations at Mesa House, a site west of Sand Bench, and a survey of the lower Moapa Valley, both of which were supported by the Southwest Museum and overseen by Harrington (Shutler 1961:1). Between 1928 and 1935 Harrington directed members of the Civilian Conservation Corps (CCC) in salvage excavations at sites that would be destroyed as Lake Mead filled (McClellan et al. 1980: 32, Shutler 1961:1-2). Fay Perkins and Willis Evans assumed direction of the CCC excavations in the lower Moapa Valley from 1933 until 1939 (McClellan et al. 1980:34). In 1961 R. Shutler (1961), relying primarily on Harrington's field notes, produced the first synthesis of Ancestral Puebloan occupation of the Virgin region (Fowler et al. 1973:5, McClellan et al. 1980:33).

Since the 1960s, the National Park Service has conducted numerous archaeological inventory surveys around the perimeter of Lake Mead. Research-oriented work in the lower Moapa Valley during this period is largely associated with the University of Nevada, Las Vegas, and confined mainly to areas of high site density that remain exposed

after the filling of Lake Mead. These are the Sand Bench area (also known as Anasazi Bench) between Overton and Logandale, Nevada, and Main Ridge above the confluence of the Virgin and Muddy rivers.

Most researchers during the 1960s and 1970s sought to delineate the chronological development of settlement in the Lowland Virgin area. Throughout the 1960s and 1970s R. H. Brooks of the University of Nevada, Las Vegas (Olson 1978:20) conducted exploratory excavations with field classes in the Sand Bench area. The Lost City Field School, directed by C. N. Warren and R. H. Crabtree of the University of Nevada, Las Vegas, in cooperation with R. F. Perkins, director of the Lost City Museum, conducted field schools in this same vicinity between 1970 and 1977 (Clark 1984:43, Olson 1978:21). This resulted in the excavation and documentation of numerous sites, including the Steve Perkins site and Pueblo Point. In 1973 a complete survey of Sand Bench, along with some limited test excavations, was conducted by Larry Alexander (1973:11), who produced a tentative chronology for the Sand Bench area and first documented the Yamashita sites.

During the 1980s and 1990s, studies in the Lowland Virgin area reflected new developments in archaeological research issues. Excavations continued during this time at sites such as Bovine Bluff, Adam 2 (26Ck 2059), the Main Ridge site, and the Yamashita sites under the direction of M. M. Lyneis of the University of Nevada, Las Vegas. Publications summarized settlement (Clark 1984, Lyneis 1995) and subsistence in the lower Moapa Valley, and contributed to the delineation of the regional chronology (Lyneis 1995). Existing pottery typologies in the area were refined, and a new pottery ware, Shivwits Plain, identified (Lyneis 1992:31).

Researchers also proposed explanations for regional abandonment. Larson and Michaelsen (1990) argued that Ancestral Puebloan populations in the Virgin Lowland area experienced two episodes of drought, one between A.D. 1000 and 1015, and another between A. D. 1120 and 1150 following a period of population growth and agricultural intensification. They argued that the balance of population density, resource availability, and climate change was so disrupted by the later drought period that populations were forced to abandon the Moapa and Virgin valleys. Other abandonment scenarios for the region included migration to the Kayenta area, and absorption into Paiute populations or displacement by them (Lyneis 1995:232-233).

The sociopolitical structure of Ancestral Puebloan populations in the Virgin region is also debated by researchers. Rafferty argues that a "chiefdom" level sociopolitical economic organization existed for Virgin populations based on the presence of kiva-like structures, "burial site analysis, examination of the presence/absence of exotic trade goods, proximity to rare resource zones, and other factors" (Rafferty 1989:571). Lyneis contends that Rafferty misinterprets the data, and argues that there is no evidence for community structures such as kivas in the lower Moapa Valley, and that there is no evidence of differential status in burial populations in the Moapa Valley (1989:568).

Prehistoric Pottery in the Lowland Virgin Area

The pottery making tradition of Ancestral Puebloan groups in the Lowland Virgin area resembles that found in the neighboring Kayenta area in terms of technique and design style. A full suite of decorated and undecorated culinary, serving, and storage vessels was produced.

Pottery appears in the Virgin region during the Basketmaker III period and persists until abandonment in the early Pueblo III period.

Pottery Classification in the Virgin Region

Early researchers in southern Utah followed a system of binomial nomenclature formulated at the Pecos Conference and at Gila Pueblo (Gladwin and Gladwin 1930) when naming and describing pottery in the Virgin culture area (Spencer 1934, Steward 1941). In 1952, H. S. Colton published a formal classification of Virgin pottery types based on samples from the Arizona Strip, or Uplands area, and from the St. George Basin (Colton 1952). Using a modified version of the classification system devised by Colton and Hargrave (1937:19-22), Colton organizes Virgin pottery into wares and types. This system is designed to identify ceramic traditions that correspond to prehistoric culture groups in the American Southwest, and is based on the assumption that similarities in pottery construction technique and design are culturally transmitted (Colton 1952:2, 1953).

Colton defines a pottery *ware* as a "group of pottery types which consistently show the same methods of manufacture" (Colton 1953:51). This definition includes similarities in clay and temper types used, paint constituents, firing atmosphere, construction methods, and surface treatments (Colton 1952).

Colton's pottery *type* is defined as a "group of pottery vessels which are alike in every important characteristic except form" (Colton 1953:51, Colton and Hargrave 1937:2). The classification of pottery types is based mainly on differences in design style, and so reflects more rapidly changing and temporally sensitive aspects of pottery production (Colton 1952:2).

Colton does not consider vessel form a defining quality of pottery types because stylistic categories crosscut vessel form in the North American Southwest.

Finally, Colton defines a pottery *series* as a sequence of pottery types within a ware that occur consecutively through time within a specific geographic area (Colton 1953:52). In the Virgin area, Colton identifies a Virgin Series of Tusayan Gray and Black-on-gray Wares, which parallels a Kayenta Series of the same ware to the east in its stylistic developmental sequence. Whether changes in design style in the Virgin region truly parallel those in the Kayenta region has yet to be formally evaluated (Allison 2000).

Intrusive Pueblo II Pottery in the Lower Moapa Valley

In the lower Moapa Valley, locally manufactured pottery is accompanied by intrusive pottery made outside the Virgin area, and that manufactured in the Uplands sub-region. Extra-regional exchange with other Ancestral Puebloan groups to the east is demonstrated by the presence of pottery types such as San Juan Red Ware, made in southeastern Utah, and Tsegi Orange and Black Mesa Black-on-white, made in the Kayenta area of Arizona. These extra-regional intrusive wares form approximately 2% of the Pueblo II pottery included in Lyneis' Main Ridge analysis (Lyneis 1992).

The presence of Moapa Gray Ware, and Shivwits Plain Ware demonstrate the existence of intra-regional socioeconomic relationships between Uplands populations, and Lowland and St. George Basin populations. Moapa Gray Ware, identifiable its olivine temper and made near Mt. Trumbull on the Plateaus, is abundant in the lower Moapa and Virgin Valleys from Basketmaker III to the Late Pueblo II period (Larson and Michaelsen 1990, Figure 2; Lyneis 1995:229; Shutler 1961:14). During the early Late

Pueblo II period, Moapa Wares combined with Shivwits Plain, also made in the uplands, comprise 38% of the pottery at Main Ridge (Lyneis 1992b:44-46, Table 15; 1995:229-230).

Petrographic and X-Ray diffraction analyses demonstrate that the olivine-tempered Moapa Gray Ware is manufactured on the Colorado Plateaus, roughly 70 miles east of the Moapa Valley (Lyneis 1986:4, 1988, 1992). In this study, Lyneis' petrographic analysis of Moapa Gray Ware sherds reveals that the olivine found in this pottery is angular (Lyneis 1986:10), and "often comprised of several crystals, supporting the contention that crushed xenolith is the tempering material" (Lyneis 1988:2), and eliminating weathered olivine deposits in the Lowland Virgin area as temper sources for Moapa Gray Ware (Lyneis 1988:4). Lyneis' argument is further supported by an X-ray diffraction study of olivine conducted by Weide (1978), who finds that magnesium in olivine-tempered sherds from the Moapa Valley is chemically similar to that found in olivine deposits near Mt. Trumbull on the Plateaus (Lyneis 1988).

Another intrusive ware produced on the Plateaus and found in the Moapa Valley during the Pueblo II period is Shivwits Plain, first described by Lyneis during her evaluation of pottery at Main Ridge (Lyneis 1992:44-46, 71). Shivwits Plain is distinguished from local ceramic types by its high-iron containing residual clay, and mixed crushed olivine and sherd temper (Lyneis 1988:4, 6). Lyneis states that "dark clays are not found in the Moapa Valley, indicating an external origin" (1988:6) for Shivwits Plain, and suggests that the temper source for Shivwits Plain is crushed Moapa Gray Ware pottery (Lyneis 1992:71).

A more recent analysis of Ancestral Puebloan pottery in the Virgin area is provided by Allison (2000), who focuses on identifying socioeconomic relationships between Lowland

and Upland occupants through pottery ware distribution patterns, and refired clay color. Allison explores the importance of "local versus distant production" of pottery in the Lowland and Upland regions, and examines the "degree to which exchange favored decorated or utilitarian ceramics" (Allison 2000:97). His research is accomplished through examination of pottery frequencies from surface collections made at sites in the lower Moapa Valley in the Lowlands, and near Mt. Trumbull in the Uplands.

Allison finds that relative frequencies of Moapa Gray Ware and Shivwits Plain are highly variable between sites during the middle and late Pueblo II period, conflating attempts to evaluate the importance of local versus distant ceramic production for Moapa Valley residents (Allison 2000:105). Combined, these two types total roughly 30% of the imported pottery in the Moapa Valley during the middle to late Pueblo II period (Alison 2000:133), a figure consistent with Lyneis' findings at the Main Ridge site. Allison estimates that middle Pueblo II pottery imports to sites in the Muddy River Valley averaged 8 to 10 Moapa Gray Ware vessels and 5 to 7 Shivwits Plain vessels per year (Allison 2000:127).

In a comparison of decorated to undecorated sherd ratios in the Muddy River Survey sample, Allison notes that Moapa Gray Ware comprises 10.5% of the painted sherds, and Tusayan Gray and Black-on-gray Ware sherds account for 7.2% of painted sherds during the Pueblo II period (Allison 2000:129). Most sherds are from bowls.

A comparison of decorated and undecorated imported wares (Moapa Gray Ware and Shivwits Plain combined) with locally produced sand-tempered decorated and undecorated Tusayan Wares showed no statistically significant difference between the number of painted and unpainted wares. Allison concludes that "decorated and undecorated vessels were exchanged to the Moapa Valley in proportions comparable to those found in the locally

produced wares. Because all the Shivwits Plain vessels were undecorated, this balance was achieved by importing slightly disproportionate amounts of decorated Moapa Gray Ware" (Allison 2000:132).

Pueblo II Sand-Tempered Decorated Pottery in the Lowland Virgin Area

Lyneis (1995:201) identifies prehistoric pottery production and distribution as one of the many current research issues requiring additional study in the Virgin area. While signature characteristics have been identified for pottery made in other regions and imported into the Lowlands, studies identifying signature characteristics of pottery made in the Lowland area are few. Researchers assume that sand-tempered pottery is made locally in the Moapa Valley, but the nature of sand makes identification of specific sources difficult. Clay sources prove equally elusive, and the few known available clay sources in the valley are described as unsuitable for pottery manufacture (Hayden 1930).

The first study to focus exclusively on identifying variability in sand-tempered pottery in the Lowland Virgin area is provided by Olson (1978), whose attribute analysis of sand-tempered pottery at seven Ancestral Puebloan sites on Sand Bench is designed to refine Colton's pottery typology, and to improve existing chronologies in the Moapa Valley (Olson 1978:1). Olson analyzed 5536 potsherds recovered from the surface of five sites documented during the Muddy River survey and from stratified deposits at the Steve Perkins and Pueblo Point sites (Olson 1978:17). Only 25 of the sherds in Olson's sample are painted (Olson 1978:62-63), and these sherds are combined with plain sherds in her analysis.

Attributes recorded by Olson pertinent to the study of standardization in pottery manufacture and identification of the variability in decorated Tusayan Gray Ware characteristics include exterior pottery color; pottery core color; temper type, size, quantity, and shape; method of firing (oxidizing or reducing firing atmosphere); and presence or absence of fugitive red paint. Olson finds that exterior pottery surfaces are light gray to gray, and core colors are mostly medium gray, light gray, and white (Olson 1978:53). According to this study, pottery paste color becomes darker through time, and quartz temper becomes more common through time as the frequency of olivine temper declines (Olson 1987:81-82).

Another study of sand-tempered pottery is provided by K. Myrher, who hypothesizes that "sherds from storage vessels should exhibit poorly sorted temper, and sherds from food consumption vessels should exhibit finely sorted temper" at the Steve Perkins Site in the lower Moapa Valley (Myrher 1989:45). Myhrer analyzes 26,932 potsherds, and discusses not only vessel form and temper sorting, but also attributes such as temper type, painted decoration, frequency of fugitive red wash, presence of corrugation, rim orifice diameter, and worked or drilled sherds (Myrher 1989:42).

Myrher identifies three sand classes based on temper size and sorting, and compares the frequencies of these classes in corrugated vessels, assumed to be used for both storage and cooking, against decorated vessels that are assumed to function as serving vessels. "Sand1 class is composed of angular, poorly-sorted, large and small grains of quartz/sand along with varying percentages from 10 to 60 percent of tan, black and other colored fragments. Sand2 is better sorted than Sand1 but still exhibits a degree of variety from roundedness to angularity and holds a mixture of quartz/sand and other minerals. Sand3

shows well-rounded, well-sorted quartz grains only, usually in a pristine-like white core color" (Myhrer 1989:45). Myrher concludes the largest range of grain sizes and poorest sorting occurs in corrugated sherds – or storage vessels. He also finds that the 17 decorated sherds included in his analysis "show well-sorted grains that are the smallest and finest in size range" (Myhrer 1989:45). All decorated sherds fall into Myrher's Sand3 class, and the maximum temper grain size ranged from 0.5 mm to 1.5 mm (Myrher 1989:46, Table 3).

One of the few researchers to actively address pottery production in the lower Moapa Valley is M. M. Lyneis. Lyneis specifies the identification of "characteristics of temper that may distinguish locally produced sand-tempered gray ware" (Lyneis 1992:41) pottery as a primary goal of her Main Ridge pottery analysis. She distinguishes between "quartz sand" and "mixed sand" temper classes at Main Ridge, attempts to identify the mineralogical constituents of each, and then identifies geologic formations in the Lowland Virgin area that may supply these sands.

Lyneis' "quartz sand" class consists of "greater than 60% clear to white quartz", that is sub-angular to well-rounded (Lyneis 1992:42). Where quartz sand composes less than 60% of the temper and is combined with "angular quartz and feldspar grains associated with grains of dark accessory minerals" (Lyneis 1992:42), sherds are classified as "mixed sand". Lyneis notes that some mixed sand sherds have gneiss derived from granitic or metamorphic lithology (Lyneis 1992). She characterizes the constituents of mixed sand as highly variable in general, and lists potential constituents as "rounded to well-rounded quartz grains", feldspars, sandstone, occasional limestone, and "microquartz or chert" (Lyneis 1992:43).

Lyneis suggests that rounded quartz constituents originate "in the Aztec and Navajo sandstones of the region" (Lyneis 1992:43). Sandstone and limestone tempers may share a similar sedimentary origin. Feldspars are derived from volcanic and metamorphic materials. Sedimentary and volcanic parent materials are abundant in the area, and "mixed sand" with these components is most likely available throughout the Lowland Virgin area (Lyneis 1992).

A more specific origin is proposed for mixed sand containing gneiss. Gneiss is derived from metamorphic parent materials that are absent in the Moapa Valley. Gneiss deposits do occur on the west flank of the Virgin Mountains, which form the east side of the Virgin River valley, from the Utah-Arizona border to an area near the Virgin-Muddy river confluence. Lyneis asserts that gneiss-containing metamorphics wash into the Virgin River in abundance (Lyneis 1992:42), and concludes that "when the mixed sand includes gneiss detritus, we can exclude the Moapa Valley upstream of Main Ridge as the material source" (Lyneis 1992:43). She further states that "coarse, moderately sorted sands of mixed lithology point to the use of sand lenses as temper sources for the production of plain gray pottery in the area" (Lyneis 1992:43). These sands occur within lenses of Pleistocene gravel terraces found in both the Muddy and Virgin River valleys, and may also have existed in wash areas at the mouth of the Colorado, Virgin, and Muddy river drainages (Lyneis 1992:43).

Lyneis argues that the variety of mixed sand temper in plain wares at Main Ridge indicates that numerous temper sources were in use by a multitude of prehistoric potters in the Moapa Valley, and that pottery production, as reflected by plain ware vessels at Main Ridge, occurred locally. She further states that "variation of mixed sand tempers in

plain gray pottery at Main Ridge, particularly the sands that include gneiss, suggest that substantial exchange of plain ware between communities in the Moapa and Lower Virgin valleys may have contributed to the variety of pottery present at this site" (Lyneis 1992:43).

Studies of temper used in black-on-gray pottery are far less comprehensive than those addressing plain ware in the lower Moapa Valley, but patterns in temper types and the color of black-on-gray pottery are recognized. At Adam 2, a habitation and storage site occupied during the Late Pueblo II or early Pueblo III period (Lyneis et al. 1989:1), Lyneis again attempts to characterize pottery temper. Most pottery at Adam 2 is sand tempered (95 percent by count and 92.4 percent by weight), and decorated sherds are classified as North Creek Black-on-gray (Lyneis et al. 1989:20). Like the pottery at Main Ridge, sand temper at Adam 2 is of "mixed lithology", with painted bowls most often tempered with "clear to white quartz grains, sub-angular to well-rounded, up to 1.0 mm dia" (Lyneis et al. 1989:26).

In a bivariate analysis evaluating paste qualities (Lyneis et al. 1989:38) at Adam 2, Lyneis finds that "sherds tempered with fine, clear to white well rounded quartz tended to be the whitest in paste color" (Lyneis et al. 1989:38). When compared to type descriptions provided by Colton, Lyneis finds a number of differences between North Creek Black-on-gray pottery made at Adam 2 in the lower Moapa Valley, and descriptions of the same pottery type in the Uplands and St. George Basin. First, Adam 2 sherds are white, often throughout, with an occasional light gray carbon streak (Lyneis et al. 1989:38). This differs slightly from Colton's characterization, which describes this type as "gray", "cream", or "light tan" with a gray core (Colton, 1952). Lyneis surmises

that, in contrast to Pueblo II pottery found elsewhere in the Virgin area, Moapa Valley residents used clay with low iron content, and had good control over firing atmosphere (Adam 2 specifically). Secondly, Colton describes North Creek Black-on-gray temper as medium sized quartz sand with angular fragments (Colton 1952), where Adam 2 temper is white rounded clean quartz (Lyneis et al. 1989). Lyneis attributes this to the fact that Colton's type sherds were retrieved form the middle Virgin Valley, which has different lithology than the lower Moapa Valley (Lyneis et al. 1989:41).

Lyneis suggests, based on a comparison of black-on-gray pottery from Main Ridge and Adam 2, that Moapa Valley potters became more selective in their choice of temper through time. This is apparent when Tusayan Gray and White ware pottery from the Adam 2 site and Main Ridge are compared. The clay color of painted pottery at Adam 2 is lighter than that at Main Ridge, and the red staining found on quartz sand temper at Main Ridge occurs less frequently at Adam 2 (Lyneis 1992:41, Lyneis et al. 1989). Based on the analysis of painted and undecorated vessels at these sites, Lyneis suggests that "a different clay body was prepared for making black-on-gray vessels than for producing unpainted ones" (Lyneis 1992:41).

A subsequent study conducted by Laureen Perry examines the relationship between temper characteristics such as type, size, angularity, and sorting; and vessel form as it relates to function at the Yamashita-2 and Yamashita-3 sites on Sand Bench in the lower Moapa Valley. This study addresses both plain and painted pottery at this site. While the focus of Perry's analysis is pottery function, her analysis identifies specific temper characteristics relevant to the issue of pottery production. Through petrographic analysis, Perry identifies six classes of temper found in Moapa Valley sherds. Three of these

classes, "quartz sand", "mixed sand", and "quartz/feldspar" are found in decorated Tusayan Gray Ware pottery (Perry 1998:62). The descriptions of these temper classes are similar to those detected by Lyneis at Main Ridge, and consist of various quantities of quartz sand, mixed sand with feldspars and dark accessory minerals, and varying amounts of mica. Perry's analysis of black-on-gray rim sherds identified 127 with quartz temper, 18 with mixed sand, and none with quartz/feldspar temper (Perry 1998:75, Table 5).

The Yamashita-3 Site

Yamashita-3 (26Ck 6446) is a Virgin Anasazi habitation and storage site on Sand Bench, a Pleistocene gravel terrace covered with 50-60 cm of red aeolian sand in the lower Moapa Valley (Figure 3). The site is one of eight found on the privately owned Yamashita property above the Muddy River channel, and lies about 10 m north of the Yamashita-2 site (Perry 1998:36).

The Yamashita-3 site was first identified, though not formally recorded, by Larry Alexander in 1973. The eight sites on the Yamashita property were relocated and recorded by M. Lyneis in 1989. Site boundaries were defined based on "artifact concentrations and evidence of adobe structures" (Perry 1998:30). Excavations were conducted at the Yamashita-3 site by an archaeological field class and volunteers under the direction of M. M. Lyneis between 1989 and 1994, during which time areas of the site disturbed by vandalism were excavated.

Yamashita-3 consists of two surface habitation rooms that are connected by an arc of storage rooms (Perry 1989:33), and separated by less than 20 m (Figure 4). Both habitation

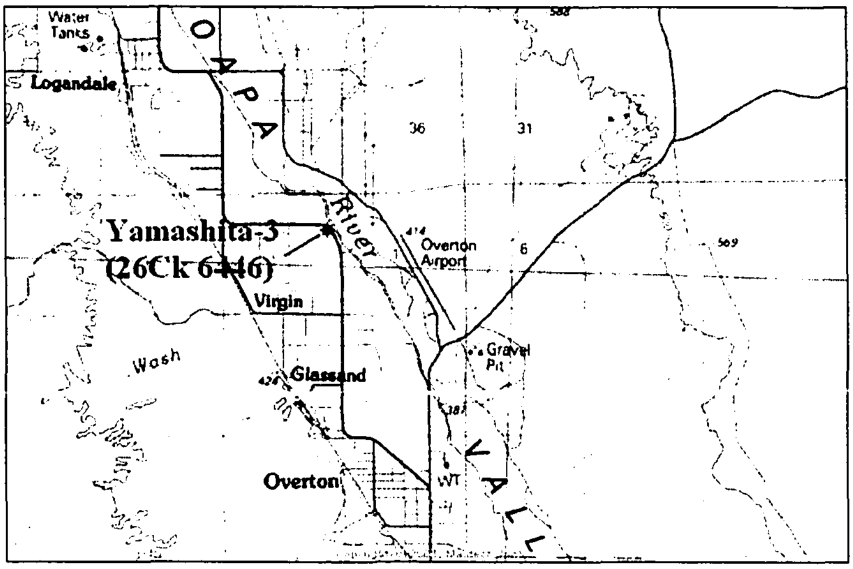

Figure 3: Location of Yamashita-3 Site (26Ck 6446). Map scale 1:100,000.

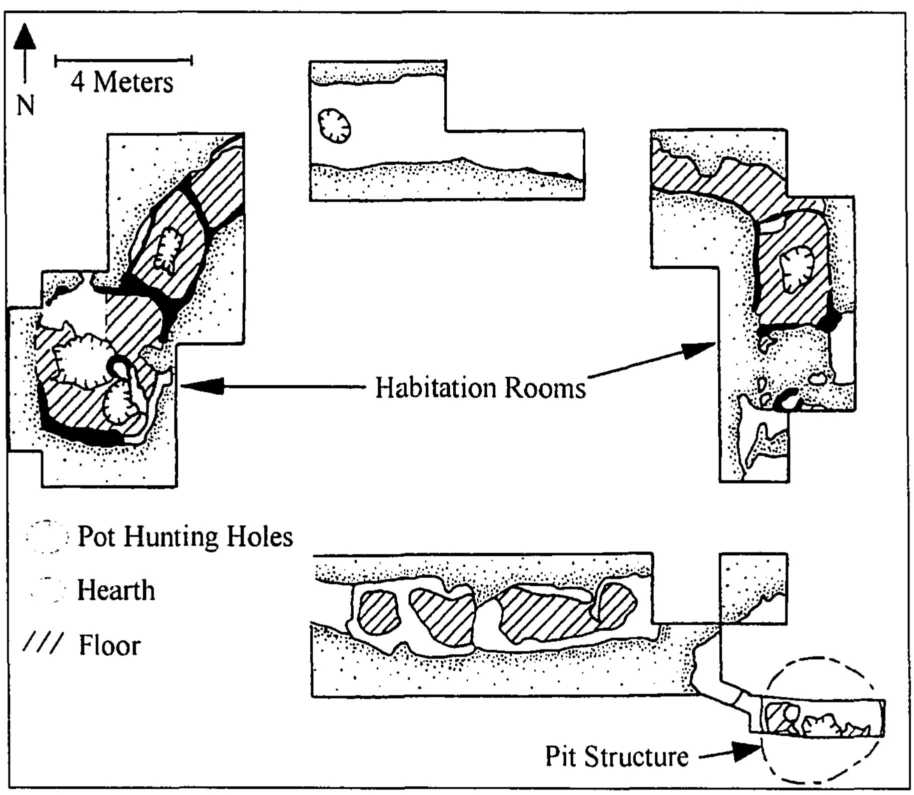

Figure 4: Map of Yamashita-3 Site (26Ck 6446) Showing Areas Exposed by Excavations Between 1989 and 1994 (Map modified from Perry 1989:35).

rooms are of adobe, and have interior, clay-rimmed hearths. Cobbles line two walls of one storeroom that separates the two habitation rooms (Perry 1998:37). A linear arrangement of storage rooms and a pithouse are south of the arced unit. Looting and weathering have impacted the condition of the site. A Pueblo II occupation is indicated by the presence of corrugated pottery, North Creek Black-on-gray pottery, and three radiocarbon dates. Uncalibrated radiocarbon dates are 1040 +/- 70 B.P. (Beta-71293; wood charcoal; isotope 13C value = -25.0) from charcoal in a hearth feature on the floor of a storage room (2 sigma calibrated range of A.D. 880 – 1170) (Radiocarbon date provided by Susan Edwards), 990 +/- 60 B.P. (Beta-162561; Charcoal; isotope 13C value = -25.0) from burned material on the floor of the east habitation room (2 sigma calibrated range of 960 to 1180 A.D.), and 1000 +/- 60 B.P. (Beta-162562; Charcoal; isotope 13C value = -25.0) from a charcoal sample retrieved from the west habitation room (2 sigma calibrated range of 1180 A.D., and 910 – 920 A.D.)

A high-density artifact deposit is associated with Yamashita-3, and concentrated in the courtyard area. Over 9,500 potsherds were recovered from the site, including gray ware, brown ware, decorated black-on-gray sherds, and red ware. Chipped stone artifacts include drills, knives, bifaces, choppers, cores, projectile points, and debitage, and number 11,163. One hundred seventeen groundstone items were recovered from the site. Other items at Yamashita-3 include bone, beads, shell, ground balls, ornaments, turquoise, and ocher and charcoal samples.

CHAPTER 3

PROBLEM STATEMENT AND SIGNIFICANCE OF RESEARCH

In the Virgin Lowland area, arguments about Ancestral Puebloan socioeconomic organization during the Pueblo II period are commonly nested in the assumption that sand-tempered decorated pottery, or Tusayan Gray Ware, Virgin Series, was made by local populations. Armed with this assumption, and with solid knowledge of pottery imported from the Uplands region, researchers argue that Lowland Virgin area populations participated in a system of decentralized, kinship-based exchange within the region (Allison 2000:26), and alternatively suggested that Main Ridge played a "centralizing role" in distributing imported if not locally-made pottery (Lyneis 1992:43). These arguments are weakened by ambiguities in the definition of decorated Tusayan Gray Ware pottery in the Lowlands, the lack of information about Tusayan Gray Ware production, and a poor understanding of the scale of pottery production in general.

Researchers note that qualities of sand-tempered black-on-gray pottery in the Lowlands diverge from Colton's type descriptions (Olson 1978), differing slightly in color and temper characteristics (Lyneis et al. 1989:38). Colton's descriptions are based on pottery from the St. George Basin and Arizona Strip, and apparent differences between Colton's descriptions and the sand-tempered pottery found in the Lowlands suggests that Tusayan Gray Ware in the Lowland area was manufactured in a location distinct from that of pottery made in other regions (Lyneis 1992).

While results vary, subsequent study of sand-tempered black-on-gray pottery in the Lowlands identifies characteristics that exhibit a degree of uniformity suggestive of low-level specialized production, especially when compared with undecorated pottery. This implies that certain potters were producing sand-tempered black-on-gray pottery in quantities that exceeded the needs of the individual household (Stark 1992:184), and supplying other households in the region with this pottery. Evaluation of characteristics indicative of source materials suggests that standardization in manufacture occurred in the Lowlands. Refired clay color at the Main Ridge Site shows that different clay bodies were prepared for plain and decorated Tusayan Gray Ware pottery (Lyneis 1992:41), suggesting that specific clays were intentionally selected for the manufacture of these different pottery types. Temper in black-on-gray sherds is described as consisting almost entirely of clear quartz sand, where temper found in undecorated vessels is described as "highly variable" mixed sand. Lyneis (1992, Lyneis et al. 1989) suggests that temper in decorated pottery becomes "cleaner" through time, and pottery color becomes lighter and more consistently colored throughout the core, indicating better control over firing atmosphere, and perhaps a refinement in the selection of clays and tempers through time. At the Adam 2 site, she argues that this refinement in production may be the result of individual or community craft specialization (Lyneis et al. 1989:75).

Stylistic variables also appear to be relatively homogeneous in Virgin Lowland decorated pottery. Examination of rim and vessel wall thickness, orifice diameter, rim length, and rim line width in Tusayan Gray Ware bowls from the Muddy River Survey found greater uniformity in these sherds than in Moapa Gray Ware in both the Lowland and Upland regions (Allison 2000:153-158). Variability is also low in decorated gray

ware bowl lip forms in the Virgin Lowlands. Fifty-one percent of decorated gray ware bowls at the Adam 2 site were characterized as having a "wiped bevel" lip form (Lyneis et al. 1989:36, Table 23), and over 77 percent of decorated gray ware bowl lip forms at the Main Ridge Site were divided evenly between form 4, "flat", and form 6, "beveled down into the interior" (Lyneis 1992:5, Table 25). Finally, in contrast to undecorated Tusayan Gray Ware pottery in the Lowlands, which occurs in an array of jar and bowl forms, decorated gray ware vessels are comprised almost entirely of bowl forms.

Research Goals

These studies show that a degree of standardization, or "reduced variation in attributes of composition, form, and style" (Rice 1987:482), may exist in certain Lowland Virgin area Tusayan Gray Ware pottery traits. It is also apparent that the full range of variation in this pottery has yet to be fully explored. The goal of the current research is to characterize variability in sand-tempered black-on-gray pottery found in the Lowland Virgin area during the Pueblo II period of prehistory by examining pottery attributes indicative of standardization in manufacture. Attributes included in this study reflect choices in pottery source materials, and stylistic decisions made by potters relative to vessel form and decoration. Clay color and texture, and temper characteristics are examined to determine the potential number of pottery source materials used by prehistoric potters. The occurrence of a dark core reflects both the clay source and the firing atmosphere used. Finally, vessel form, rim form, design elements, and the occurrence of fugitive red paint are included in this analysis as traits that may reflect stylistic choices made by individual potters.

Significance of Research

Characterizing the variation in sand-tempered decorated pottery will contribute to the refinement of Tusayan Gray Ware pottery type definitions in the Lowlands, aid future researchers in the identifying clay and temper source materials used to manufacture decorated pottery, facilitate the identification of the scale of pottery production in the Lowland Virgin area, and ultimately contribute to the understanding of the production and distribution of ceramic artifacts, and underlying socioeconomic relationships.

The Study Population

The current research examines 310 sand-tempered, black-on-gray painted potsherds from the Yamashita-3 site in southern Nevada's lower Moapa Valley (Figure 3). This is a Virgin Anasazi habitation and storage site on Sand Bench above the Muddy River drainage channel, and is comprised of 2 habitation rooms connected by an arc of storage rooms, an activity area, and an associated pithouse and linear arrangement of storage rooms (Figure 4). A Pueblo II occupation is supported by the presence of corrugated and North Creek Black-on-gray pottery, and three radiocarbon dates with a 2 sigma calibrated range of 910 to 1180 A.D.

Decorated pottery from the Yamashita-3 site is an appropriate test sample because as a Pueblo II period manifestation the Yamashita-3 site represents the height of Virgin Anasazi exchange and population in the Lower Moapa Valley. Yamashita-3 typifies Virgin Anasazi occupation in the lower Moapa Valley during the Pueblo II period, and should contain a representative sample of functional pottery types, including those used for storage, cooking, and serving. The site is the product of a single discrete occupation

during the Pueblo II period, allowing differences in the ceramic attributes under study to be ascribed to different choices in manufacture, and availability of source material rather than to temporal variation. Finally, sand tempered painted pottery is abundant at this site, possesses numerous quantifiable attributes, and is distinguishable from intrusive black-on-white and black-on-gray painted pottery.

CHAPTER 4

METHODOLOGY

Given that the goal of this research is to characterize attributes of decorated Tusayan Gray Ware pottery that may be indicative of standardization in manufacture, the variables included in this analysis are selected specifically because they reflect source materials used in pottery manufacture and stylistic choices made by individual potters.

The analysis of the Yamashita-3 black-on-gray pottery was accomplished in four stages. First, all sand-tempered black-on-gray potsherds were sorted based on basic similarities in clay, temper, paint, and surface finish. Each sherd was then assigned to a specific ware and type using the classification system devised by Colton (1952) for the Virgin area. Sherds were classified either as Tusayan Gray Ware, Virgin Series or Tusayan White Ware, Kayenta Series, and assigned to the appropriate type category where this was possible. In many cases sherds could not be assigned to a specific type because sherd size was small and not enough of a given design element remained on the sherd surface for classification. Classification was aided by type descriptions provided by Colton (1952), and by pottery type collections housed at the Museum of Northern Arizona, and the University of Nevada, Las Vegas Department of Anthropology and Ethnic Studies.

After typological classification, analysis of selected variables was performed on all decorated Tusayan Gray Ware, Virgin Series potsherds. The methods used to evaluate each variable, and the rational for selection of variables are described below.

Clay Color

Clay surface color refers to the surface color of the clay where a darker colored core exists in the sherd cross-section, and to the entire cross section where no core is present. Clay color is influenced by clay composition (primarily iron content), the amount of carbonaceous matter in the clay, and by firing temperature, atmosphere, and duration (Rice 1987:331, Shepard 1961:103). Once all organics are eliminated from clay the primary influences on color are the amount and distribution of the iron in the clay, firing temperature, and clay particle size (Shepard 1961:103, Rice 1987:335). As such clay color can inform about the nature of clay sources available to potters, and provide information related to the firing techniques used by local potters to compensate for differences in available clays. Clay color assessments were made with a Munsell Soil Color Chart on the freshly broken area of the potsherd. Both the Munsell designations (chroma, value, and hue) and the English equivalents were recorded.

Dark Core

Firing atmosphere is often recorded in a sherd cross section as a dark core bounded by lighter clay. A dark core is usually indicative of firing duration, temperature, and atmosphere (Rice 1987:334), and influenced by the coarseness or fineness of the original clay (Rice 1987:335). It is produced by large amounts of organic material in the original clay that were not entirely eliminated during the firing process (Rice 1997:334). Where the core color was darker than the surface color in the sherd cross-section, the color of the core was recorded separately using a Munsell Soil Color Chart.

Quality and Width of Oxidation

The quality and width of an oxidized surface is another indicator of firing atmosphere. Where a dark core was present, the quality of the oxidation surface was recorded subjectively as either *sharp* or *gradual* by looking at the freshly broken surface of the sherd. A single measurement of the interior and exterior oxidized surface of the sherd was measured with a Mututoyo Digital Caliper to the nearest tenth millimeter.

Vitrification

Vitrification refers to the melting of clay particles during the firing process, and results in individual particles adhering to each other (Shepard 1961:83). This increases the density of a clay body, eliminates pores, and reduces mass (Rice 1987: 93-94, Shepard 1961:83). Vitrification tells of the nature of the clay, the firing atmosphere, and of fluxes that may be present.

Vitrification of the clay was recorded as *present* if a glossy or lustrous surface could be observed in a freshly exposed area of the clay paste. If no lustrous surface was observed, vitrification is recorded as *absent*. During analysis vitrification could occasionally be evaluated simply by examining the sherd cross section with the naked eye. More often, evaluation of vitrification required a binocular light microscope with a magnification of 15x.

Temper

For the purposes of this analysis, temper is defined as any non-plastic inclusion in the clay body. Temper may either occur naturally in the clay or be added intentionally to the clay to modify its physical properties (Rice 1987:408). Temper can be derived from organic carbon

or mineral sources (Rice 1987:407), and when added to clay it serves specifically to modify clay plasticity (Rice 1987:74), influence firing behavior and post-fire characteristics, and to reducing shrinkage and prevent cracking during drying and firing (Rice 1987:74:408). Temper can also act as a flux during firing, or alter the thermal resistance or strength of a finished vessel (Rice 1987:74-75).

In this analysis temper was evaluated for the purpose of identifying potential temper sources. Temper variables that serve as geologic source indicators include temper type, roundness, size and sorting, which collectively are indicators of depositional processes and transport.

Temper Type

Temper type observations were made by examining the entire sherd surface and a freshly broken cross section under a binocular light microscope at a magnification of 15x. In some cases this level of magnification was insufficient for determination of temper type and a magnification of 30x was used. Temper was recorded by listing all recognizable inclusions (Appendix 1). Temper materials include *quartz (including clear and white quartz sand), feldspar, coppery mica, garnet, unidentified orange inclusions (possibly sandstone), well-rounded unidentified opaque gray material (possibly a form of quartz), dark accessory minerals (including fine black material and large dark gray or black angular material), or very fine multicolored sand.* Notation was also made of whether temper grains were rust-stained, or whether large chunks of rust were present in the paste.

Temper Roundness

Temper roundness (Figure 5) was evaluated by examining the sherd cross-section under a binocular light microscope at a magnification of 15x, and comparing it to an existing template for grain roundness (Pettijohn et. al. 1972:521, Figure A-2). Temper rounding was recorded as *very angular, angular, sub-angular, sub-rounded, rounded, well rounded,* or *very well rounded.* When multiple temper rounding classes were present in a single sherd the entire range was recorded. For example, many sherds had sub-angular to sub-rounded temper grains.

Temper Sorting

Temper sorting (Figure 6) was recorded by examining the sherd cross-section with a binocular light microscope at a magnification of 15x, and comparing the sherd cross-section against a grain sorting template (Pettijohn et. al. 1972:521, Figure A-2). Temper sorting was documented as *poorly sorted, moderately sorted, or well sorted.*

Temper Size

Temper size was measured to the nearest quarter millimeter by placing a translucent ruler over the freshly broken sherd cross section and examining it under a binocular light microscope with a magnification of 15x. A single measurement was taken for the smallest grain size, and for the largest grain size. In each case, the entire sherd surface and cross section was examined and a single diameter measurement was made for what appeared to be the smallest, and largest grain. Where grains were less than one-quarter millimeter in diameter

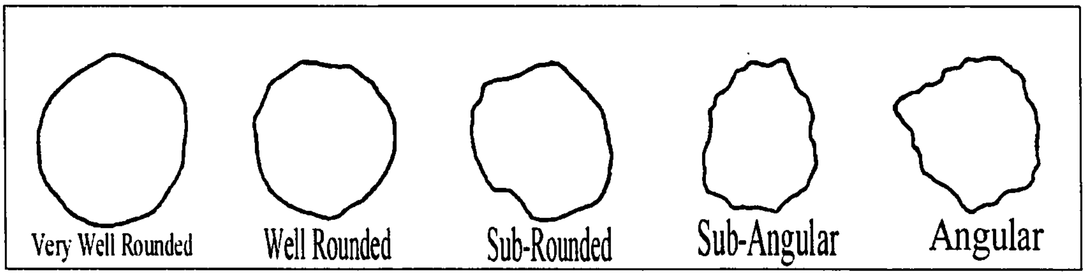

Figure 5: Temper Rounding Categories Used to Classify Sand Grains in Decorated Tusayan Gray Ware Pottery from the Yamashita-3 Site (after Pettijohn et al. 1972:586).

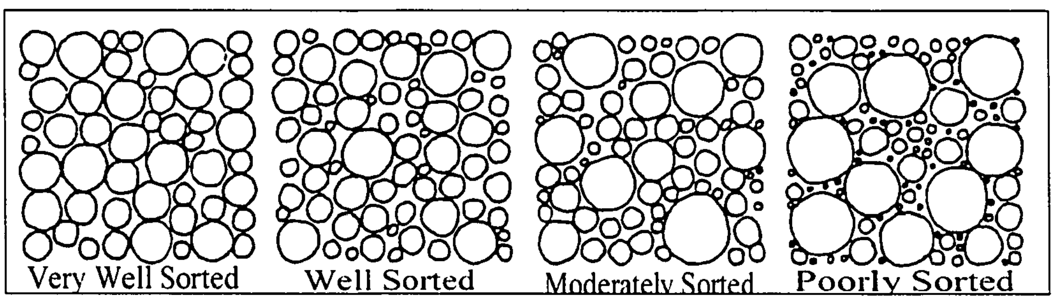

Figure 6: Temper Sorting Categories Used to Classify Sand Grains in Decorated Tusayan Gray Ware Pottery from the Yamashita-3 Site (after Pettijohn et al. 1972:586).

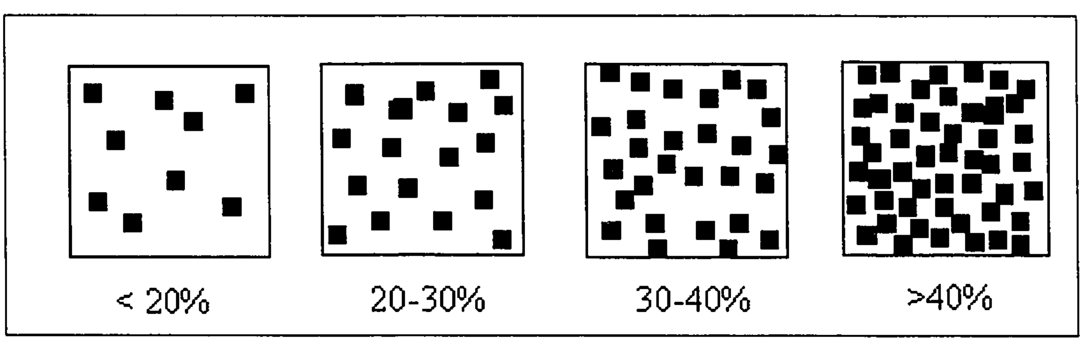

Figure 7: Temper Abundance Categories Used to Classify Sand Grains in Decorated Tusayan Gray Ware Pottery from the Yamashita-3 Site (after Perry 1998:53).

the smallest grain size was recorded as "less than 0.25 mm". Minimum temper classes were recorded as <0.25 mm, and 0.25 mm. Maximum temper size classes were recorded as 0.5 mm, 0.75 mm, 1.0 mm, 1.25 mm, 1.5 mm, 1.75 mm, and 2.0 mm.

Temper Abundance

Temper abundance (Figure 7) does not reflect the geologic origin of materials directly, but it does reflect the properties of the clays used in the region. If clays used to make decorated Tusayan Gray Ware pottery are variable in terms of shrinkage and particle size, then potters might include differing amounts of temper to compensate for variable clay qualities. As such temper abundance reflects specific decisions made by pottery manufacturers. Temper abundance was recorded to determine if correlations exist between abundance and other attributes of temper and clay. Temper abundance was evaluated by comparing the sherd cross-section with a modified version of a template from Perry (1999:35). Temper abundance is recorded as *Less than 20%, 20-30%, 30-40%,* and *Greater than 45%.*

Pigments

Pigments are coloring materials, often mixed with clay, water, and/or a binder, that are applied to the surface of clay as decorative elements (Rice 1987:148). In this analysis, pigment color and quality are recorded as constituents of decorated Tusayan Gray Ware pottery that might reflect standardization in manufacture. During analysis, decorative pigment color and quality used to paint designs on interior vessel surfaces were characterized subjectively. Color was described as *black and opaque*, *gray and translucent,* or a combination of *black and gray* if no single color was dominant and the pigment had a mottled

appearance. Fugitive red pigment is a common, highly erodable pigment applied to the exterior surfaces of decorated Tusayan Gray Ware pottery. Fugitive red is defined by Rice (1987:151) as a "wash" and is distinguished from slips and other pigments by being applied after the firing process. For the purposes of this analysis, *fugitive red* was recorded when present and included in the paint/pigment category as a pigment choice available to potters in the Virgin area.

Vessel and Rim Lip Form

Vessel form was classified as *bowl* or *unidentifiable* based on the curvature of the sherd, the surface finish, and the location of the decorative elements. Lip form was classified using Colton and Hargrave's (1937) Rim Everson and Lip Form chart (Figure 8, Table 1 in Appendix 2). Modifications were made to the existing classification where lip forms diverged from standard forms.

Corrugation and Decorative Elements

The presence of corrugation in the exterior surface of sherds was recorded as a potential indicator of standardization in manufacture, as were the variety of decorative elements on the sherd surface. Corrugation was recorded as *present* or *absent*. Painted decoration was recorded as *solid element*, *zig-zag line*, *wide line*, *narrow line*, *triangle*, *framing line*, or *pendant dot or tick*.

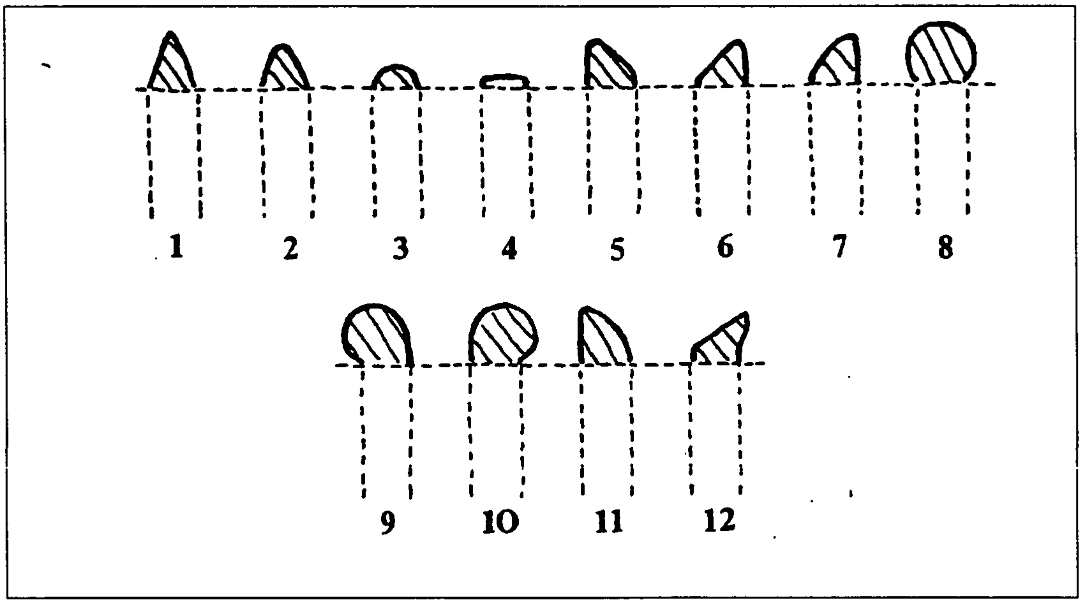

Figure 8: Rim Sherd Lip Forms (after Colton 1952:14).

Refiring and Petrographic Analysis

The final stage of analysis consisted of refiring and petrographic analysis. Refiring is a means of identifying basic compositional similarities or differences in clay (Rice 1987:344, Shepard 1961:103). By refiring a sherd in an oxidizing atmosphere, impurities and carbonaceous material present in the clay that influence clay color are removed. The resulting change in clay color can be attributed to the iron content of the clay rather than to contaminants (Rice 1987:344). Forty-seven sherds from Yamashita-3 were placed in a kiln and fired to a temperature of 950 degrees Celsius. This temperature was maintained for 30 minutes, and then sherds were allowed to cool. The resulting clay color was recorded using a Munsell Soil Color Chart.

Fourteen thin sections of black-on-gray sherds from Yamashita-3 were prepared and examined with a polarizing microscope by the author. Polarizing microscopes enable identification of specific mineral constituents of temper (Rice 1987:372, Shepard 1961).

Petrography is often used to "identify regionally distinctive tempering materials" (Orton et al. 1993:140, Shepard 1961:120, Sinpoli 1991:104), and allows more detailed evaluation of temper qualities such as roundness, abundance, sorting, and size (Rice 1987:279). In this analysis, petrography served mainly to identify potential material constituents of the sand temper used in black-on-gray pottery at Yamashita-3. Slide samples were stained for plagioclase and potassium feldspar to aid the identification of these materials. A qualitative characterization of temper roundness, abundance and sorting was also made using the petrographic microscope.

CHAPTER 5

RESULTS

A total of 355 sand-tempered black-on-gray sherds were recovered from the Yamashita-3 site. Of these, 22 sherds (6.2 percent) are excluded from this analysis because they are too small to assess accurately, and 23 sherds (6.5 percent) are excluded because they appear to be part of the Kayenta Series of Tusayan Gray Ware, and therefore not considered locally made. Analysis of the remaining 310 potsherds identified three classes of sand tempered decorated pottery at the Yamashita-3 site. Classes are defined by subtle differences in clay color and texture, and in temper size range.

Pottery Class 1 contains 246 potsherds (79.4 percent of the sand-tempered decorated pottery sample from Yamashita-3), and consists of sherds with variable clay color that is most commonly white or light gray. Clay texture is silty, with few shrinkage voids and an irregular fracture surface. The majority of temper grains average 1 mm in diameter and are generally no smaller than 0.25 mm in diameter. Pottery Class 2 contains 22 potsherds (7.1 percent of the sample). The clay surface color is generally white. Clay texture is fine-grained and platy with no shrinkage voids. Temper size is similar to that in Pottery Class 1. Pottery Class 3 contains 42 potsherds (13.5 percent of the sample), and is characterized by a very white firing clay, with only a few sherds having a light gray surface color. Sherd surfaces have a chalky, lusterless appearance. Paste texture is

smooth, fine grained, and in cross section fractures in a series of parallel lines that run diagonal to the sherd wall. Petrographic analysis suggests that the size range for temper in Pottery Class 3 is greater than that for Classes 1 and 2, ranging from much less than 0.25 mm to 2.0 mm. Descriptions of the variables included in this analysis are provided for each Pottery Class in the following paragraphs.

Clay Surface and Core Color

Ten color classes (Table 1, Appendix 2) describe the clay surface and core colors of sherds at the Yamashita-3 site prior to refiring. Clay surface colors are variable in general (Figure 9; Table 1, Appendix 3), but most variable for sherds in Pottery Class 1. A white surface color (N = 174, 70.7 percent of the Pottery Class 1 sample) is most common in this class, followed by light gray (N = 48, 19.5 percent of the sample). Other clay surface colors include gray (N = 10, 4.1 percent), pinkish gray (N = 8, 3.3 percent), and light brown (N = 2, 0.8 percent). Brown, dark brown, gray and reddish gray each comprise 0.4 (N = 1 each) percent of the clay surface colors in Pottery Class 1. Only three clay surface colors are represented in Pottery Class 2. In this class, 81.8 percent (N = 18) of the sherds display a white surface color, and light gray and brown surface colors comprise 9.1 percent (N = 2) each of the sample. Pottery Class 3 contains mainly sherds with a white surface color (N = 36, 85.7 percent of the Pottery Class 3 sample). Light gray comprises 7.1 percent (N = 3), and gray, light brown, and pinkish gray comprise 2.4 percent (N = 1) each of the remainder of the sample.

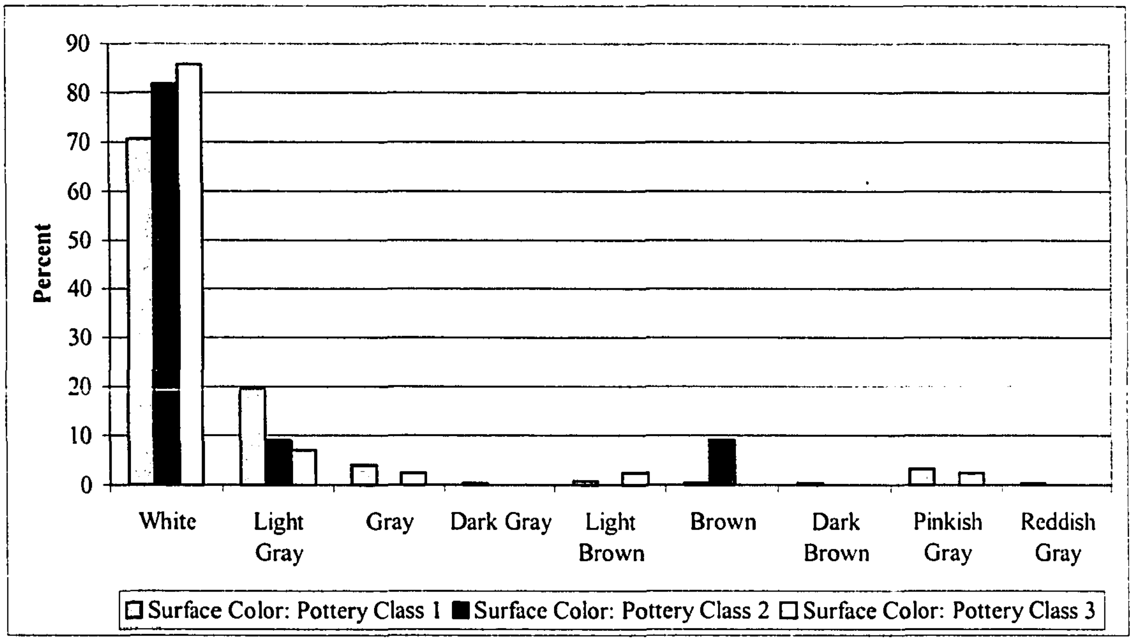

Figure 9: Frequency of Clay Surface Color by Pottery Class.

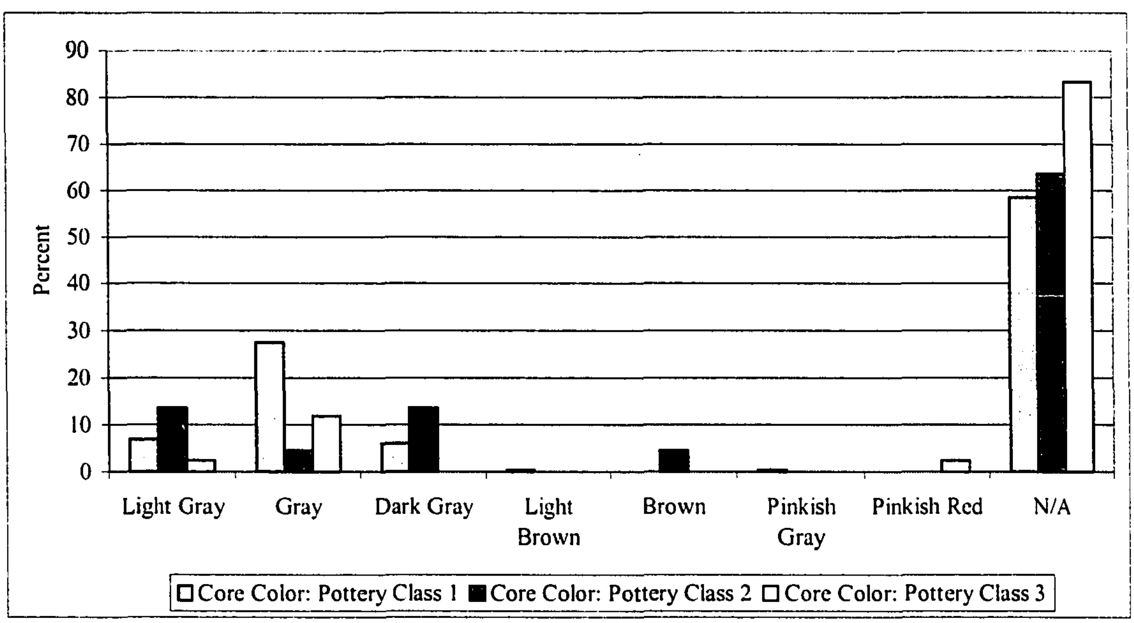

Figure 10: Frequency of Clay Core Color by Pottery Class.

Core Color and Characterization

Sand-tempered decorated potsherds with a dark core color that differs from the clay surface color number 117 (34.74 percent) at the Yamashita-3 site (Figure 10; Table 1, Appendix 3). In Pottery Class 1, 41.5 percent (N = 102) of the sherds have a dark core. Core colors are dominantly gray (N = 68, 66.7 percent of the sample), but light gray (N = 17, 16.7 percent) and dark gray (N = 15, 14.7 percent) are also common. Light brown (N = 1, 0.4 percent) and pinkish gray (N = 1, 0.4 percent) also occur in low frequencies. Thirty six point four percent (N = 8) of the sherds in Pottery Class 2 contain dark cores. The most abundant clay core colors for Pottery Class 2 are light gray and dark gray (N = 3 each, 37.5 percent each), followed by gray and brown (N = 1 each, 12.5 percent each). Dark cores are present in only 16.7 percent (N = 7) of the sherds in Pottery Class 3. The most common core color in this pottery class is gray (N = 5, 11.9 percent of the sample), followed by light gray (N = 1, 2.4 percent).

The transition from the core to the surface color is almost always gradual in all three sand-tempered decorated pottery classes. Width of oxidized surfaces ranges from 0.18 mm to 2.29 mm, with an average of 0.84 mm. Certain irregularities were noted while examining sherds with dark cores, indicating that firing atmospheres fluctuated during the course of firing a given vessel. In 12 sherds, the transition from core to surface color was so gradual that no width measurement can be taken for the oxidized surface. Twenty-four of the 105 sherds having an oxidized exterior surface lack a corresponding oxidized interior surface, and three of the 87 sherds with oxidized interior surfaces are without an exterior oxidation surface.

Temper Type

Petrographic analysis revealed that apparent temper classes identified during analysis with a binocular microscope were not valid. All sherds contained varying amounts of the same material. Temper constituents were usually dominated by quartz (some with shadowy extinction), followed by various feldspars (including plagioclase, twinned feldspar, potassium feldspar, and a few pyroxenes), lesser amounts of weathered muscovites and biotites, and varying amounts of sand or siltstone. A possible crinoid stem was observed in sherd A230-1952 (Petrographic Sample A202-521). The results of the petrographic analysis are summarized in Appendix 4.

Temper Rounding

Pottery was classified as one of three temper roundedness categories (Figure 11; Table 2, Appendix 3). Temper roundedness in all three pottery classes falls predominantly in the rounded category (N = 215, 87.4 percent of the sherds in Pottery Class 1, N = 18, 81.8 percent of the sherds in Pottery Class 2, and N = 24, 57.1 percent of the sherds in Pottery Class 3). Distributions for other roundedness categories are mixed. Very well rounded temper is found in Pottery Class 1 (N = 25, 10.2 percent) and in Pottery Class 2 (N = 2, 9.1 percent), but is absent in Pottery Class 3. Angular temper dominates Pottery Class 3 (N = 18, 42.9 percent), but is found in only 2.4 percent (N = 6) of the sherds in Pottery Class 1, and in 9.1 percent (N = 2) of the sherds in Pottery Class 2.

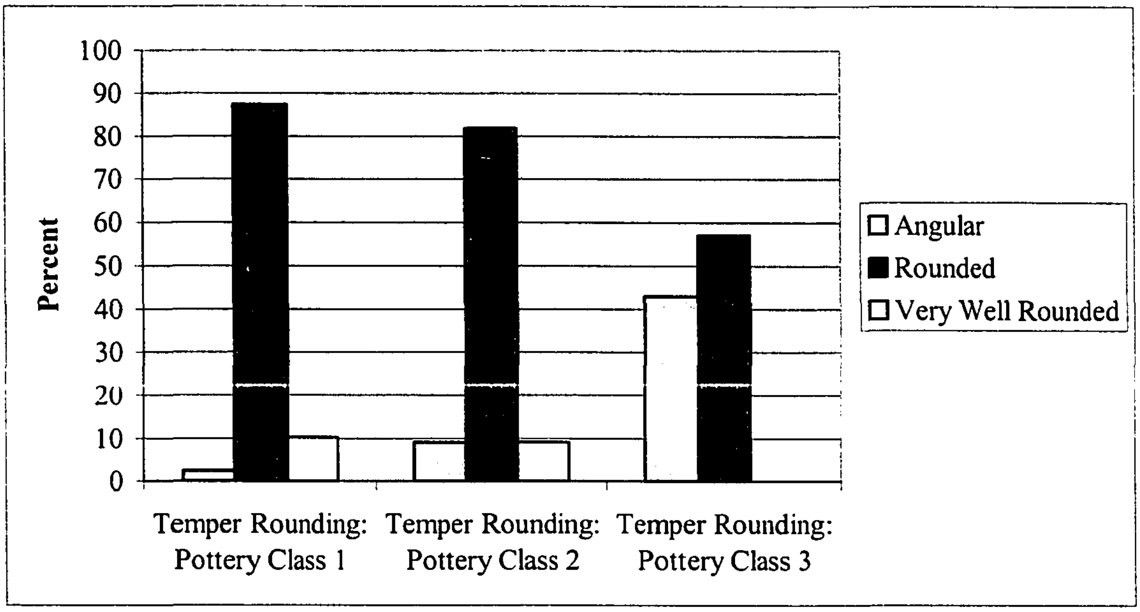

Figure 11: Frequency of Temper Rounding by Pottery Class.

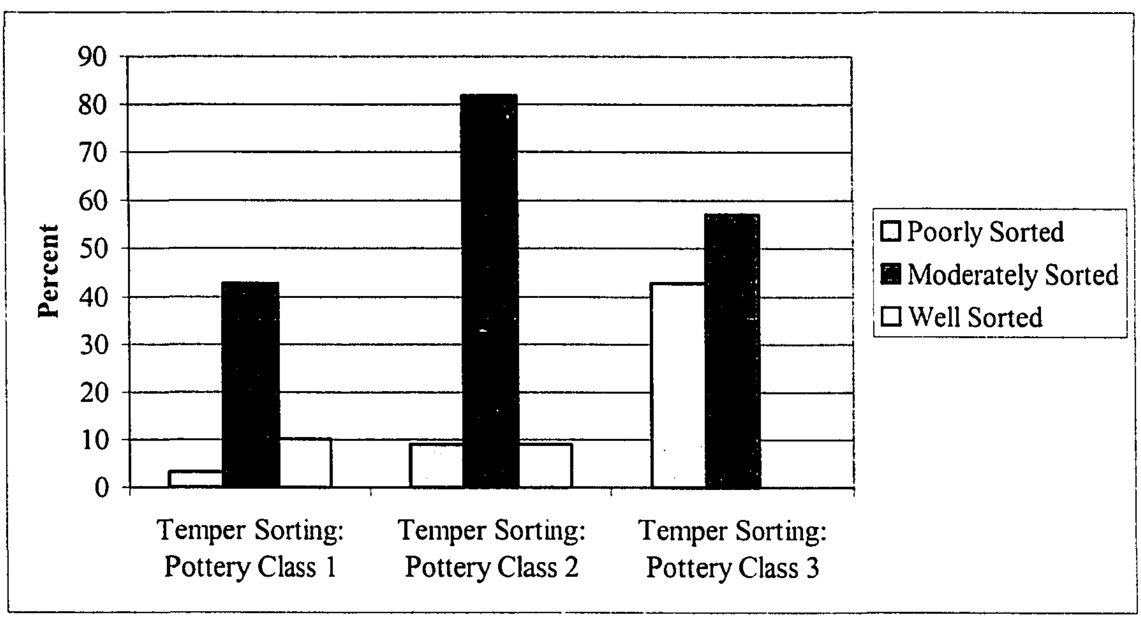

Figure 12: Frequency of Temper Sorting by Pottery Class.

Temper Sorting

Sherds are divided between three temper sorting categories (Figure 12; Table 3, Appendix 3). In Pottery Class 1, temper is mainly well sorted (N = 133. 54.1 percent), but moderate sorting is also common (N = 105, 42.7 percent). Poorly sorted temper occurs only in Pottery Class 1 and constitutes 3.3 percent (N = 8) of the sherds in this class. One hundred percent (N = 22) of the sherds in Pottery Class 2 have well sorted temper. In Pottery Class 3, 71.4 percent (N = 30) of the sherds are classified as having well sorted temper, and 28.6 percent (N = 12) have moderately sorted temper.

Temper Abundance

Four temper abundance categories were developed to characterize the percentage of temper that comprises the paste in the Yamashita-3 sample (Figure 13; Table 4, Appendix 3). Temper abundance ranges from making up less than 20 percent of the paste to over 40 percent of the paste. The greatest variety of temper abundance occurs in Pottery Class 1. Pottery Class 1 is dominated by sherds with 20-30 percent temper (N = 128, 52 percent), followed by sherds with less than 20 percent temper (N = 67, 27.2 percent), and sherds with 30-40 percent temper (N = 45, 18.3 percent). Two point four percent (N = 6) of the Pottery Class 1 sample contains more than 40 percent temper. Pottery Class 2 is the most uniform class in terms of temper abundance, and is composed of sherds containing less than 20 percent temper (N = 12, 54.5 percent of the sample) and sherds with 20-30 percent temper (N = 10, 45.5 percent of the sample). Pottery Class 3 is divided between three temper abundance categories, but most sherds (N = 25, 59.5

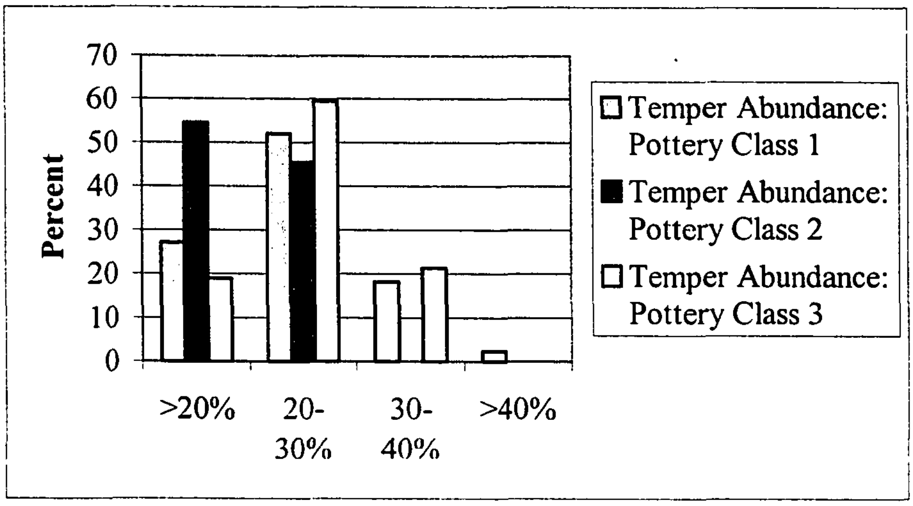

Figure 13: Frequency of Temper Abundance by Pottery Class.

percent) contain 20-30 percent temper. Sherds with less than 20 percent temper comprise 19 percent (N = 8) of the sample, and those with 30-40 percent make up 21.4 percent (N = 9) of the sample.

Temper Grain Size

Temper grain sizes range from less than 0.25 mm to 2.0 mm (Figures 14-15; Tables 5-6, Appendix 3) in the Yamashita-3 sample. Minimum temper grain sizes fall into one of two categories. Most sherds in Pottery Class 1 (N = 152, 61.8 percent) contain temper with a minimum size of 0.25 mm. Thirty-eight point two percent (N = 94) of the Pottery Class 1 sample contains sherds with a minimum grain size of less than 0.25 mm. The reverse pattern occurs in Pottery Classes 2 and 3, where minimum grain sizes of less than 0.25 mm constitute 77.3 percent of the sherds in Pottery Class 2 (N = 17), and 76.2 percent of Pottery Class 3 (N = 32). The remaining 22.7 percent (N = 5) of Pottery Class

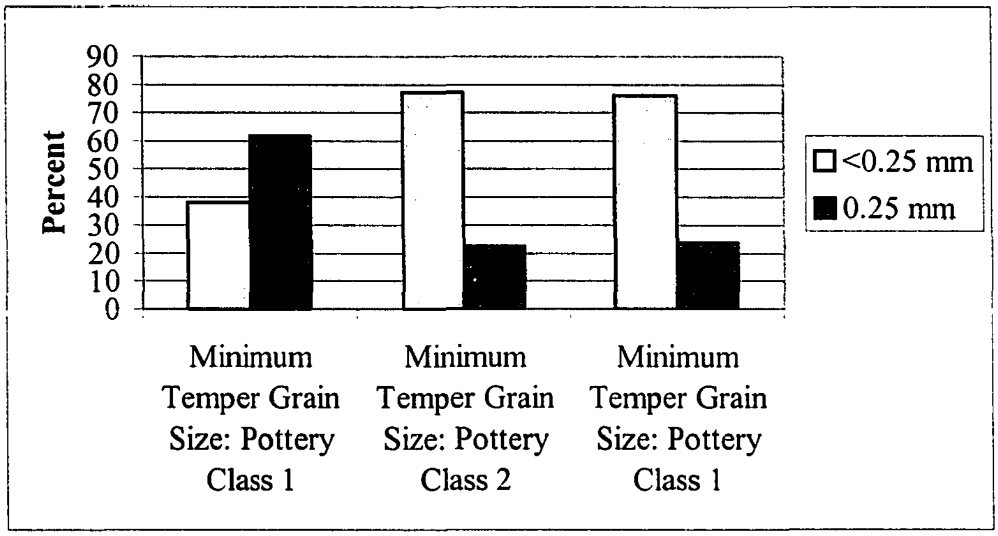

Figure 14: Frequency of Minimum Temper Grain Size by Pottery Class.

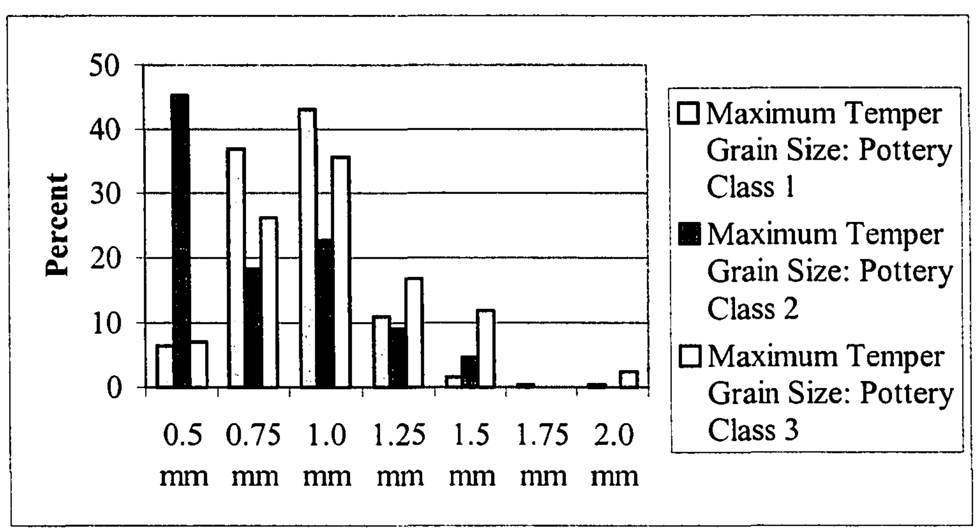

Figure 15: Frequency of Maximum Temper Grain Size by Pottery Class.

2 sherds have minimum grain sizes of 0.25 mm. Sherds with a minimum grain size of 0.25 mm constitute 23.8 percent (N = 10) of Pottery Class 3.

The maximum temper grain size ranges from 0.50 mm to 2.00 mm in diameter in sand-tempered pottery at Yamashita-3, and is classified as one of seven categories. Pottery Class 1 exhibits the most variability in maximum grain size of the three pottery classes. The most common category (N = 106, 43.1 percent of the sample) in this group is 1.0 mm, followed by slightly lesser quantities with a maximum grain size of 0.75 mm (N = 91, 37 percent). Eleven percent (N = 27) of the sherds in the Pottery Class 1 sample have a maximum grain size of 1.25 mm. Other maximum temper grain size classes represented are 0.5 mm (N = 16, 6.5 percent of the sample), 1.5 mm (N = 4, 1.6 percent of the sample), 1.75 mm (N = 1, 0.4 percent of the sample), and 2.0 mm (N = 1, 0.4 percent of the sample). The maximum temper grain size in Pottery Class 2 is the most uniform of the three pottery classes, and is most often 0.5 mm (N = 10, 45.4 percent of the sample). Maximum grain sizes of 1.0 mm (N == 5, 22.7 percent) and 0.75 mm (N = 4, 18.2 percent) are also common. The remainder of the Pottery Class 2 sample has a maximum grain size of either 1.25 mm (N == 2, 9.1 percent) or 1.5 mm (N = 1, 4.6 percent). A maximum temper grain size of 1.0 mm is most common (N = 15, 35.7 percent) in Pottery Class 3, followed by maximum grain sizes of 0.75 mm (N = 11, 26.2 percent) 1.25 mm (N = 7, 16.7 percent), 1.5 mm (N = 5, 11.9 percent), 0.5 mm (N = 3, 7.1 percent), and 2.0 mm (N = 1, 2.4 percent).

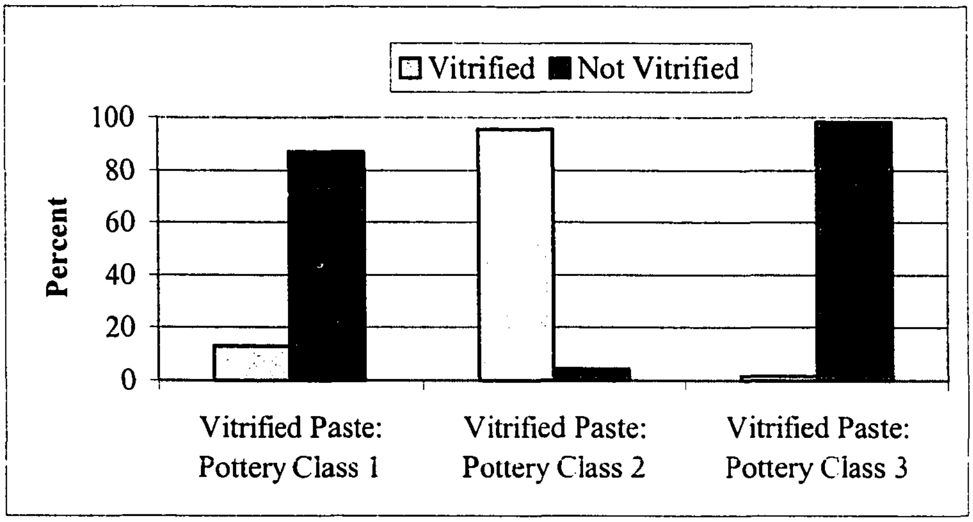

Figure 16: Frequency of Vitrified Paste by Pottery Class.

Vitrification

Only 11 percent (N = 54) of the decorated sherds at Yamashita-3 have vitrified pastes (Figure 16: Table 7, Appendix 3). In Pottery Class 1, the most abundant sand-tempered decorated pottery class at Yamashita-3, 13 percent (N = 32) of the sherds have vitrified pastes. The frequency of vitrified paste is highest (N = 21, 95.5 percent) in Pottery Class 2, and lowest (N = 1, 1.7 percent) in Pottery Class 3.

Vessel and Lip Forms

Only bowl forms were documented during the analysis of Yamashita-3 pottery. The lip forms of bowl rims are quite variable. A total of 65 rim sherds, or 21 percent of the Yamashita-3 sherd sample, were identified during analysis (Figure 17, Table 8, Appendix 3). Rims are placed into 1 of 14 lip form categories (Table 2, Appendix 2). For the Yamashita-3 sample combined, the most abundant lip forms are Form 3 (N = 15, 23.1 percent), Form 4 (N = 14, 21.5 percent) and Form 7 (N = 11, 17 percent). These are

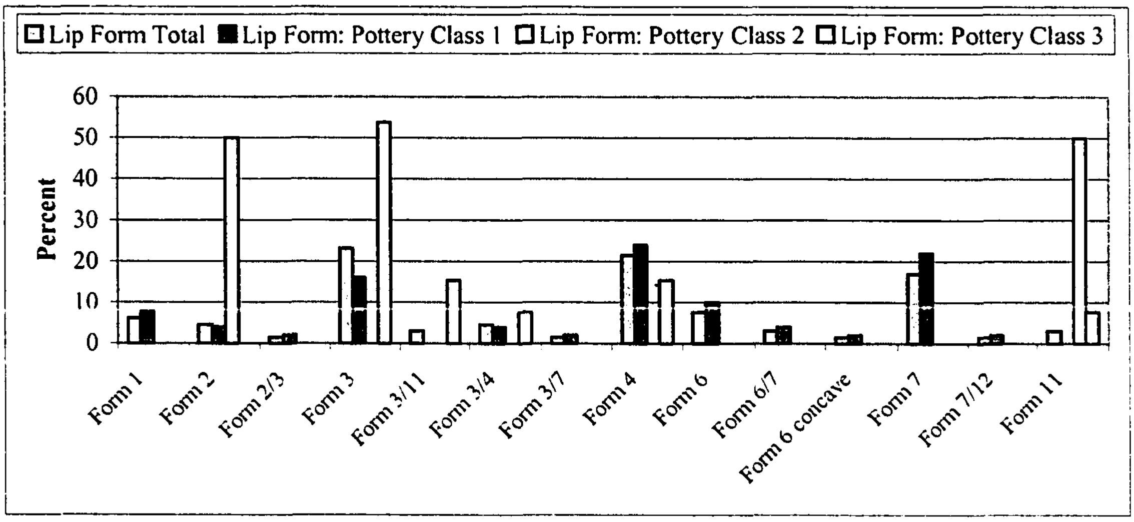

Figure 17: Frequency of Lip Form by Entire Sample and by Pottery Class.

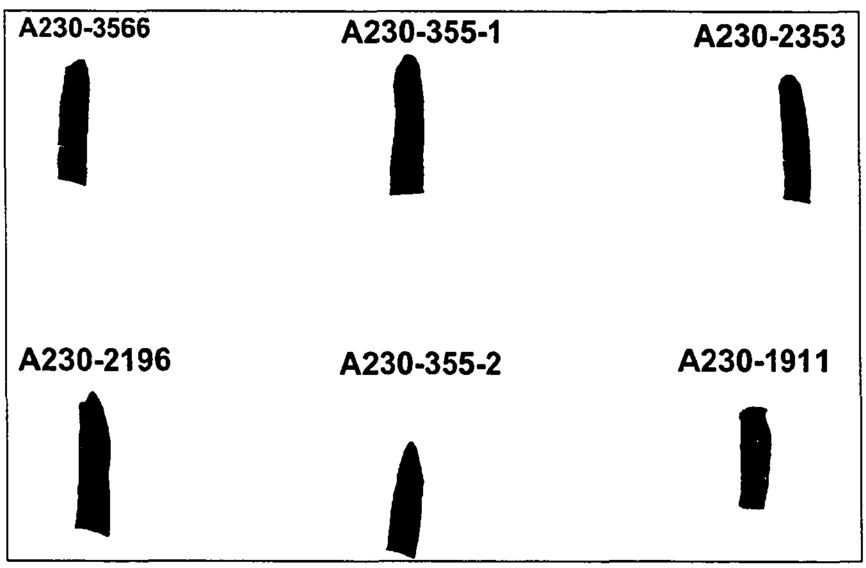

Figure 18: Examples of Lip Forms for Rim Sherds from Yamashita-3.

followed in abundance by Form 6 (N = 5, 7.7 percent) and Form 1 (N = 4, 6.2 percent). Lip Form 2 and lip Form 3/4 comprise 4.6 percent (N = 3) of the sample each. Lip Form 11, lip Form 3/11, and lip Form 6/7 each constitute 3.1 percent (N = 2 each) of the sample. Lip Form 2/3, Form 3/7, Form 7/12, and a fourth category that resembles lip Form 6 with a concave surface each constitute 1.5 percent (N = 1 each) of the sample.

Pottery Class 1, which contains a total of 50 rim sherds, displays the greatest number of lip forms. The most common lip forms are Form 4 (N = 12, 24 percent of the Pottery Class 1 sample), Form 7 (N = 11, 22 percent), and Form 3 (N = 8, 16 percent). Ten percent of the sample (N = 5) is composed of Form 6, and 8 percent (N = 4) is Form 1. Form 2, Form 3/4, and Form 6/7 compose 4 percent (N = 2 each) of the sample each, and Form 2/3, Form 3/7, Form 6 with a concave groove, and Form 7/12 each form 2 percent (N = 1 each) of the sample. Pottery Class 2 contains 2 rim sherds, one that is classified as Form 2 and another that is classified as Form 11. Of the 13 rim sherds in Pottery Class 3, 53.8 percent (N = 7) are classed as lip Form 3. Forms 3/11 and 4 compose 15.4 percent (N = 2) each of the sample, followed by Forms 3/4 and 11, which each represent 7.7 percent (N = 1) of the sample.

Fugitive Red

A fugitive red wash was identified on the exterior surface of 28.4 percent (N = 88) of the sand-tempered decorated potsherds at Yamashita-3 (Figure 18; Table 9, Appendix 3). No traces of fugitive red pigment were found on 71.3 percent (N = 221) of the sample, and 1 sherd (0.3 percent) has such an eroded exterior surface that no determination can be made. Fugitive red is most commonly found on sherds in Pottery Class 1, where it occurs

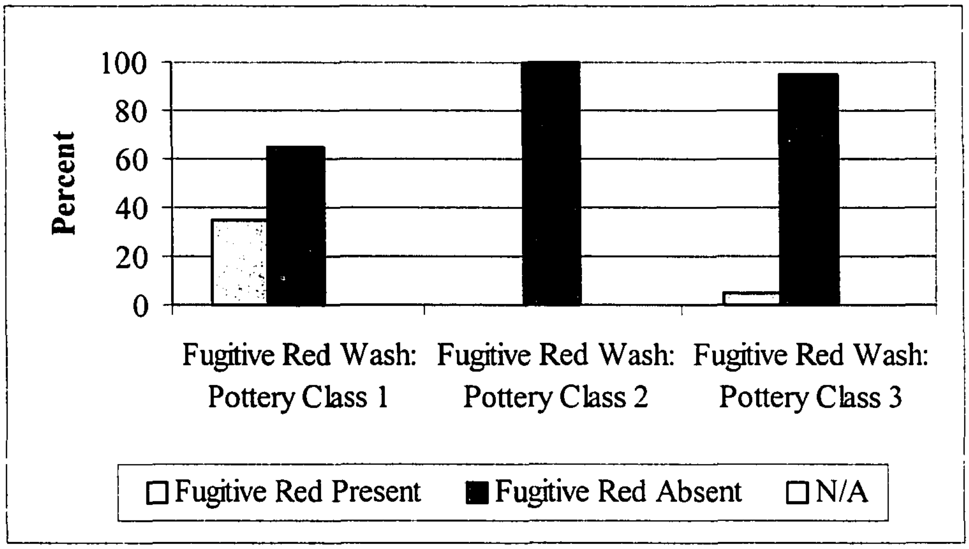

Figure 19: Frequency of Fugitive Red Wash by Pottery Class.

on 35 percent (N = 86) of the sample. Pottery Class 2 does not contain any sherds with fugitive red pigment, and only 4.8 percent (N = 2) of the sherds in Pottery Class 3 are treated with fugitive red pigment.

Decorative Paint Color

The color of decorative paint on the interior surface of sherds varies from gray and translucent (N = 21, 6.8 percent of the Yamashita-3 sample) to black and opaque (N = 147, 47.4 percent of the Yamashita-3 sample). In many cases (N = 142, 45.8 percent of the sample), the paint is characterized as a combination of these 2 categories. The distribution of the three categories is similar for all Pottery Classes. Black paint is most common, and comprises 46.3 percent (N = 114) of Pottery Class 1, 50 percent (N = 11) of Pottery Class 2, and 52.4 percent (N = 22) of Pottery Class 3. Paint that varies between black and gray in color is also very common, and constitutes 45.9 percent (N = 113), 45.5 percent (N = 10), 54.2 percent (N = 22) of Pottery Class 1, 2, and 3

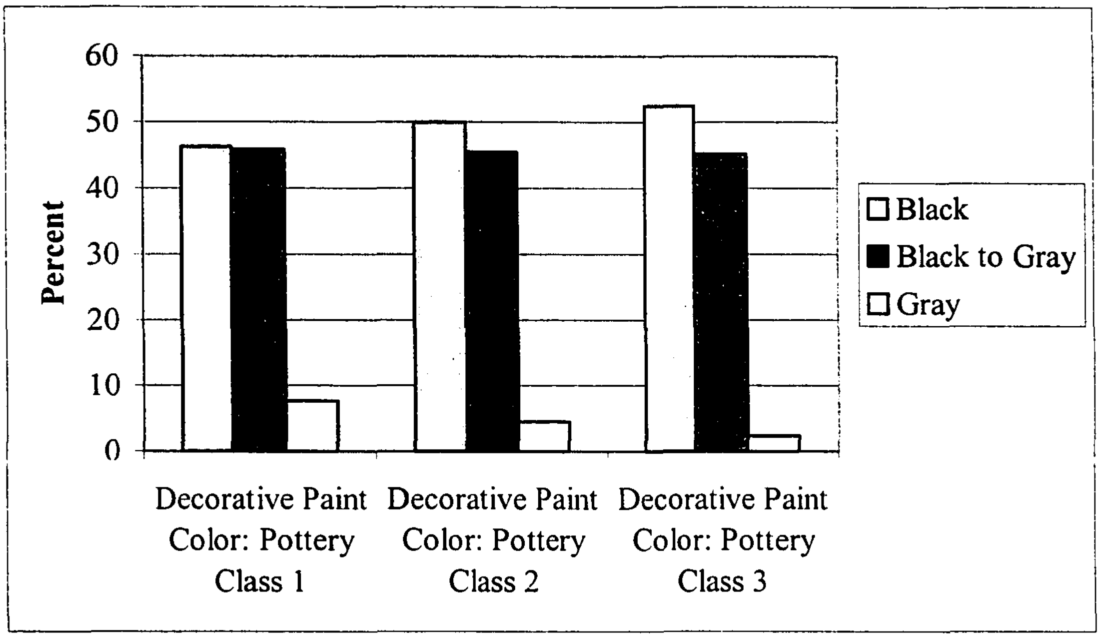

Figure 20: Frequency of Decorative Paint Color by Pottery Class.

respectively. Only 7.7 percent (19) of the sherds in Pottery Class 1 have gray paint. Gray paint is found on 4.5 percent (N = 1) of the sherds in Pottery Class 2, and on 2.4 percent (N = 1) sherds in Pottery Class 3 (Figure 19; Table 10, Appendix 3).

Exterior Corrugation

Exterior corrugation occurs on 3.5 percent (N = 11) of the decorated potsherds at Yamashita-3 (Figure 20; Table 11, Appendix 3). Three of these are in Pottery Class 1 and 19 are in Pottery Class 3. No sherds from Pottery Class 2 have corrugated exterior surfaces.

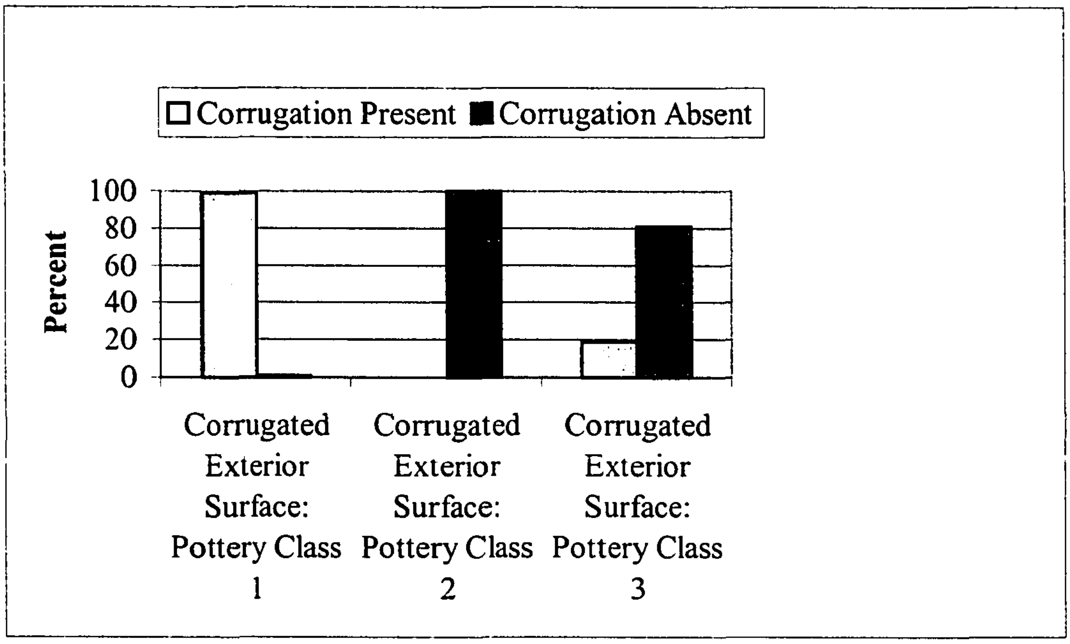

Figure 21: Frequency of Corrugated Exterior Surface by Pottery Class.

Decorative Elements

Decorative elements (Table 12, Appendix 3) painted on interior bowl sherd surfaces include wide lines (lines greater than 3 mm in width, narrow lines (lines with a width of less than 3 mm), zig-zag designs, triangles (some of which are pendant to framing lines), solid elements (including unidentified solid elements and checkerboard designs), and pendant dots. Elements occur in isolated contexts and in combination with other elements. In the Yamashita-3 sand-tempered decorated sherd sample, solid elements are most common (N = 128, 41.3 percent of the sample), and are occasionally combined with framing lines (N = 1, 0.3 percent), narrow lines (N = 3, 1 percent), pendant dots (N = 6, 1.9 percent), triangles (N = 7, 2.3 percent), triangles and zig-zag designs (N = 1, 0.3 percent), wide and narrow lines (N = 1, 0.3 percent), wide lines and pendant dots (N = 1, 0.3 percent), and with zig-zag elements (N = 1, 0.3 percent). Isolated triangles constitute

Figure 22: Examples of Pottery Designs on sand-tempered Black-on-gray Pottery from the Yamashita-3 Site.

4.8 percent (N = 15) of the sample, and are sometimes found in combination with pendant dots (N = 1, 0.3 percent), and zig-zag lines (N = 3, 1 percent). Wide lines are also common (N = 100, 32.3 percent of the sample), and are sometimes combined with narrow lines (N = 4, 1.3 percent), triangles (N = 5, 1.6 percent), triangles and framing lines (N = 1, 0.3 percent), triangles and zig-zag lines (N = 1, 0.3 percent), zig-zag lines (N = 1, 0.3 percent), and sometimes have pendant dots (N = 2, 0.6 percent). Occasionally isolated narrow lines (N = 8, 2.6 percent) and isolated zig-zag lines (N = 5, 1.6 percent) are found.

Refired Pottery Color

A total of 47 potsherds (15.2 percent) from the Yamashita-3 site was refired, including 43 sand-tempered black-on-gray sherds (Tusayan Gray Ware), 3 undecorated sand-tempered gray ware sherds (Tusayan Gray Ware), and 1 olivine-tempered black-on-gray sherd (Moapa Gray Ware). Resulting refired colors are divided into 8 groups based on subjective observations of color groupings and on Munsell color designations of the resulting colors (Figure 21; Table 13, Appendix 3). Refired Color Group 1 corresponds to Munsell color 10YR 6/3-6/4, and includes 3 sherds (6.4 percent of the sample) from Pottery Class 1. Refired Color Group 2 corresponds to Munsell color 10YR 7/3-7/4, and includes 10 sherds (40 percent of the sample) from Pottery Class 1. Refired Color Group 3 corresponds to Munsell colors 10YR 8/3-8/4, and includes 5 sherds from Pottery Class 1. Refired Color Group 4 includes 1 sherd (2.1 percent of the sample) from Pottery Class 1, and corresponds to Munsell colors 5YR 6/6-6/8. Refired Color Group 5 (Munsell Color 5YR 7/4) includes 1 sherd (2.1 percent of the sample) from Pottery Class 1. Refired Color Group 5 includes 1 sherd (2.1 percent) from Pottery Class 1 and corresponds to Munsell color 5YR 7/4. Refired Color Group 6 corresponds to Munsell color 10YR 8/2 and includes 6 sherds from Pottery Class 2, 8 sherds from Pottery Class 3, and 1 Moapa Gray Ware sherd (12.8 percent of the sample combined). Undecorated Tusayan Gray Ware sherds in this sample refired to Color Groups 7 (2 sherds, or 4.3 percent of the sample) and 8 (1 sherd, or 2.1 percent of the sample), which correspond to Munsell colors 5YR 5/8 and 5YR 6/6-6/9, respectively.

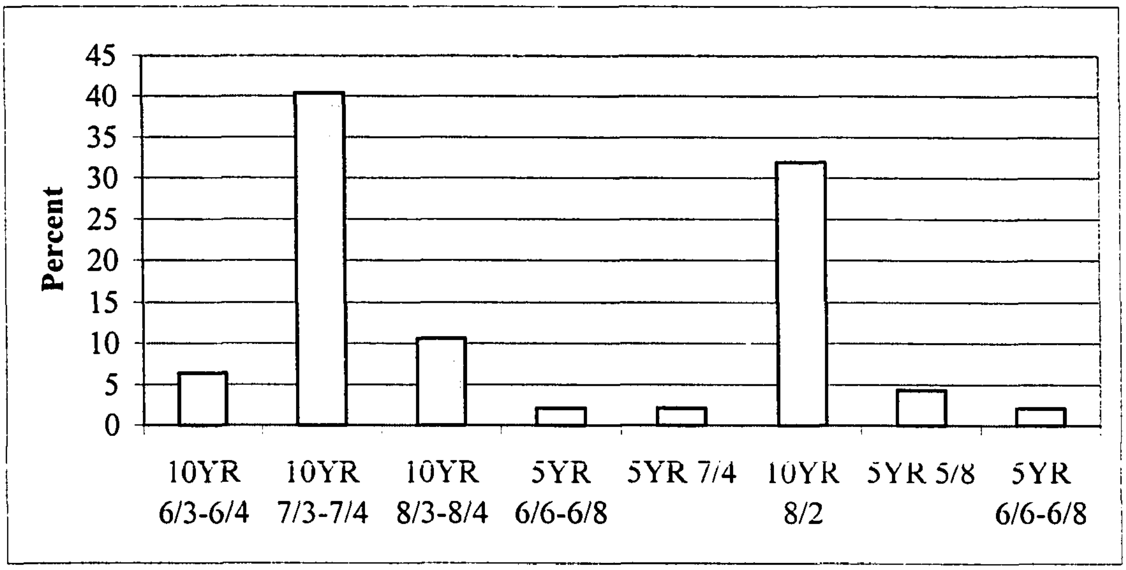

Figure 23: Frequency of Refired Pottery Colors.

Petrographic Analysis

Petrographic analysis of the 14 decorated Tusayan Gray Ware sherds from the Yamashita-3 site was conducted mainly to identify the mineral constituents of the sand temper in these sherds (Appendix 4). All sherds contained the same kinds of mineral components (see *Temper Type* results above). Petrography also confirmed the abundance, angularity, and roundedness of temper, but these variables were not systematically documented during analysis and are not included in the current evaluation.

CHAPTER 6

DISCUSSION AND CONCLUSIONS

While an assessment of standardization in production of decorated Tusayan Gray Ware pottery in the Lowland Virgin area during the Pueblo II period of prehistory is beyond the scope of this analysis, a few statements can be made about the range of variation observed in characteristics of this pottery at the Yamashita-3 site. Sherds from Yamashita-3 do exhibit a wide range of variability, but most attributes that reflect geologic source materials and many of those that reflect stylistic decisions made by potters are fairly homogeneous, or comprise greater than 50 percent of the sample. Exceptions include refired clay colors and lip form, both of which display greater variability.

Variation in Source Materials

Clay surface color and temper in decorated Tusayan Gray Ware pottery at the Yamashita-3 site tend to be uniform. Although three pottery classes were identified during analysis, distinctions between these classes are minimal. Classes 1 and 2 appear to represent a limited number of vessels each (i.e. one to two vessels each) based on similarities in clay texture and temper qualities, and do not reflect the entire pottery sample as a whole. An array of clay surface colors were observed during analysis, but the majority (70 percent) of the sample from Yamashita-3 is white in color. This shows

that surface color at the Yamashita-3 site is slightly more homogeneous than that from the Main Ridge site (26Ck 2148), a site occupied just prior to Yamashita-3, where the dominant clay color is divided more evenly between white (61 percent) and light gray (44 percent) (Lyneis 1992:10, Table 30). This uniformity is consistent with Lyneis' argument that clay color during the Pueblo II period is light in color (Lyneis et al. 1989, Lyneis 1992), and implies that production of this pottery may be specialized in the sense that specific source materials were sought out for its manufacture.

Surface clay color within the Yamashita-3 sample may be characterized as uniform, but the results of refiring confirm that more than one clay source was used to manufacture decorated sand-tempered pottery in the Virgin region. Decorated Tusayan Gray ware is distributed throughout six different refired color groups. Pottery Classes 2 and 3 consistently refire to Munsell color 10YR 8/2 (White), the same color as the refired decorated Moapa Gray ware sherd from the Uplands region of the Virgin area. This implies that either clays with similar iron content are present in both Upland and Lowland regions, or that small amounts of sand tempered pottery were imported to the Moapa Valley from the Uplands along with Moapa Gray Ware and Shivwits Plain pottery. The implication inherent in this later scenario is that not all sand-tempered decorated pottery was made by local potters in the Lowlands. Some sand-tempered decorated pottery may have been imported from the Uplands along with Moapa Gray Ware and Shivwits Plain, and as such reflects exchange relationships in the Virgin Region. Sherds in Pottery Class 1 refire to an assortment of five colors that are dominated by Very Pale Brown, but also include Light Yellowish Brown and Pale Brown. Undecorated Tusayan Gray ware sherds refire to a different color entirely (Yellowish-Red). These differences in refired

clay color are consistent with the results of refiring at the Main Ridge site and at Adam 2 (26Ck 2059), where decorated and undecorated sand-tempered pottery refired to different colors (Lyneis 1992:41), indicating that different clay recipes or sources were used to make decorated and undecorated Tusayan Gray Ware pottery. This also confirms that specific clays were deliberately sought out for the manufacture of decorated Tusayan Gray Ware pottery.

The occurrence of a dark core is more frequent at the Yamashita-3 site (34.74 percent of the sample) than at Main Ridge, where a dark core was found in only 10 percent of the sherds (Lyneis 1992:8, Table 27). Whether this is indicative of standardization in manufacture cannot be evaluated by the current study. Notable is the variation in color common in the Yamashita-3 cores. The inconsistency in core colors contradicts other studies (Lyneis 1992) that find uniformity in core color during the Pueblo II period, and suggests that pottery manufactures had poor control over firing atmosphere, a characteristic more common during earlier times. Also interesting is the refired color of pottery with a dark core in Pottery Class 1. Forty one point five percent of the sherds in Pottery Class 1 have a dark core. The refired color of these sherds is slightly darker than that for the bulk of the Pottery Class 1 sample, suggesting that the appearance of a dark core may be related to differences in clay source materials, differences in clay recipes or processing, or to the influence of temper inclusions. If clays were deliberately chosen or manipulated to obtain a dark core, this may represent an attempt to mimic imported Kayenta pottery, which consistently has a dark core.

Temper characteristics tend to be homogeneous throughout the Yamashita-3 sample, and are consistent with the results of previous studies by Lyneis (1992), Lyneis et al.

(1989), Olson (1979), and Myrher (1986). The limited petrographic analysis conducted by the author determined that the material constituents of all three pottery classes are similar. Slight differences do occur in temper rounding, sorting, abundance, and size. For example, temper is better sorted and least abundant in Pottery Class 2, and tends to be more angular in Pottery Class 3 than in other classes. Temper in sherds at the Yamashita-3 site tends to be less abundant overall (20-30 percent at Yamashita-3) than temper abundance at Main Ridge, which tends to comprise 30-40 percent of the paste (Lyneis 1992:9, Table 29). The range of temper size is fairly consistent throughout the Yamashita-3 sample, although the maximum temper grain size in Pottery Class 2 tends to be consistently smaller than in the other 2 pottery classes at the site. Overall, the distribution of maximum temper grain size for Yamashita-3 pottery is consistent with that for the same pottery at the Main Ridge site, where 72 percent of the pottery had a maximum grain size of 1.0 mm, and 56 percent had a maximum grain size of 0.5 mm (Lyneis 1992:9: Table 28).

Vitrification occurs in 11 percent of the decorated Tusayan Gray Ware sherds at Yamashita-3. This percentage is low compared with sand-tempered decorated sherds at the Main Ridge site, where 22 percent of 153 decorated Tusayan Gray Ware sherds had vitrified pastes. Also interesting is the frequency of vitrification within the individual pottery classes at Yamashita-3. In Pottery Class 1, 13 percent of the sherds have vitrified pastes. The frequency of vitrified paste is highest (95.5 percent) in Pottery Class 2, and lowest (1.7 percent) in Pottery Class 3.

Variation in Stylistic Attributes

As with other sites such as Adam 2 (Lyneis et al. 1989:38) and Main Ridge (Lyneis 1992), black-on-gray vessel form at Yamashita-3 is very consistent, and comprised exclusively of bowls. The color of decorative paint used to create designs on bowl surfaces is consistently black to a combination of black and gray, and decorative elements tend to be uniformly composed of solids, wide lines, and combinations of these elements with few narrow lines and pendant dots or tics. The homogeneity in these characteristics implies a degree of standardization in these stylistic elements, but no sample is available for comparison. The corrugated decorated sherd sample form Yamashita-3 is too small (11 sherds total) to evaluate as part of the current study.

Other variables such as rim lip form and the occurrence of fugitive red wash are less consistent. Fugitive red wash occurs on 28 percent of the sherds from Yamashita-3, and is absent only from Pottery Class 3. Rim lip forms are extremely variable, especially when compared with lip form frequencies for decorated Tusayan Gray Ware sherds at the Main Ridge site and Adam 2. A total of 14 different lip forms are represented in the sample of 65 sherds from Yamashita-3. The 27 rim sherds from Main Ridge fall within only four different lip forms (Lyneis 1992:7, Table 25), and the 34 rim sherds recovered from the Adam 2 site are divided between 5 lip forms (Lyneis et al. 1989:36, Table 8).

Conclusions and Future Research Directions

This analysis is too limited in scope and the sample population too small to assess the degree to which specialized production of decorated Tusayan Gray Ware pottery took place in the Virgin region. However, a wide range of attributes is characterized, and may

aid future researchers in evaluating the issue of pottery production. Many elements of this analysis are consistent with previous studies that find relative uniformity in clay color; temper type, rounding, and size; and the occurrence of stylistic elements such as the application of fugitive red paint and design elements. Such consistencies may support arguments for limited craft specialization of decorated Tusayan Gray Ware pottery in the Virgin region. However, a great deal of variation is apparent in rim sherd lip forms, suggesting that this aspect of pottery production may be less standardized than others. The variety of refired clay colors at Yamashita-3 also indicates that multiple sources of clay were selected for pottery manufacture, possibly in multiple regions within the Virgin area.

Future research would be enhanced by examining larger samples of decorated Tusayan Gray Ware pottery from all three regions of the Virgin area. This would not only endow researchers with a better understanding of the variability within this pottery throughout the Virgin region, but might also clarify the issue of whether decorated sand-tempered pottery made in the Uplands was imported to the Lowlands along with Moapa Gray Ware and Shivwits Plain pottery. A better understanding of the geology in the Virgin region might also aid in the identification of pottery source materials. Finally, chemical and mineralogical analysis of this pottery might allow a specific number of potential production locales to be identified.

APPENDIX I

ANALYSIS CODES

Vessel Form
B = Bowl
U = Unidentifiable

Vessel Section
B = Body
R= Rim
A = Base
U = Unidentifiable

Core/Surface Margin
S = Sharp
G = Gradual

Vitrification
P = Present
A = Absent

Surface Treatment and Decoration
W = Fugitive Red Wash
C = Corrugated

Paint Color
B = Black and Opaque
G = Gray and Translucent or Faded
G-B = Mottled Gray and Black

Inclusions
Q = Quartz
F = Feldspar
C = Coppery Mica
G = Garnet
R = Rust Stained Grains or Rust Chunks in Clay
D = Dark Accessory Minerals
A = Very Fine Sand
O = Unidentifiable Orange Inclusions

Temper Abundance
See Figures 5-7, Chapter 4, pp.33.

Temper Roundness
See Figures 5-7, Chapter 4, pp.33.

Temper Sorting
See Figures 5-7, Chapter 4, pp.33.

Lip Form
See Figure 8, Chapter 7, pp. 34.

Design Elements
W = Wide Solid Line
F = Framing Line
N = Narrow Line
S = Solid Element
Z = Zig-Zag Line
P = Pendant Dot or Tick
T = Triangle

APPENDIX II

CLAY SURFACE AND CORE COLORS, AND VESSEL LIP FORMS

Table 1: Summary of Clay Surface and Core Colors.						
	Clay Surface Color		Clay Core Color		Clay Core Color without N/A Category	
Clay Color w/ Corresponding Munsell Colors	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
White (5YR 8/1, 8/2; 10YR 8/1, 7.5YR 8/1)	228	73.5	0	0	0	0
Light Gray (5YR 7/1, 7/2; 10YR 7/1, 7/2, 6/2; 7.5YR 7/1; 2.5YR 8/2)	53	17.1	21	6.8	21	17.9
Gray (5YR 5/1, 6/1, 7/1; 10YR 5/1, 6/1, 7/1; 7.5YR 5/1, 5/2, 6/1, 6/2, 7/1)	11	3.6	74	23.9	74	63.2
Dark Gray (5YR 3/1, 4/1, 5/1, 7/2; 10YR 4/1; 7.5YR 3/1, 4/1, 5/1; 2.5YR 3/1, 4/1, 5/1)	1	0.3	18	5.8	18	15.3
Light Brown (10YR 6/3, 7/2, 8/2)	3	1.0	1	0.3	1	0.9
Brown (7.5YR 4/2, 5/2, 6/2)	3	1.0	1	0.3	1	0.9
Dark Brown (7.5YR 3/2, 4/1)	1	0.3	0	0	0	0
Pinkish Gray (5YR 6/2; 7.5YR 7/2, 7/3, 6/2, 6/3)	9	2.9	1	0.3	1	0.9
Reddish Gray (5YR 5/2; 10R 6/1, 6/2, 6/3)	1	0.3	0	0	0	0
N/A	0	0	193	62.3	0	0
TOTAL	310	100	310	100	117	100

Table 2: Verbal Description of Lip Forms to Accompany Figure 8.	
Lip Form	**Description**
Form 1	Triangular
Form 2	Triangular w/ rounded top
Form 2/3	Intermediary between triangular w/ rounded top and rounded
Form 3	Rounded
Form 3/11	Rounded bevel sloping toward exterior sherd surface at a less severe angle than that of Form 11
Form 3/4	Intermediary between rounded and flat
Form 3/7	Rounded bevel sloping toward interior sherd surface at a less severe angle than that of Form 7
Form 4	Flat
Form 6	Flat bevel facing sherd interior
Form 6/7	Bevel facing interior sherd surface that is somewhat rounded
Form 6 w/ concave ridge	Flat bevel with concave surface facing interior sherd surface
Form 7	Rounded bevel facing sherd interior
Form 7/12	Rounded bevel w/ ridge extending over exterior sherd surface
Form 11	Rounded bevel facing sherd exterior

APPENDIX III

CHAPTER 5 SUMMARY TABLES

Table 1: Frequency of Clay Surface Color and Clay Core Color

	Surface Color	White	Light Gray	Gray	Dark Gray	Light Brown	Brown	Dark Brown	Pinkish Gray	Reddish Gray
Pottery Class 1	Number	174	48	10	1	2	1	1	8	1
	Percent	70.7	19.5	4.1	0.4	0.8	0.4	0.4	3.3	0.4
	Core Color									
	Number	0	17	68	15	1	0	0	1	0
	Percent	0	6.9	27.6	6.1	0.4	0	0	0.4	0
Pottery Class 2	**Surface Color**									
	Number	18	2	0	0	0	2	0	0	0
	Percent	81.8	9.1	0	0	0	9.1	0	0	0
	Core Color									
	Number	0	3	1	3	0	1	0	0	0
	Percent	0	13.6	4.6	13.6	0	4.6	0	0	0
Pottery Class 3	**Surface Color**									
	Number	36	3	1	0	1	0	0	1	0
	Percent	85.7	7.1	2.4	0	2.4	0	0	2.4	0
	Core Color									
	Number	0	1	5	0	0	0	0	0	1
	Percent	0	2.4	11.9	0	0	0	0	0	2.4

Table 2: Frequency of Temper Rounding.

	Pottery Class 1		**Pottery Class 2**		**Pottery Class 3**	
Temper Rounding	Frequency	Percent	Frequency	Percent	Frequency	Percent
Angular	6	2.4	2	9.1	18	42.9
Rounded	215	87.4	18	81.8	24	57.1
Very Well Rounded	25	10.2	2	9.1	0	0
TOTAL	246	100	22	100	42	100

Table 3: Frequency of Temper Sorting.

	Pottery Class 1		**Pottery Class 2**		**Pottery Class 3**	
Temper Sorting	Frequency	Percent	Frequency	Percent	Frequency	Percent
Poorly Sorted	8	3.3	0	0	0	0
Moderately Sorted	105	42.7	0	0	12	28.6
Well Sorted	133	54.1	22	100	30	71.4
TOTAL	246	100	22	100	42	100

Table 4: Frequency of Temper Abundance.						
	Pottery Class 1		Pottery Class 2		Pottery Class 3	
Temper Abundance	Frequency	Percent	Frequency	Percent	Frequency	Percent
<20%	67	27.2	12	54.5	8	19
20-30%	128	52.2	10	45.5	25	59.5
30-40%	45	18.3	0	0	9	21.4
>40%	6	2.4	0	0	0	0
TOTAL	246	100	22	100	42	100

Table 5: Frequency of Minimum Temper Grain Size.			
	Minimum Grain Size	Frequency	Percent
Pottery Class 1	<0.25 mm	94	38.2
	0.25 mm	152	61.8
	TOTAL	246	100
Pottery Class 2	<0.25 mm	17	77.3
	0.25 mm	5	22.7
	TOTAL	22	100
Pottery Class 3	<0.25 mm	32	76.2
	0.25 mm	10	23.8
	TOTAL	42	100

Table 6: Frequency of Maximum Temper Grain Size.

	Maximum Grain Size	Frequency	Percent
Pottery Class 1	0.50 mm	16	6.5
	0.75 mm	91	37
	1.00 mm	106	43.1
	1.25 mm	27	11
	1.5 mm	4	1.6
	1.75 mm	1	0.4
	2.0 mm	1	0.4
	TOTAL	246	100
Pottery Class 2	0.50 mm	10	45.4
	0.75 mm	4	18.2
	1.00 mm	5	22.7
	1.25 mm	2	9.1
	1.5 mm	1	4.6
	TOTAL	22	100
Pottery Class 3	0.50 mm	3	7.1
	0.75 mm	11	26.2
	1.00 mm	15	35.7
	1.25 mm	7	16.7
	1.5 mm	5	11.9
	2.0 mm	1	2.4
	TOTAL	42	100

Table 7: Frequency of Vitrified Paste.

	Pottery Class 1		**Pottery Class 2**		**Pottery Class 3**	
Vitrification	Frequency	Percent	Frequency	Percent	Frequency	Percent
Present	32	13	21	95.5	1	1.7
Absent	214	87	1	4.5	41	98.3
TOTAL	246	100	22	100	58	100

Table 8: Rim Form Frequency.								
	Pottery Class 1		**Pottery Class 2**		**Pottery Class 3**		**Sand-Tempered Decorated Pottery Combined**	
Lip Form	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Form 1	4	8	0	0	0	0	4	6.2
Form 2	2	4	1	50	0	0	3	4.6
Form 2-3	1	2	0	0	0	0	1	1.5
Form 3	8	16	0	0	7	53.8	15	23.1
Form 3-11	0	0	0	0	2	15.4	2	3.1
Form 3-4	2	4	0	0	1	7.7	3	4.6
Form 3-7	1	2	0	0	0	0	1	1.5
Form 4	12	24	0	0	2	15.4	14	21.5
Form 6	5	10	0	0	0	0	5	7.7
Form 6-7	2	4	0	0	0	0	2	3.1
Form 6 w/ concave ridge	1	2	0	0	0	0	1	1.5
Form 7	11	22	0	0	0	0	11	17
Form 7-12	1	2	0	0	0	0	1	1.5
Form 11	0	0	1	50	1	7.7	2	3.1
TOTAL	50	100	2	100	13	100	65	100

Table 9: Frequency of Fugitive Red Wash on Exterior Sherd Surface.						
	Pottery Class 1		**Pottery Class 2**		**Pottery Class 3**	
Fugitive Red Wash	Frequency	Percent	Frequency	Percent	Frequency	Percent
Present	86	35	0	0	2	4.8
Absent	159	64.6	22	100	40	95.2
N/A	1	0.4	0	0	0	0
TOTAL	246	100	22	100	58	100

Table 10: Frequency of Decorative Paint Color on Interior Sherd Surface.

	Decorative Paint Color	Frequency	Percent
Pottery Class 1	Black	114	46.3
	Variable Black and Gray	113	45.9
	Gray	19	7.7
	TOTAL	246	100
Pottery Class 2	Black	11	50
	Black to Gray	10	45.5
	Gray	1	4.5
	TOTAL	22	100
Pottery Class 3	Black	22	52.4
	Black to Gray	19	45.2
	Gray	1	2.4
	TOTAL	42	100

Table 11: Frequency of Corrugation on Exterior Sherd Surface.

	Corrugation	Frequency	Percent
Pottery Class 1	Present	3	98.8
	Absent	243	1.2
	TOTAL	246	100
Pottery Class 2	Present	0	0
	Absent	22	
	TOTAL	22	100
Pottery Class 3	Present	8	19
	Absent	34	81
	TOTAL	42	100

Table 12: Frequency of Design Elements.

Design Element	Number	Percent
Narrow Lines	8	2.6
Solid Elements	128	41.3
Solid Elements with Framing Lines	1	0.3
Solid Elements and Narrow Lines	3	1
Solid Elements with Pendant Dots	6	1.9
Solid Elements and Triangles	7	2.3
Solids, Triangles, and Zig-Zags	1	0.3
Solids and Wide Lines	15	4.8
Solids, Wide Lines, and Narrow Lines	1	0.3
Solids, Wide Lines and Pendant Dots	1	0.3
Solids and Zig-Zags	1	0.3
Triangles	15	4.8
Triangles and Pendant Dots	1	0.3
Triangles and Zig-Zag Lines	3	1
Wide Lines	100	32.3
Wide and Narrow Lines	4	1.3
Wide Lines with Pendant Dots	2	0.6
Wide Lines and Triangles	5	1.6
Wide Lines, Triangles and Framing Lines	1	0.3
Wide Lines, Triangles, and Zig-Zag Lines	1	0.3
Wide Lines and Zig-Zag Lines	1	0.3
Zig-Zag Lines	5	1.6

Table 13: Refired Pottery Colors.					
Cat. No.	**Pottery Class**	**Pottery Description**	**Color Group**	**Munsell Color**	**Pottery Color (English Equivalent of Munsell)**
A230-2434-1	C1	Sand-tempered Black-on-gray	1	10YR 6/3	Pale brown
A230-2696-5	C1	Sand-tempered Black-on-gray	1	10YR 6/4	Light yellowish brown
A230-2158-2	C1	Sand-tempered Black-on-gray	1	10YR 6/4	Light yellowish brown
A230-355-2	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-3515-1	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-106	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-500-1	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A30-3288	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-355-1	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-616	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-2196-1	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A23-1896	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-2015	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-1911	C1	Sand-tempered Black-on-gray	2	10YR 7/3-7/4	Very pale brown
A230-234-2	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-455-1	C1	Sand tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-185-1	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-3351	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-1324	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-3566	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-2353	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-480-1	C1	Sand-tempered Black-on-gray	2	10YR 7/4	Very pale brown
A230-3515-3	C1	Sand-tempered Black-on-gray	3	10YR 8/3	Very pale brown
A230-977-4	C1	Sand-tempered Black-on-gray	3	10YR 8/3	Very pale brown
A230-1154	C1	Sand-tempered Black-on-gray	3	10YR 8/3	Very pale brown

Cat. No.	Pottery Class	Pottery Description	Color Group	Munsell Color	Pottery Color (English Equivalent of Munsell)
A230-860-3	C1	Sand-tempered Black-on-gray	3	10YR 8/3	Very pale brown
A230-1979	C1	Sand-tempered Black-on-gray	3	10YR 8/3-8/4	Very pale brown
A230-314-2	C1	Sand-tempered Black-on-gray	4	5YR 6/6-6/8	Reddish-yellow
A230-2210-1	C1	Sand-tempered Black-on-gray	5	5YR 7/4	Pink
A230-3750	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-1847	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-3180-3	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-1172-2	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-3200-2	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-2052	C2	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-908-2	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-1793	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-915-1	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-2752	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-1367	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-203-2	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-2956-6	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-97	C3	Sand-tempered Black-on-gray	6	10YR 8/2	White
A230-525-1	Moapa	Olivine-tempered Black-on-gray	6	10YR 8/2	White
A230-1029	Undec-orated	Sand-tempered Undec.	7	5YR 5/8	Yellowish-red
A230-1048	Undec-orated	Sand-tempered Undec.	7	5YR 5/8	Yellowish-red
A230-1045	Undec-orated	Sand-tempered Undec.	8	5YR 6/6-6/8	Reddish-yellow

APPENDIX IV

PETROGRAPHIC ANALYSIS

Catalog Number	Temper Types	Angularity/Density	Description
A202-520	Quartz (some w/ shadowy extinction), feldspar, pyroxenes, Potassium feldspar.	Sub-rounded. Moderate density. Full range of sizes. Dominantly medium sized grains w/ a few small and large grains.	Dominantly pyroxenes & quartz crystals. Very little feldspar and sandstone.
A202-521	Quartz, twinned feldspar, crinoid stem or other fossil, biotite, sandstone, plagioclase, muscovite.	Sub-rounded to well-rounded. Moderate to high density.	Many of the feldspars are weathered. Quartz only slightly more abundant than feldspar. Abundant mica and sandstone. Full range of grain sizes in roughly equal amounts.
A202-522	Quartz, weathered twinned feldspar, plagioclase, small sandstone grains (possibly siltstone).	Sub-rounded to well-rounded, Moderate to sparse density.	Layer of densely packed temper along 1 edge of sherd. Temper mainly quartz w/ some feldspar, and traces of other minerals.
A202-523	Quartz, potassium feldspar, twined feldspar, plagioclase, muscovite fragments.	Dense angular to sub-rounded temper. Medium to small grain size. Full size range present.	None.
A202-524	Quartz, potassium feldspar, biotite (some in large lenticular strips), a few twinned feldspars.	Angular to sub-rounded. Moderate density. Mainly large, w/ a few medium and small particles.	Abundant voids. Equal amounts of Quartz and potassium feldspar.
A230-525	Quartz, muscovite, biotite, twinned feldspar, sandstone.	Abundant temper that is sub-angular to sub-rounded. Mainly small grain size but full size range present.	Slipped on one side. Mainly quartz with a few other minerals.
A230-526	Quartz, sandstone, biotite, pyroxenes, plagioclase, potassium feldspar, twinned feldspars.	Large grains that are sub-rounded. Abundant angular round grains. Variable sizes.	Slipped on one surface. Mainly sandstone and quartz w/ small amounts of other minerals.
A230-527	Quartz, sandstone, unground clay, potassium feldspar.	Sparse to moderate density. Sub-rounded grains.	Temper mainly sandstone and quartz, followed by micas (which are sparse and small except in a few cases), and other minerals. Mainly large fragments w/ a very few small quartz fragments and potassium feldspar fragments.

Catalog Number	Temper Types	Angularity/Density	Description
A230-528	Quartz, potassium feldspar, plagioclase, sandstone, muscovite, biotite.	Sub-rounded to angular and dense.	Very fine, angular, abundant temper. Lots of potassium feldspar and quartz.
A230-529	Quartz (some with shadowy extinction), potassium feldspars, plagioclase, biotite, muscovite, sandstone.	Moderate to dense temper that is well-rounded.	Some sizable biotites, a few unground clay fragments. Micas are lenticular but always small. Mainly quartz temper followed by equal amounts of sandstone and potassium feldspar, and plagioclase. Quartz and sandstone grains are largest.
A230-530	Quartz (some with shadowy extinction), biotite, potassium feldspar, sandstone, biotite in glassy matrix.	Rounded quartz and potassium feldspar. Moderate to high density.	A few unground clay fragments. Mostly quartz and mica, with lesser amounts of feldspar, and sandstone. A few very small fragments of quartz and feldspar, but most grains are fairly large.
A230-531	Quartz, possibly biotite, muscovite, sandstone, feldspar, plagioclase, muscovites in glassy matrix.	Quartz is rounded. Most minerals heavily weathered. Densely concentrated small fragments.	Abundant biotite, some of which is large and structurally intact. Abundant unground clay grains. Temper very dense in terms of small mica and quartz (?) grains. Abundant shrinkage voids.
A230-532	Quartz, unground clay, possibly a few muscovites, biotite, sandstone.	Sub-rounded to rounded.	Temper very sparse and mostly rounded quartz grains followed by sandstone. Lesser amounts of other minerals. Grains are medium to large.
A230-533	Quartz and other minerals that are not identifiable due to weathering.	Rounded and very sparse.	Mainly large, rounded, quartz. Very sparse, w/ a few very small angular fragments. Unground clay is abundant.
A202-259	Quartz, muscovite, twinned feldspars.	Abundant temper. Moderate sub-angular to sub-rounded particles. Mainly large and medium w/ a few small.	Abundant voids. This sample is not dyed for potassium feldspar or plagioclase.
A202-620	Quartz, sandstone, biotite,	Sparse sub-rounded to rounded grains. Mainly large, w/ a few medium and small grains.	Temper almost entirely quartz. 1 possible twinned feldspar. A few very small biotite fragments. This sample is not dyed for potassium feldspar or plagioclase.

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