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# Potters' Norms: Examining the Social Organization of Ceramic Production of Panamanian Majolica and Criolla Wares in Panama la Vieja (1519-1673)

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# POTTERS' NORMS: EXAMINING THE SOCIAL ORGANIZATION OF CERAMIC PRODUCTION OF PANAMANIAN MAJOLICA AND CRIOLLA WARES IN PANAMÁ LA VIEJA (1519-1673)

A Thesis Presented

by

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ABSTRACT

POTTERS’ NORMS: EXAMINING THE SOCIAL ORGANIZATION OF CERAMIC PRODUCTION OF PANAMANIAN MAJOLICA AND CRIOLLA WARES IN PANAMÁ LA VIEJA (1519-1673)

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During the 16th and 17th century, the colonial city of Asunción de Panamá (now known as Panamá la Vieja) rose to regional prominence as a strategic geopolitical and commercial port due to its pivotal role along a transcontinental commercial network that connected Spain and its South American colonies. In the 154 years it was occupied by residents from diverse cultural backgrounds, contemporary but technologically- and compositionally-distinct ceramic industries developed and flourished in this city. Panamá la Vieja’s ceramic record presents a unique opportunity to examine how coexisting but seemingly distinct potting communities organized their craft and to explore whether their social structures were maintained over time in a colonial context.

This thesis analyzes a sample composed of two locally produced wares—one characterized by high-fired, wheel-thrown, and tin-glazed vessels known as Panamanian

Majolica and the other by low-fired, handmade, and coarse-textured utilitarian vessels known as Criolla—that were recovered from two chronologically-distinct contexts in Panamá la Vieja. Through the application of macroscopic and microscopic characterizations, this study seeks to determine if the organization of each ceramic ware reflects the existence of discrete potting units or communities and whether diachronic change or continuity is observed in each ware's production organization.

The results indicate that the production of Panamanian Majolica and Criolla differed greatly, not just in terms of the technological choices that were employed but most notably in the way each craft was organized and transmitted. In the case of the former, a centralized system was in place where social control was exerted by an established social hierarchy inside the workshop which ensured the adherence to a set of established production norms. That control is reflected in the low degree of compositional and technological variability of the Panamanian Majolica sample. In the case of the latter, production was decentralized and each potter appears to have been free to produce pots following his or her unique *chaîne-opératoire* without being subject to any form of political, social, or economic control. This decentralization is reflected in the high variability of Criolla fabrics identified in this study.

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# CHAPTER 1
# INTRODUCTION AND THEORETICAL FOUNDATION

Ceramics have long been recognized as humanity's first synthetic material (Rice 2005: 3), whose earliest use as figurines can be dated back to 30,000 years BCE (Orton and Hughes 2013: 5). The transformation occurs when clay, an inorganic plastic material, is exposed to heat which permanently alters its chemical, crystalline, and physical properties, resulting in an aplastic and hardened object (Rye 1988: 1; Rice 2005: 80). In archaeology, ceramic research holds a perennial and notable position in the study of ancient culture due to a vessel's resilience to most depositional environmental conditions, nonperishable nature, and ubiquity in many types of contexts (Orton and Hughes 2013: 3-5; Rice 2005: 24, 25). But most importantly, because pottery making is an "additive process in which the successive steps are recorded in the final product," ceramic analysis can reveal relevant information on human behavior and culture (Rice 2005: 25). Therefore, each phase of a pot's life cycle—production, circulation, consumption, and disposal—has the potential of informing scholars on a myriad of topics including cultural change and colonization, the emergence of changing production and consumption practices, and local and regional trade patterns (Barker and Majewski 2010: 205). The aim of ceramic studies should not be to merely "describe microscale prehistoric activities, but to understand microscale social processes" (Dobres and Hoffman 1994: 213).

Ceramic[1] production corresponds to the first phase of a vessel's life history and it includes the selection, procurement, and processing of the raw materials along with the forming, surface treatment, and firing of a ceramic vessel (Tite 1999: 182). In this phase, potters effectively transform raw clay into a ceramic object through the selection and use of a set of procedures, known as techniques, at every stage. The processes involved in this transformation are referred to as technology, which is broadly defined as the particular ways people decide to do things (Sigaut 1994). The reconstruction of ceramic production often involves identifying the techniques employed in the manufacture of a ceramic vessel and analyzing the underlying factors influencing a potter's technical choices (Sillar and Tite 2000; Albero 2014: 52, 53).

This thesis focuses on the production of two contemporary but technologically- and compositionally-distinct wares that were produced at the colonial site of Panamá la Vieja, Panamá. The site's ceramic record presents a unique opportunity to examine the ways seemingly different but coexisting potting communities organized their craft and explore if these social structures were maintained over time. Through the application of both macroscopic and microscopic methods of analysis, this thesis aims to determine if the organization of each ceramic ware reflects the existence of discrete potting units or communities and whether diachronic change or continuity is observed in each ware's production organization.

[1] Some scholars distinguish between the terms ceramics and pottery to refer respectively to high fired and vitrified vessels in contrast with low fired and unvitrified pots (Rice 2005: 4). In this thesis both terms are used interchangeably.

*Social Dimensions of Technology and Organization of Ceramic Production*

In recent decades, there have been significant paradigm shifts in ceramic studies as archaeologists moved away from traditional ecological and functionalist models for material and technological selection to also consider possible cultural factors. While this new approach does not pretend to discard potential constraints on a technological choice posed by the natural environment or the vessel's intended function, it maintains that the selection of certain techniques and knowledge can be influenced by the potter's social context (Albero 2014: 195). This social theory of technology draws mainly upon fundamental concepts developed by Pierre Bourdieu in his seminal work *Outline of a Theory of Practice* (1977), which examined the relationship between an established social structure and individual action within it. Among his central concepts, Bourdieu defined *habitus* as an organized set of regulated actions or habits that an individual or group develops through regular practice. In this sense habitus comprises embodied dispositions or "way of doing things" that are the product of a particular cultural and historical context. As actions or dispositions acquire a perception of "naturalness" and become unconsciously accepted as unquestionable, "taken for granted" truths among members of a social group, they are referred to as *doxa* (Bourdieu 2017).

In ceramic studies, these concepts offer a mechanism to relate both technical and social knowledge and action because pottery production is consciously and unconsciously embedded in an individual potter's social life, where cultural values can be transmitted through practice (Dobres and Hoffman 1994: 222). The concept of habitus is particularly useful in this sense, because techniques are regulated, patterned actions that are generated

through regular practice and often represent unconscious expressions of culture. Furthermore, material manifestations of doxic behavior can be linked to the establishment of a technological tradition in ceramic production which is defined as a social consensus regarding the set of technological choices required in the manufacture of a vessel that are "socially significant in a given context" (Albero 2014: 241). Because the concept of habitus situates these technological choices socially in a particular historical context, it also draws our attention to how, over time, these dispositions can be changed in response to a variety of demands and reasons (Dietler and Herbich 1998: 246, 253).

Concepts such as habitus and doxa offer an alternative approach to seeing technological choices as conscious or intentional decisions by potters, since it opens the possibility that the use of certain techniques may reflect unconscious behaviors, learned and reproduced through habitus and thus a reflection of socially meaningful boundaries (Albero 2014: 199). By examining the transmission of production knowledge across one or more generations of potters, it is possible to relate technological traditions to social groups. Such groups imply that a learning structure was in place to enable a potter to transfer his or her way of producing pots to an apprentice for an extended period of time until the transmitted technical gestures became automatic (Roux 2011: 81-82). According to the theory of situated learning developed by Jean Lave and Etienne Wenger (1991):

> "The individual progressively constructs his social identity during his apprenticeship which, by a participatory effect, will be at least in part that of the group in which he learns. These practice groups—or communities—can be very diverse in transmission networks governed by rules particular to each of them: social-vertical transmission (adult/young learner), horizontal (adult/adult), exogamic versus endogamic—political, professional, etc. (Hegmon 2000). 'Frontiers' result between the technical traditions corresponding to the perimeters between the transmission networks" (Roux 2011: 81-82).

Once the learning process has concluded, the learned production practices are "embodied" by the apprentices through consistent and repeated practice (*habitus*) and consequently it becomes difficult (albeit not impossible) to perceive and manufacture objects in a different way than that which he or she has been taught (Dobres 2000; Roux 2016: 102).

While potting practices are not static and modifications in a ware's production sequence can occur over time in response to a variety of changing social circumstances or demands, certain stages in a vessel's production process appear to be more resilient to change than others. Oliver Gosselain (2000) proposes that techniques which are technically malleable and leave visible traces on the finished products (such as decoration, post-firing treatments, and body processing techniques) are more susceptible to modification in response to changing trends, disposition towards innovation, as well as other influences. On the other end of the spectrum are stages that leave no visible traces on the finished product, such as primary forming techniques, which are deeply embedded in a potter's *habitus* through constant and repeated practice. Gosselain's (2000: 209-210) extensive ethnographic research in sub-Saharan Africa revealed that, while the distribution of decorative techniques such as rouletting could be found among neighboring but culturally-unaffiliated groups, primary forming techniques followed a series of meaningful social boundaries between individuals and communities along sociocultural divisions in language, caste, and gender.

Given that individual techniques and the production sequence in which they are employed impact one or more formal properties of the finished product, it is possible to

reconstruct a vessel's production technology and explore what factors might have conditioned the choices that a potter employed in its manufacture (Dietler and Herbich 1998). To this end, the concept of *chaîne opératoire* or operational sequence has been a useful tool to study diverse aspects of ancient technology, including the organization of ceramic production, change and continuity in production practices, knowledge transmission, and the properties of end products (Albero 2014: 55). This concept was developed by André Leroi-Gourhan in the 1960s while seeking to characterize lithic technology, and since then it has been become one of the preferred methods employed in various forms of archaeological research including ceramic study (Roux 2016: 101). *Chaîne opératoire* is defined as a "a series of operations transforming a raw material into a finished product—whether it be an article of consumption or tools" (Cresswell 1976: 13). Given that each stage of a ceramic production sequence can vary depending on the choices a potter makes, organizing a vessel's production using the *chaîne opératoire* model enables researchers to more effectively visualize these technological choices and facilitate an examination of the natural and social factors behind particular choices (Roux 2011: 81). Since individual potters tend to perform the same way their group does, the reconstruction of a ware's operational sequence helps establish the existence of technological traditions that are closely linked to the social and natural context in which these ceramics were produced (Albero 2014: 58).

Under a diachronic approach, the *chaîne opératoires* model allows archaeologists to address continuity and change in technological traditions over time and evaluate the successful generational transmission of production knowledge and practices (Roux 2011: 82, 85). By examining the degree of variability of ceramic assemblages at both

macroscopic (i.e., vessel shape, manufacturing technique, dimensions) and microscopic (i.e., paste recipe) scales, researchers can determine important aspects of a group's history and the organization of its ceramic production. On the one hand, homogeneity or standardization of ceramic products tends to reflect specialized mass production in communities where pottery production is exclusively in the hands of only a few individuals (Tite 1999: 192; Albero 2014: 254). On the other hand, heterogenous or highly variable assemblages tend to reflect the existence of multiple potting units with distinct *chaîne-opératoires* that do not share a common technological tradition. This heterogeneity may point to the existence of multiple social groups involved in the production of ceramics (groups that can be ethnic-, language-, or family-based). However, it is also important to note that the presence of compositionally variable assemblages at a single site can also be a consequence of the importation of ceramic vessels (Albero 2014: 255-256; Roux 2016: 109).

*Thesis Organization*

This thesis is structured in eight chapters (including the present one) and three appendixes. Chapter Two provides a historical synthesis of Panamá la Vieja's occupation from the pre-Hispanic to the Colonial periods that focuses on the city's geopolitical and commercial prominence during the 16$^{th}$ and 17$^{th}$ centuries and its demographic composition. The ceramic sampling strategy is described in Chapter Three, where a thorough outline of the criteria employed in the selection of the 60 analyzed sherds is provided and an examination of the two archaeological contexts from which the sample was recovered is given to add both archaeological and historical support for each

context's temporal range. Subsequently, the macroscopic and microscopic methods used will be also discussed, and the main concepts and procedures involved in ceramic petrography are reviewed.

The development of tin-glaze ceramic traditions in 16$^{th}$ and 17$^{th}$ century Spanish-American is explored in Chapter Four, starting with an examination of the craft's organization in New Spain's production centers of Mexico City and Puebla, based on evidence from the historical and archaeological records. This chapter concludes with a brief discussion of the historical and archaeological evidence pointing to ceramic production at Asunción de Panamá during the Colonial period, and a detailed description of Panamanian Majolica's physical and compositional attributes. Chapter Five presents the results obtained from the macroscopic and microscopic characterization of the Panamanian Majolica sample and examines its technological and social implications for this craft's organization.

Ceramics produced outside of the Spanish-tradition workshops in Spanish America during the 16$^{th}$ and 17$^{th}$ century are the focus of Chapter Six, which begins with an examination of four different ceramic assemblages produced in distinct parts of early colonial Spanish America to explore how potters responded to the multiplicity of technologies and techniques available, some of which were novel. Subsequently, the focus shifts to Asunción de Panamá's Criolla Ware, as its physical and compositional attributes are characterized and debates over its provenience and temporality are introduced. Chapter Seven presents the results obtained from the macroscopic and

microscopic characterization of the Criolla sample and examines its technological, social, and compositional implications for this craft's organization.

The thesis concludes with a review of the main themes examined in all previous chapters, focusing on the technological and social implications of Panamanian Majolica's and Criolla's characterizations. The main elements of divergence between these two industries' organization are explored and potential avenues for future research are laid out.

CHAPTER 2

ORIGINS, LIFE, AND DEMISE OF NUESTRA SEÑORA DE LA ASUNCIÓN DE PANAMÁ: A HISTORICAL AND SOCIAL OVERVIEW OF PANAMÁ LA VIEJA

The Spanish discovery of the Pacific Ocean in 1513 (aided by indigenous guides) opened the door to further explorations of an extensive and heavily populated stretch of land that, until then, the *conquistadores* had only heard of. This monumental sighting eventually led to the establishment of some of the most lucrative colonies of the Spanish Empire, starting with the occupation of the Panamanian Pacific coast.

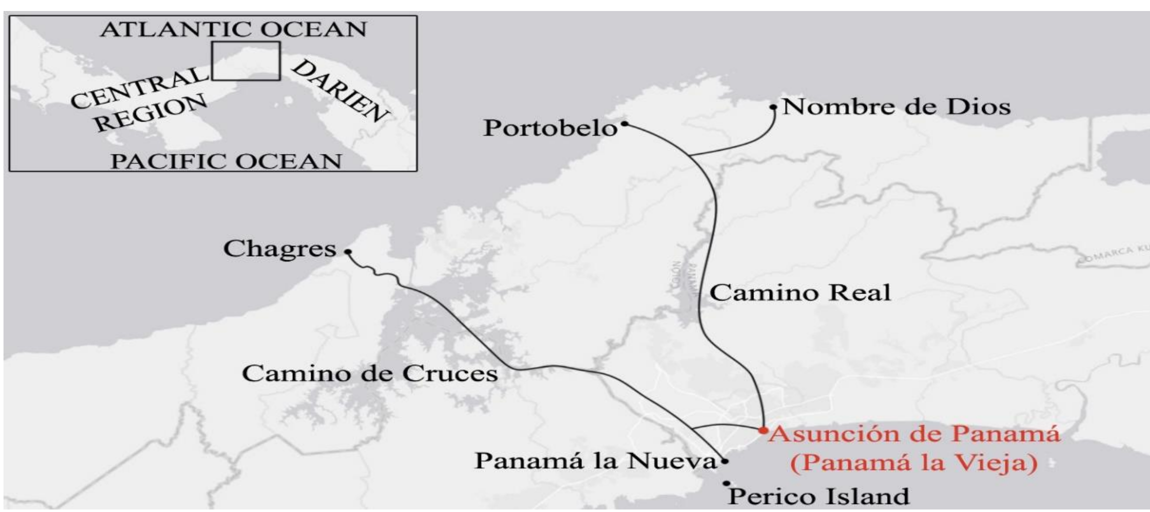


**Figure 1** Map of the Isthmus of Panamá, showing the locations of Asunción de Panamá, other colonial towns, transisthmian roads, and geographical features that will be mentioned in this thesis. Note: parts of the Camino de Cruces and Camino Real are currently submerged under artificial lakes created during the 20th century.

*A Fishing Village*

Despite being described by Spanish conquistador Gaspar de Espinosa as a small hamlet of fishermen,[2] archaeological evidence reveals that the pre-Hispanic settlement in Panamá la Vieja was both extensive and sacred. Ceramic remains indicate that human occupation at the site dates back to approximately 850 A.D. (Martín-Rincón 2002), where possible domestic structures (Martín-Rincón 2006: 339, 340) as well as three large distinct cemeteries have been identified in the course of numerous excavations (Mendizábal 2004: 123). Nonetheless, it is fair to say that Espinosa's observation was not entirely inaccurate as marine resources were the primary source of subsistence for the site's pre-Hispanic inhabitants (Mendizábal 2004: 122).

According to several chroniclers, at the time the Spaniards arrived at the shores of Panamá la Vieja the area was occupied by a group of Natives that spoke Cueva, a language that was used by virtually every chiefdom in the Darien region[3] to communicate, albeit with regional differences[4] (Martín-Rincón 2006: 33, 34). While it remains uncertain whether Cueva-speaking people occupied the site since 850 A.D. (Mendizábal 2004: 119), chroniclers confirm their presence at the time of contact

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[2] Cooke and Sánchez-Herrera (2004: 55) believe that the Spaniards did not erect their city in the same location where de Espinosa sighted "Panamá." Rather this fishing hamlet was located a short-distance away and might have been the location where they founded an ephemeral settlement.

[3] For exceptions see Cooke and Sánchez-Herrera 2004: 55.

[4] The cultural composition and perceived homogeneity of the Cueva is still a matter of debate among scholars (Martín-Rincón 2006: 34). Some question whether every group spoke Cueva because they were part of the same culture, or whether these groups shared certain cultural characteristics and used this language as a *lingua franca* for their commercial transactions, or whether these groups were culturally different but their languages were historically akin (Cooke and Sánchez-Herrera 2004: 53).

(Martín-Rincón 2006: 34). However, the impact of the Spanish conquest in this portion of the Isthmus was devastating for the Natives, who suffered swift and "irreversible" losses similar to those experienced by indigenous groups in the Caribbean islands (Mena García 1992: 49). Exposure to new diseases, constant slave raiding, excessive labor, and brutal treatment by the Spanish colonizers were just some of the causes that provoked the virtual depopulation of the Darien region (Sauer 2008: 253, 283, 284).

*A Locus of Colonial Expansion*

Lured by news of the existence of a southern ocean and an area where the path between the two seas was short, the Spanish Crown ordered Pedrarias Dávila, governor of Castilla de Oro, to find and settle this narrow stretch of land. On August 15th 1519,[5] after de Espinosa informed him that this area (which the Natives called "Panamá") had been located, Pedrarias founded the port city of Nuestra Señora de la Asunción de Panamá – the first permanent European settlement on the Pacific coast. The area chosen by the Spaniards for the provincial capital of Castilla de Oro was in a low-lying peninsula that was flanked by two small rivers and surrounded by the ocean and wetlands. While a port was erected in the city (named La Tasca), it was soon considered to be too small, narrow, and shallow to permit the arrival of large vessels, thus by 1585 the city council (*cabildo*) ordered these ships to anchor two leagues (9 km) to the west at Perico Island (Figure 2) (Mena García 1992: 33, 34, 61, 68).

[5] While August 15th 1519 is the official date of the foundation of Asunción de Panamá, some historians have disputed it (see Castillero Calvo 2006: 85-89 for a thorough discussion of the subject).

**Figure 2** Plan of Asunción de Panamá drawn in 1609 by Spanish engineer Cristóbal Roda depicting the urbanized city center in white, surrounding wetlands in green, and La Tasca port (referenced by the boats located near lower right section of the city).

Because the Crown had initially hoped to find a fast route to the Orient from Asunción de Panamá, Pedrarias was ordered to repopulate the abandoned Spanish port of Nombre de Dios located on the Caribbean coast. This settlement was conceived as a terminal that would connect Spain and its new colonies after the establishment of a permanent trade route with Asunción de Panamá (Mena García 1992: 41). As a result, for most of its colonial history the Isthmus of Panamá's Atlantic and Pacific coasts were connected by two major and contemporary trans-Isthmian roads called the Camino Real and the Camino de Cruces. The former was a land-route of approximately 80 km (18 leagues) that took on average four days to complete by mule. The latter was a mixed-route of approximately 199 km (36 leagues) length that took on average 21 days to complete, and was travelled by land until reaching the Chagres River where ships would navigate until reaching the river's mouth and then head to the Atlantic port terminal by

sea (Castillero Calvo 2004c: 377, 378, 381) (Figure 1). Both roads ended at Nombre de Dios until 1597, after which the settlement was moved to a more defensible location with a deeper bay called San Felipe de Portobelo. Although the journey along the Camino de Cruces was a significantly longer than the Camino Real, it was the safer, cheaper, and more comfortable of the two routes, which is the reason it was preferred by colonial merchants (Mena García 1992: 206-207, 246).

The strategic geographical advantages offered by the Isthmus of Panamá were quickly realized by Pedrarias, who turned Asunción de Panamá into a political locus where he could expand his ambitions westward to conquer the gold-rich lands that had been explored by Gonzalo de Badajoz (Mena García 1992: 40-41) and beyond towards Central America (Castillero Calvo 2004a: 110). Other *conquistadores* followed suit, and some of the earliest waves of colonizing expeditions towards Central and South America, including Francisco Pizzaro's search for the Inca Empire, departed from this city (Martín-Rincón 2006: 43). The ensuing conquest of Peru, followed by the exploitation of silver mines in Potosí, solidified Asunción de Panamá's commercial vocation. For nearly two centuries the city was a pivotal component of a global exchange system from which South America's "treasures" travelled to Spain.

*A Commercial Hub*

With the expansion of the Spanish Empire along the South American Pacific coast during the 16$^{th}$ century, the transit of both European and South American goods through the Isthmus of Panamá became increasingly frequent. Historian Earl J. Hamilton estimates that between 1531 and 1660 upwards of 60% of the gold and silver that entered

Spain from all its colonies made its way via Asunción de Panamá (cited in Castillero Calvo 2004c: 360). Conversely, 2000 million *pesos*' worth of European merchandise (Castillero Calvo 2004c: 360) and a large number of African slaves (Castillero Calvo 2006: 537; Gaitán-Amaan 2012) crossed the Isthmus on their way to Pacific colonies.

This transcontinental commercial network was facilitated by the monopolistic "Carrera de Indias" system, whereby a fleet of Spanish merchant ships sailed from Seville (and after 1679, Cadiz) towards selected ports in the Americas that the Crown had legally authorized to participate in international commerce, where they collected gold, silver, and other goods produced in the colonies. Fairs were held upon the arrival of these fleets in specific ports in each of Spain's American viceroyalties; Veracruz was designated for the Viceroyalty of New Spain, while Nombre de Dios (and after 1597, Portobelo) for the Viceroyalty of Peru (Ward 1993: 19). This meant that for a few weeks local, South American, and European merchants met and conducted an estimated years' worth of trading (Ward 1993: 67). The initial success of these fairs was hailed by many, including treasurer Juan López de Cañizares, who in 1623 declared that Portobelo was "such an important port, frontier, fortress and route for Peru and where its treasures are collected for Your Majesty and the most important fair of the world is held" (quoted in Castillero Calvo 2004b: 331, my translation). While this commercial system did not cease until 1739, approximately three decades before the abandonment of Asunción de Panamá, the fairs experienced periods of slow but steady decline due to corruption, contraband, and the development of alternative routes in South America (Ward 1993: 103, 137).

Prior to the establishment of the fairs, the “Panamá-Callao axis” was a frequented route that linked South America’s Pacific coast with Asunción de Panamá (Castillero Calvo 2006: 537). Trade with other colonies in the Viceroyalty of Peru was particularly significant for the city, because throughout much of its history it depended on the importation of certain food supplies, such as flour, wine, and sugar, to meet its population’s subsistence needs. For example, the value of imported products traded between local and foreign merchants in 1607, 1626, and 1637 corresponded to as much as 87.9%, 82%, and 95.9% respectively of all trade in Asunción de Panamá (Castillero Calvo 2006: 538-539, 542). Not surprisingly, most (but not all) of the cargo brought from South America consisted of perishable goods (Castillero Calvo 2006: 540). Nonetheless, documentary evidence indicates that Panamanian products such as rice, beans, wood, and stone were also exported to Pacific markets (Lima in particular), as were African slaves (Castillero Calvo 2006: 537-538).

*Population at Asunción de Panamá*

Throughout its history many estimates of Asunción de Panamá’s population were made by various sources, but only a handful referred to the city’s demographic composition by *casta* or socioracial category. Of these, local historian Alfredo Castillero Calvo (2006: 857, 861) argues that Alonso Criado de Castilla’s 1575 *Sumaria Descripción del Reyno de Tierra Firme*[6] (published in Jaén Suárez 1986) and the

[6] Full name of the document is *Sumaria Descripción del Reyno de Tierra Firme, Llamado Castilla del Oro, que está Subjeto a la Real Audiencia de la Ciudad de Panamá*.

Audiencia de Panamá's 1607 *Descripción de Panamá y su Provincia*[7] (published in Serrano y Sanz 1908) are the most reliable and detailed. Criado de Castilla was the Real Audiencia de Panamá's senior judge (*oidor decano*), and Castillero Calvo (2004: 261) believes that his census, which only quantified the city's White and Black residents, was elaborated in obedience to a Royal Decree (*Real Cedula*) expedited in 1574 that required this demographic information for fiscal purposes. The Audiencia de Panamá's census was part of a response to a questionnaire sent by the Crown to its officials in Asunción de Panamá and Portobelo (Castillero Calvo 2006: 860). The following table breakdowns Asunción de Panamá's demographic composition by *casta* in those two years:

**Table 1** Asunción de Panamá's demographic composition by casta group in 1575 (Criado de Castilla 1986) and in 1607 (Audiencia de Panamá 1908).

| ***Casta* group** | **1575** | **1607** |
|---|---|---|
| Black (enslaved) | 2809 | 3696 |
| Black (freed) | 300 | 313 |
| *Cuarterón*[8] | | 79 |
| Indian | | 27 |
| Mestizo[9] | | 64 |
| Mulatto[10] (freed) | | 246 |
| White | 800 | 1267 |
| *Zambo*[11] | | 16 |
| **TOTAL** | **3909** | **5708** |

Of all the socioracial categories residing in the city, enslaved Africans represented the bulk of the population (Table 1). Such a high proportion of slaves is not surprising,

[7] Full name of the document is *Descripción de Panamá y su Provincia, Sacada de la Relación que por Mandado del Consejo Hizo y Embió Aquella Audiencia*.
[8] Person with Spanish parent and a mestizo parent.
[9] Person with a Spanish parent and an indigenous parent.
[10] Person with a Spanish parent and a Black parent.
[11] Person with an indigenous parent and a Black parent.

given the paucity of indigenous laborers following the demise of the Cueva and the city's role as a major port of departure for slaves on their way to Peru and other South American Pacific colonies (Mena García 1992: 49; Gaitán-Ammann 2012: 6-7). However, the number of freed slaves was also considerable and appears to have steadily increased throughout the city's occupation (Castillero Calvo 2006: 870). Although there were various methods available for Black or mixed-race slaves to obtain their manumission (such as buying their own freedom and depending on the mercy of an owner), once emancipated they still faced discrimination and most lived in miserable conditions (Castillero Calvo 2006: 852, 872, 875).

Although the 1575 and 1607 censuses indicate a rising population of whites in Asunción de Panamá, by the decade of 1620 the pattern shifted and their numbers decreased exponentially (Castillero Calvo 2006: 299). Based on an analysis of the estimates given by several chroniclers and travelers, Castillero Calvo believes with "reasonable certainty" that from 1640 until 1671 the number of white *vecinos* in the city remained consistently low at approximately 300 (Castillero Calvo 2006: 300, 302). Castillero Calvo (2006: 301) argues that the decline of whites can be attributed to a series of factors, including the decreasing rate of European immigration to the city, long periods of food shortages, economic crises during the 1640s and 1650s, and a fire in 1644 that caused heavy losses to commerce and ruined many wealthy families.

The indigenous population appears to have only represented a minimal percentage of the city's demographic composition throughout its history, a predictable consequence of the brutality that the Cueva suffered during the initial years of this region's conquest.

While the decimation of the Darien's indigenous populations did not impede Spaniards from acquiring Native workers through slave raids from other regions, indigenous labor played a marginal role in the city's economy, as *encomiendas* or allocations of Native laborers were banned by the mid-16th century (Castillero Calvo 2006: 858; Sauer 2008: 284). In 1607, the Audiencia de Panamá (1908: 215-218) reported that, apart from the 27 Natives that lived in Asunción de Panamá (Table 1), there were only three "Indian towns" in the entire jurisdiction and their combined census totaled only 67 people. As a result, the workforce demand was met by African slaves (Mena García 1992: 49).

Historians have noted that the city's demographic trend in the decades subsequent to the Audiencia de Panamá report was characterized by small overall population increments in which the number of African slaves and other *castas* increased while that of white *vecinos* declined sharply. The visibly high number of people of African ancestry in Asunción de Panamá was noted in 1672 by the Jesuit priest Pedro de Mercado: "it seemed like a town from Ethiopia, because it had many Blacks in it" (quoted in Castillero Calvo 2006: 303, my translation).

### *Economic Activities in Asunción de Panamá*

Given the city's commercial vocation, it is not surprising that professions in the service sector (which included trading, renting, and transportation) and primary sector (which included animal husbandry, mining, and pearling) were among the most lucrative. However, vocational occupations (which included carpentry, tailoring, notary services, and shoe making) were also an important part of the city's economy. In the 1607 Audiencia de Panamá's report, the professions of 424 of the city's 545 white *vecinos*

were registered; of these 38.7% were involved in the service sector, 12.3% in the primary sector, and 34% in a form of vocational occupation (Castillero Calvo 2006: 851). Castillero Calvo points out that, although most of these vocational occupations were initially carried out by Spaniards "who probably did not have any other choice than to engage in the only occupation they knew" (2006: 850, my translation), over time non-Europeans took over some of these professions (2006: 848). This statement is corroborated by Criado de Castillo's 1575 report, which listed the occupation of 54 of the city's free Blacks and mulattos:

> 20 engaged in a vocational occupation that required some kind of training; 6 managed small-business—two of them were cattleman [*ganaderos*] and 4 worked in the service sector. The rest were simple employees of the service sector ranging from maids to muleteers [*arrieros*], marines and soldiers. (Castillero Calvo 2006: 852, my translation).

Historical sources seem to indicate that both locally produced and imported goods were sold in *pulperías* (stores) rather than in markets, some of which were located on the ground floor of the city's principal houses. These stores appear to have been widespread, for a 1630 census accounts for a total of 57 *pulperías*, of which 19 were categorized as "for supplying the city," while the remaining 38 were "of composition for His Majesty" (Castillero Calvo 2010: 185, my translation). Given that these *pulperías* required just a small amount of capital to operate, they were owned by Europeans of different social classes and freed Blacks and mulattos as well, who even hired poor whites to work for them (Castillero Calvo 2006: 848; 2010: 185).

*A City in Ruins*

Boosted by his successful and lucrative looting of Portobelo in 1668, English privateer Henry Morgan carefully planned the sack of Asunción de Panamá in hopes of achieving an even bigger plunder. After capturing the fortified Atlantic port of Chagres, the pirate army marched down the Camino de Cruces without encountering any resistance until the city was in sight. On January 28th 1671, just 8 km west of the city in the Matasnillo Plain, Morgan was confronted by an ill-equipped and ill-prepared army commanded by the province's governor Juan Pérez de Guzmán, which Morgan rapidly defeated and dispersed. Pérez de Guzmán fled to the city and ordered his captain to explode the powder kegs he had strategically placed in several buildings in an effort to prevent the pirates from taking anything useful (Figure 3). However, the fire spread and by the time the pirates marched into Asunción de Panamá, the city was engulfed in flames. Morgan remained in the fire-ravaged city for over a month, collecting anything valuable that was left behind, killing and capturing its inhabitants, and taking freed and enslaved Blacks and mulattos back to Jamaica to sell. Although the plunder was not as lucrative as Morgan had predicted, the attack was devastating for Asunción de Panamá, as it not only left the city in ruins but also missing a large number of its inhabitants; an estimated 500 people perished just in the Battle of Matasnillo (Exquemelin 1892; Earle 2007).

Following the sack, the Crown sent Antonio Fernandez de Cordoba to replace the disgraced Perez de Guzmán and ordered him to, among other things, reconstruct the city that the pirates and the fire had destroyed. Since the majority of the surviving *vecinos*

favored relocation to a more defensible and salubrious site, on January 21st 1673 (following the Crown's authorization) a ceremony was held to officiate the foundation of Panamá la Nueva on a small peninsula just 8 km from what thereafter became known as Panamá la Vieja (Tejeira Davis 2001: 28).


**Figure 3** Detail of a map of the Isthmus of Panamá drawn in 1686 by Alexandre-Olivier Exquemelin depicting the Battle of Matasnillo between Asunción de Panamá's *vecinos* and English pirates commanded by Henry Morgan, taking place just 8 km away from the city.

# CHAPTER 3

# SAMPLING AND METHODS

This chapter explains both the sampling criteria and the methodology that were employed in this study of Colonial Panamanian ceramic production. The first section describes the sampling strategy and examines the two archaeological contexts at Panamá la Vieja from which the sherds were recovered. The second section details the macroscopic and microscopic approaches that were used, explores the main concepts of ceramic petrography, and outlines the thin-sectioning procedure.

## *Sample*

The ceramic sample on which this analysis is based comprises a total of 60 sherds, of which half were recovered from a late context and the remaining half from an early context (in-depth description to follow) at the archaeological site of Panamá la Vieja. Appendix 1 lists the basic characteristics of each sherd, including its identification tag, context, ware, sherd type, and vessel form (if discernable).

The sampling strategy was based on eight requirements, of which five were established by myself and three by the institution that holds these sherds in its collection as stewards of the site, the Patronato Panamá Viejo (thereafter, PPV) (Table 2). The first three requirements applied to every sherd, the following two were established to ensure

the representativeness of each ware type, and the final three were required by the PPV given the destructive preparation procedures involved in the thin-sectioning process:

**Table 2** Sampling criteria used in this thesis.

| | |
|---|---|
| **1** | Sherd must meet the formal typological characteristics of its respective ware. |
| **2** | Sherd must be larger than 2 mm to reduce the chances of total sample destruction during the thin-sectioning procedure. |
| **3** | Sherd must have been recovered from one of two contexts with well-established and separate temporal ranges associated to the initial stages of Panamanian Majolica production (ca. late-16$^{th}$ to early-17$^{th}$ century), and the abandonment of Asunción de Panamá (ca. 1673) (Figure 4). |
| **4** | The three main types of Panamanian Majolica ware—Panama Plain, Panama-Blue on-White, and Panama Polychrome Type A—need to be equally represented (five sherds per context). |
| **5** | While there are two types of Criolla ware—Plain Criolla and Slipped Criolla—the number of sherds in the latter category that fulfilled the first two requirements was not large enough in one of the contexts, thus the proportion was established at 2:1 ratio (two Plain sherds for every Slipped sherd). |
| **6** | Selection of the sherd must ensure the existence of other samples available by ware type in each context to guarantee future researchers access to non-processed sherds. |
| **7** | Body sherds were privileged over diagnostic parts of a vessel (which include rims, bases, and handles). Any diagnostic sherd required the approval of the PPV to be incorporated in the sample. |
| **8** | Undecorated Criolla sherds were privileged over decorated samples. Any decorated sherd required the approval of the PPV to be incorporated in the sample. |

While a larger sample size would have been ideal, there were a couple of constraints that kept the total number of analyzed sherds at 60. The main limitation was a temporal one, as the addition of more sherds to the sample would have required extra time to both thin section and analyze each sample. Given the little experience I possessed performing thin section analysis[12] and the limited time (the 2016 fall semester) I could dedicate exclusively to the microscopic characterization, I considered that a sample of 60

[12] The final fabric grouping was verified by ceramic petrography specialist Dr. Jennifer Meanwell to ensure the accuracy of the microscopic characterization.

was both a representative and manageable size with which to guarantee the timely completion of this study. Another constraint was a financial one, as I had to assume the cost of the thin-sectioning procedure of most of the sample, and the analysis of additional sherds would have incremented this study's expenditure.

*Late Archaeological Context*

Because changes in ceramic production over time is a key aspect of this study, demonstrating the chronological integrity of my sample contexts is important. For the late context of my sample, I selected the excavation at the Western Houses (Casas Oeste de la Plaza Mayor*)*. This domestic complex is located on the western side of the city's Plaza Mayor (Figure 4) and was excavated by PPV in 1996. The initial goal of this project was to determine the original layout of the *Plaza Mayor*, however given the magnitude of its findings the PPV decided to further explore the area where domestic features were detected (Proyecto Arqueológico Panamá Viejo[13] 1996a: 2).

The Western Houses were excavated using 2 x 2 meter units and the area extended from the western edges of the Plaza Mayor to the old Vía Cincuentenario road, which was in use until 2013 (PAPV 1996a: 2). Among the identified architectural features are cobblestone (*canto rodado*) floors, stone column bases and walls, and a small brick floor which appears to have been part of an earlier structure (PAPV 1996a: 5). Most floors in the Western Houses were covered by a thick layer containing clay tiles and iron nails marking the collapse of a wooden ceiling. However, unlike other areas excavated around the Plaza Mayor (such as the city's *cabildo*), an ash layer was absent, which

[13] Hereafter, PAPV.

suggests that the Western Houses did not burn during Morgan's 1671 attack; rather they appear to have been abandoned, and over time the timber structure decomposed and toppled (PAPV 1996a: 6). West of the structure, a trash midden was identified containing large quantities of colonial period materials, including ceramics, faunal remains, iron nails, and slag[14] (PAPV 1996a: 7). In addition, an elaborate pre-Hispanic burial consisting of an individual with a *Spondylus* shell necklace surrounded by 10 human skulls and pottery vessels containing faunal remains was discovered (PAPV 1996a: 13).

Although there are no historical records that indicate who lived in the Western Houses, given their proximity to the Plaza Mayor it is probable that they belonged to some of the city's wealthiest residents (PAPV 1996a: 2). Furthermore, while it is also unclear how many residences existed in this structure due to the lack of internal walls, based on estimations developed by Castillero Calvo (1994), it was calculated that there might have been between two to three separate dwellings (PAPV 1996a: 3).

The sherds in the layer between the Western Houses' cobblestone floor and the accumulation of clay tiles and iron nails were chosen for the late context sample because this context is temporally associated with the abandonment of the city after Morgan's attack. Given the absence of an ash layer, I argue it is likely that the materials present in it were deposited some time shortly before or after the sack in 1671. All of these samples were recovered from units located in Area 2 of the Northern Section of the excavation, in the stratigraphic layer labelled as "Capa III-1" (PAPV 1996b: 1, 2).

[14] Despite the absence of furnaces, it is possible that a blacksmith workshop operated in the Western Houses due to the large pieces of slag that were recovered in the trash midden (PAPV 1996a: 7).

*Early Archaeological Context*

For my early context, I selected the excavation at the Cathedral. This structure stands directly opposite to the Western Houses on the eastern side of the Plaza Mayor and was excavated by the PPV in 2000 (Figure 4). The goals of this project were to identify the cathedral's floor, establish its layout, and carry out a detailed graphic and photographic record of the findings (PAPV 2000: 3).

A primitive church was probably erected shortly after the foundation of Asunción de Panamá and replaced in 1535 by a wooden structure that was later described as being small, poor in appearance, and located[15] in a "part [of the city] where it had no view" (Sosa 1919: 45; Mena García 1992: 156, my translation). After a fire consumed the building on February 15th 1540, a royal decree mandated that a new cathedral be built in a better location (where it is currently situated) to ensure it had a better view and so that it would "honor and greatly adorn the plaza and the city" (Tomás de Berlanga quoted in Castillero Calvo 2006: 229, my translation). While arrangements had been made by the city's bishop to construct the cathedral using stone, most of the tools and skilled laborers he had purchased and hired in Spain for this undertaking were lost in a shipwreck in 1541, forcing him to rebuild the temple using wood and clay tiles (Mena García 1992: 157, 158). The following table outlines the cathedral's subsequent construction events and changes to its architectural layout until the city's abandonment:

[15] The exact location alluded in this document is unknown, as is that of the previous structure (Mena García 1992: 156).

**Table 3** Details of each of the cathedral's reconstructions based on historical records and contemporary observation.

| Years in construction | Building materials | Dimensions (m) | Number of naves | Number of collateral chapels |
|---|---|---|---|---|
| ca. 1580-ca. 1586 | Wood and clay tiles | Length: 46.8<br>Width: 16.1 | 3 | 0 |
| ca. 1612-1626 | Stone, wood, clay tiles and bricks | Length: 41 | 3 | 2 |
| 1644-1649 | Stone, wood, clay tiles and bricks | Length: 56<br>Width: 34 | 3 | 2 |

In 1578, Asunción de Panamá's bishop complained to the Crown that the cathedral, which until then had one nave, was in deplorable conditions and too narrow for a city that was steadily receiving more visitors due to the growing importance of the trans-Isthmian commercial route. As a result, a royal decree in 1580 ordered that a new building be constructed (Mena García 1992: 158). While the precise year this construction concluded is unknown, Antonelli's 1586 plan suggests that the temple was ready by then (Castillero Calvo 2006: 203). The new structure measured "LVI *varas* in length" (converted to 46.8 m) and 20 *varas* in width (converted to 16.1 m); it was made of wood and included of 3 naves and a wooden bell tower on the south side (Audiencia de Panamá 1908: 207).

Nearly three decades after this reconstruction, Asunción de Panamá's residents complained about the cathedral's condition. According to Juan Requejo Salcedo (1908: 28) in 1619, water dripped from the ceiling when it rained, converting the floor into a swamp ("*cienaga*"). None of the city's *vecinos* dared go inside due to the building's precarious conditions, requiring 20 braces to support the structure, and due to the foul odor emanating from the corpses buried beneath its floor. However, a Proof of Merit

(*Probanza de Méritos*) petition presented by the church official Agustín Ribero in 1618 indicates that the cathedral was already being reconstructed out of stone when Requejo Salcedo made his complaint. The walls appear to have been erected adjacent to the wooden building, which was still holding services (Carta de los Prebenderos 1622, cited in Castillero Cavo 2006: 236) and by 1618 "nearly half of the cathedral's structure and its main entrance was finished" in stone[16] (Agustín Ribero quoted in Castillero Calvo 2006: 235, my translation). Therefore, it is likely that the construction of the cathedral in stone masonry began sometime during Ribero's stewardship which lasted from 1612 to 1618 (Castillero Calvo 2006: 234, 235, 236). In 1621 the cathedral was only missing the ceiling ("*el cuerpo de la yglessia está en aluerca [alberca]*") and had even survived a strong earthquake on May 21st of that year which shook the wooden building so much that, if it had not been able to support itself on the "new stone walls," it would had "fallen to the ground" (Requejo Salcedo 1908: 53). The wooden structure was demolished, and services were held in the nearby Jesuit convent from August 20th 1626[17] until September 29th of that year, when the stone cathedral was inaugurated. The finished building consisted of 3 naves measuring "10 *lumbres*" (41 m) in length, 2 collateral chapels, a brick floor, a wooden interior, and a three-story stone bell tower (Requejo Salcedo 1908: 17-18, 29).

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[16] Both Sosa 1919: 47 and Mena García 1992:160 state that this construction began after 1619 (a likely deduction based on Requejo Salcedo's references to the conditions of the structure in that year), however the Proof of Merit petition clearly indicates that by 1618 it was advanced. Therefore, I agree with Castillero Calvo's (2006: 235) assertion that it was during Ribero's stewardship that the reconstruction began.

[17] Both Sosa (1919: 47) and Mena García (1992:163) state that this event occurred on August 20th 1624, however it is unclear where they obtained this information as Requejo Salcedo's account indicates that it occurred in 1626 (1908: 17).

The final modifications to the cathedral occurred after a devastating fire that consumed the structure on February 21st 1644, along with nearly 83 other buildings belonging to some of the city's wealthiest families (Sosa 1919: 49). With the exception of the bell tower, which had an additional story added, it appears that only the building's ceiling and interior were replaced, for Sosa states that by "1649 the cathedral was finished, with the same dimensions and layout as the previous one[18]" (1919: 50, my translation), and Castillero Calvo's partial historical references only mention the wooden parts of the structure: "it [the cathedral] fell to the ground as it was mostly made of wood" (Ramírez 1650 quoted in Castillero Calvo 2006: 238). This new building, which was "more splendid and well carved than how it was before it burned" (Ramírez 1650 quoted in Castillero Calvo 2006: 238), lasted no more than two decades before it was heavily damaged during the sack in 1671. Its stones were repurposed by Panamá la Nueva's residents for the construction of the new city (Castillero Calvo 2006: 239).

The 2000 archaeological field season concentrated on the cathedral's naves, baptistery, and western collateral chapel, which were completely excavated using 10 cm arbitrary levels (PAPV 2000: 5). The original floor of the cathedral was identified in certain areas of the building. It was composed of clay bricks that were held together using a mortar composed of a mixture of water, calcined lime, and sand called *argamasa* (PAPV 2000: 13, 34). Underneath the areas where this brick floor is absent, a

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[18] Sosa (and Castillero Calvo (2006) probably in reference to him) states that the dimensions of the 1649 cathedral were 65.5 m in length and 31.7 m in width (from one collateral chapel to the other). However, neither does he cite any historical source to indicate where he obtained these numbers nor do these dimensions coincide with those taken in the field (length: 56 m, width: 34 m). It is probable that Sosa measured these dimensions himself and possibly included the cathedral's southern atrium.

homogenous fill layer associated with the construction of the cathedral was identified, extending from the stratigraphic levels 2 to 9 (PAPV 2000: 29, 30). Other architectural features, such as column bases and stone wall foundations in the naves and the western collateral chapel, were also reported (PAPV 2000: 15, 16). PPV's archaeologists believe that it is premature to relate these foundations to an earlier structure, arguing instead that they could be associated with the cathedral's choir (PAPV 2000: 35). Furthermore, a total of 10 individual human remains were recovered during this excavation in units adjacent to the western wall (B10) and the eastern wall (A1/B1) (Martín-Rincón and Díaz 2001: 68). The skeletal remains of some of these individuals were complete, while those of others were incomplete and dispersed, which the authors argue indicates that the space was continually reutilized for funerary purposes and individuals were being exhumed and reburied (Martín-Rincón and Díaz 2001: 69, 73).

Sherds from the construction fill were chosen for the early context sample of this study because this layer is likely[19] associated with the early 17th-century reconstruction of the cathedral. That date reflects when the stone walls were first erected and the building

[19] Since primary sources indicate either directly or indirectly that the stone masonry structure was built around the wooden temple while it was still in service, it is possible that this context might date to the ca. 1580-ca. 1586 reconstruction, which is when the cathedral first expanded its layout to 3 naves. Given that it appears that the wooden structure was only demolished in order to install the ceiling and brick floor, and adorn the interior space, it seems unlikely that it was after that moment builders removed the construction fill beneath the wooden structure, laid on and replaced it with a new one. Furthermore, it is also possible that the platform where the cathedral's southern and eastern atriums are located could have been constructed during this time period, as Roda appears to have graphically represented this feature in his 1609 plan. However, it is unclear whether this representation is an accurate depiction of the space or an idealized element employed by the engineer in an effort to give his plan a sense of symmetry. Further research needs to be conducted to corroborate this hypothesis.

acquired the architectural layout that persists until today (consisting of 3 naves and 2 collateral chapels) (Table 3). The stratigraphy of this context is vertically and horizontally homogenous, for it was identified in different areas of the building and was sealed underneath the brick floor that originally covered the entire cathedral for the first time in this building period. Although unit B10, where three of the samples were recovered, had been reused for funerary purposes, there are no indications that these sherds were intrusive, for the same layer of soil appears to have been used to inter the human remains (Juan Guillermo Martín-Rincón 2014, personal communication). Therefore, I argue that the materials recovered from this context were deposited between the years when Ribero's stewardship began in 1612 and when Requejo Salcedo (1908: 53) states the stone structure was completed in 1621[20].

**Figure 4** Aerial photograph of Panamá la Vieja's Plaza Mayor and its surrounding structures. The area colored in blue corresponds to the Western Houses while the area colored in red correspond to the Cathedral. Credit: Byron Fung.

[20] It is probable that this *terminus ante quem* is earlier because the foundations were undoubtedly laid before that year.

### *Methodology of the Ceramic Analysis*

Different forms of paste analysis were performed in this study to characterize main attributes for each sherd from the sample at both a macroscopic and a microscopic scale. Accordingly, the first stage of analysis consisted of macroscopic or visual characterization while the second stage of microscopic characterization was carried out through ceramic petrography.

#### *Macroscopic Characterization*

Prior to thin-sectioning, each sherd was inspected macroscopically, noting such visual characteristics as surface treatment, type of decoration, paste and pigment colors (using the 2015 Munsell Soil Color Charts), presence of firing cores and glaze defects, maximum length, width, and thickness measurements (in cm), and other observations regarding the manufacturing process and mineralogical composition of the vessel's fabric. The anterior, posterior, and profile views of each sherd were drawn, while the two sherd faces and a cross-section of the profile exposing a flat surface with the fabric's properties were photographed by Melody Henkel and processed using an image editing software.

#### *Ceramic Petrography: A Synthetized Introduction*

Although its origins can be traced to geology, petrography is an analytical technique that has been successfully applied in archaeological research since the late 19$^{th}$ century to examine various types of objects including rocks, plasters, and ceramics through the analysis of thin sections (Albero 2014: 22). To create a thin section, a small fragment of the sampled material is mounted onto a glass microscope slide and ground to

a thickness of approximately 30 micrometers (μm) to allow light from a polarizing microscope to pass through it. This enables examination of a fabric's composition through the identification of its microstructural and textural features, as well as its aplastic inclusions (which include minerals, rocks, microfossils, and grog[21]) based on their characteristic optical properties. Other compositional attributes, including the color and degree of birefringence of the clay matrix, the orientation, shape and size of voids, and the presence of glazed or slip layers, can also be observed (Peterson 2009: 3).

In ceramic petrography, one of the most commonly employed interpretative strategies after the characterization is performed is to classify individual fabrics into petrogroups or fabric groups based on shared compositional characteristics. In doing so, archaeologically meaningful patterns can be detected and possible technological differences between or within assemblages can be more easily assessed. For this thesis, the definition of a fabric group is modelled after Patrick Quinn's:

> Assuming that the fabrics, groups or classes identified in an assemblage are of cultural significance, they can be thought of as samples that were made using the same raw materials and technological practices. In this way, petrographic fabrics of ceramics are akin to recipes or pastes defined by their constituent ingredients and the ways in which these are prepared (e.g. crushing, levigation) and combined (e.g. tempering, clay mixing) (Quinn 2013: 77).

This classification can be made using either a qualitative or a quantitative approach, whose suitability depends on the research design and the nature of the examined sample. The former groups fabrics based on their perceived or visual compositional and textural

[21] Term used to refer to crushed fragments of previously-fired ceramics that were deliberately added to the paste as temper.

resemblance and subsequently characterizes each group's individual fabric, while the latter creates groups based on the compositional and textural similarities that were determined through statistically-generated characterizations (Quinn 2013: 71; Albero 2014: 23).

Researchers have traditionally applied petrography in ceramic artifacts to examine two non-mutually exclusive issues: the establishment of provenience and the reconstruction of production technology. In provenience studies, petrography offers significant advantages over other compositional analyses in that it provides precise mineralogical and textural information on the different constituents that comprise a ceramic's fabric, information which can then be related to a geological source in the area where the vessel was produced. In technological studies, the focus is on identifying which methods were used to produce the ceramic vessel, allowing the investigator to decipher certain techniques that leave no macroscopic traces on the artifact (Quinn 2013: 116, 151). The premise in reconstructing a vessel's *chaîne-opératoire* is that the processes that lead to its manufacture are the result of cultural choices because production practices are part of a cultural system. Therefore, these practices (i.e. primary forming, firing, and body preparation techniques) may convey significant information about the society as well as the object itself, including the relationships that might exist between social groups (Gosselain 2000). This approach has largely been employed by prehistorians in Europe and the Middle East, who use petrography to examine how social identity is reflected in the formation of technological traditions (e.g. Kreitter et al. 2009), and to trace foreign manufacturing influences on local products (e.g. Boileau et al. 2010).

*Thin-Sectioning Procedure*

The first 11 samples (TPPV-1 to TPPV-11) were thin-sectioned by the author following the standard protocol of the Center for Material Research in Archaeology and Ethnology (CMRAE) at the Massachusetts Institute of Technology (MIT). The procedure was supervised by Dr. Jennifer Meanwell as part of a graduate course CMRAE offered to Boston-area graduate students on ceramics. The remaining 49 samples (TPPV-16 to TPPV-64) were thin-sectioned by a commercial laboratory that specializes in this procedure, Applied Petrographic Services, Inc., based in Greensburg, Pennsylvania. Their services were contracted because currently the Historical Archaeology facilities at UMass Boston do not possess all the equipment needed to undertake this process, and it was deemed preferable to expedite this laborious stage of the study. The thin-sections were received in satisfactory condition from Applied Petrographic Services.

All 60 sherds were cut in a longitudinal orientation, adhered to standard 27 x 46 mm glass slides using an epoxy mixture, and ground to a thickness of 30 µm required for petrographic analysis. Subsequently, every sample was covered with a permanent glass slip to avoid damage to the thin-section, and an identification tag was glued to each slide.

*Microscopic Characterization*

Microscopic characterization of the 60 sherds was carried out using polarizing light microscopes from the Fiske Center for Archaeological Research at UMass Boston and the CMRAE facilities at MIT. Photomicrographs were taken of representative areas of each sample's clay matrix in plane polarized light (PPL) and cross polarized light

(XPL), and other notable features were also documented, using the microphotographic equipment available at CMRAE in MIT.

A predominantly qualitative approach was employed to characterize the entire sample to detect any microstructural, textural, and mineralogical feature that could have been missed in quantitative analysis.[22] However, each of the sherd's inclusions were extensively measured by randomly gauging the grains located in different parts of a thin section in order to obtain an accurate representation of the inclusion's size range within the sample. The analysis format used in this thesis[23] was modelled after CMRAE's characterization sheet, which lists a series of attributes associated with the sample's microstructure, groundmass, and inclusions, leaving space for any other pertinent observations. These attributes include the fabric's area estimate, void shape, distribution, and orientation, and particle spacing, sorting, and distribution for the microstructural features, the groundmass' degree of optical activity and color in both PPL and XPL, and the type, frequency, size range, angularity, and shape of its inclusions.

Sorting of the sherds into fabric groups was carried out employing a qualitative approach, whereby visual patterns in mineralogical composition and microstructural characteristics formed the basis of fabrics. Sherds that shared a similar mineral content and texture and a comparable degree and type of chemical alterations (when present) were grouped together because they represent the result of applying a specific set of production practices to a single clay source. Within each fabric group a small degree of

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[22] The quantitative approach was also necessitated by time and equipment constraints, and because this thesis' objectives were more effectively fulfilled by qualitative analysis.
[23] A model analysis sheet is provided in Appendix 2.

variations in the frequency and size range of the inclusions, and microstructural traits can be present as no two sherds are compositionally-identical, thus these differences were not used as the basis to conform a separate group unless they could be attributed to distinct changes in a paste recipe's production sequence. Although certain post-depositional and technological processes such as the precipitation of secondary calcite and the rate of oxidation or maximum firing temperature can produce visible differences between compositionally-related fabrics (Quinn 2013: 76), these were disregarded during the grouping as they do not provide relevant archaeological information.

The identified fabric groups were numbered sequentially, leaving any more descriptive names or informative names until such time as future research permits assignment of individual groups to a geographically-provenienced location. If subtle but archaeologically-significant variations within a fabric group were noted, such as clear differences in the fine fraction, these were further classified into sub-fabric group that added a letter in sequence next to the group number (i.e. Sub-Fabric 1a, 1b, and 1c).

While the macroscopic characterization was expedient, taking less than a week to complete, the microscopic characterization was more time consuming as it required upwards of four months to complete. Nonetheless, the thorough approach adopted for the thin section analysis resulted in a highly detailed characterization that enabled a thorough analysis of the patterns that emerged. Furthermore, when the qualitative-based grouping was compared with the mineralogical and textural characteristics (which were extensively measured at random) of the sherds they comprised, a relatively high degree of affinity was discernable. This not only corroborated the compositional resemblance of the sorted

sherds, but also enabled me to notice subtle variations within certain groups and provided quantitative evidence for the creations of sub-fabric groups. This will be particularly clear in Chapter 5, as small visually evident variations within the Panamanian Majolica fabric were confirmed by the compositional and textural characteristics of individual sherds. The quantitatively-derived data enabled me to both identify the possible causes of these subtleties and evaluate their implications which, I believe, would have been difficult to support with only a qualitative-based approach.

# CHAPTER 4

# MAJOLICA PRODUCTION IN 16^TH^ AND 17^TH^ CENTURY SPANISH AMERICA AND ASUNCIÓN DE PANAMÁ

The Spanish conquest of the American continent was part of a process in which new customs, religious canons, political organization, and social models were implanted in foreign lands. Along with these ideas and institutions came the introduction of goods and commodities that the Iberians were used to possessing at home, some of which, like tin-glazed or majolica ceramics, were imported initially from Europe but were later supplanted by emerging local production centers. The first section of this chapter explores both how tin-glazed vessels in Mexico City and Puebla were produced and what social norms appear to have been in place during this manufacturing process. My focus on these production centers in New Spain is based on the more abundant archival and archaeological data for that part of Spanish America, where potting guild ordinances and extensive research on tin-glazed assemblages enable a more comprehensive understanding of local majolica production than that possible for coeval centers in the Americas (Figure 5). Subsequently, Asunción de Panamá's historical and archaeological records are examined to evidence the existence of a tin-glazed industry in the city. Finally, the chapter presents a thorough characterization of Panamanian Majolica's main macroscopic, typological, stylistic, morphological, and chemical attributes.


**Figure 5** Map of Spanish America showing majolica production centers and colonial cities mentioned in this chapter, and part of the viceregal limits at the time of Asunción de Panamá's abandonment.

*Majolica Production Practices and Organization in New Spain*

Majolica or tin-glazed ware refers to a type of ceramic whose glossy, opaque, and white-colored finish (often decorated with colorful designs) is obtained when the surface of a pre-fired vessel (known as bisque) is coated with a lead-based solution containing tin oxide and fired for a second time (Gavin 2003: 2). These vessels were typically modeled using a potter's wheel and fired in kilns for up to 14 hours at high temperatures (between 1000° to 1100° C) to allow the glaze to properly mature and adhere to the clay surface (Lister and Lister 1987: 266). The ware originated in the Middle East during the 9$^{th}$ century A.D. and was introduced to Spain during the Muslim occupation of the Iberian Peninsula following the Umayyad conquest in the 8$^{th}$ century A.D. However, it is

important to note that, while tin-glazing was brought in by the invading Muslims, other technological elements used in majolica production such as the potter's wheel and the two-chambered updraft kiln were present in Iberia since the Roman occupation (Lister and Lister 1987: 13-15). In the centuries leading to the *Reconquista* or reconquest of the peninsula by the Iberian kingdoms, tin-glazed production centers developed in both Muslim- and Christian-controlled territories, including Seville in Andalusia, Teruel and Muel in Aragón, and Talavera de la Reina in Castile (Pleguezuelo 2003: 113-114). By the time the Muslims were expelled from Spain in 1492, majolica production had spread across Europe and would promptly travel across the Atlantic Ocean as Spaniards established permanent colonies on the American continent.

Craving materials that were reminiscent of their peninsular life, the early colonizers regularly imported perishable and non-perishable goods from Spain, including majolica vessels, whose price was exceedingly high due to the cost of trans-Atlantic transport (Gómez et al. 2001: 48-49). As crate loads of tin-glazed earthenware continued to cross the ocean, Spanish potters as early as the mid-16$^{th}$ century petitioned for licenses to settle in the Indies, where they established majolica factories to supply the local demand for this valued commodity. As a result, between the 16$^{th}$ and 17$^{th}$ centuries a number of production centers were established in colonies across Spanish America, including in present-day Mexico, Guatemala, Panamá, Ecuador, and Perú (Goggin 1968; Lister and Lister 1974; Vaz and Cruxent 1975; Rice 2013). Given that the corpus of historical and archaeological data available on the colonial majolica production centers of Mexico City and Puebla far exceeds that from all the other aforementioned industries, the

remainder of this section will be focused on the practices and organization at these two centers.

Historical and ethnographical records point to the existence of a longstanding majolica production tradition in New Spain, but it was not until several instrumental neutron activation analysis (INAA) tests were performed on early colonial tin-glazed sherds that three 16th and 17th century production centers were identified: Mexico City, Puebla, and Oaxaca (Olin et al. 1978; Fournier et al. 2009a; Fournier et al. 2012; de la Vega 2013). According to historical records, majolica workshops were established in Mexico City as early as the 1550s by potters from Talavera de la Reina[24] (Gómez et al. 2001: 38; Castillo Cárdenas 2007: 18) and in Puebla during the 1580s (Lister and Lister 1984: 88; Connors McQuade 2015: 55) by potters possibly from Toledo (Castro 2002: 22). As New Spain's majolica industry developed in the succeeding decades due to a growing local demand for tin-glazed vessels, the importation of European majolica slowly declined and by the mid-17th century locally-produced wares had replaced European vessels across New Spain (Goggin 1968: 213).

Although the migrating Spanish potters encountered an unfamiliar environment, they brought with them the know-how and operational organization required for majolica production and successfully "implanted" it in this new setting. As Lister and Lister argue, the establishment of majolica production centers in the American colonies was to the

[24] Lister and Lister (1987) initially proposed that the first majolica producers to arrive in Mexico City were Sevillian, however a series of historical documents published in Gómez et al. (2001) provides strong evidence that the first potters to settle in the capital come from Talavera de la Reina.

potters "just a territorial transfer", as they kept producing "the same old pots in the same old ways" (1987: 219, 272). This conclusion is supported by archaeological evidence from workshops located on the outskirts of Puebla (Lister and Lister 1984: 88-89) and Mexico City (Lister and Lister 1987: 254). Moreover, reports of two-chambered updraft kilns and kiln furniture (saggars, clay pins, and cockspurs) (Lister and Lister 1984; Castillo Cárdenas 2007) indicate a replication of European majolica production customs and technology. New Spain's ceramic products themselves[25] were modelled using a potter's wheel, and their forms (such as brimmed plates and *escudillas*) and decorative styles[26] are akin to existing European wares (Lister and Lister 1982: 13). While such physical characteristics themselves demonstrate how Spanish ceramic production traditions were maintained in the American colonies, formal guild ordinances issued in Puebla in 1653 (amended in 1682) and Mexico City in 1677 (Castillo Cárdenas 2007: 28) provide a unique glimpse of some of the intangible norms that governed majolica production.

The guild system is a centuries-old Iberian institution which, by means of ordinances and the "obligatory membership of all persons pursuing that line of work," ordered a craft and established technical, normative, social, and economic standards to provide security and guidance to its members against unwanted competitors. Therefore,

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[25] INAA results revealed that ware-types thought to have been exclusively manufactured in Spanish production centers such as Columbian Plain and Santo Domingo Blue-on-White were also produced in Mexico City and Puebla (Fournier et al. 2009a).

[26] Nevertheless, it is important to note that while the vast majority of the motifs and color palette used in decoration can be directly linked to both medieval- and Renaissance-inspired iconography in Europe, several cases of indigenous designs in tin-glazed vessels have been identified which suggest indigenous influence or participation in the craft (Gámez Martínez 2003: 233; Connors McQuade 2015: 64).

to produce and sell goods, an individual had to become a guild member and adhere to the policies established in its ordinances (Lister and Lister 1987: 289, 290).

In Puebla and Mexico City, the technical regulations of their nearly identical potting guilds' ordinances (Gámez Martínez 2003) included established ratios of raw material and minerals in glaze solutions, firing methods, and a set of approved decorative modes. The paste, for example, had to be composed of two sources (one white-colored and the other darker-colored) that were mixed to "strengthen the clay body and receive the colors with perfection" (Lister and Lister 1987: 257; Castro 2002: 52). Vessel dimensions were also regulated in Puebla, as the thickness of plates and the diameter of *escudillas* could not exceed a *real* (coin) and 1/8 of a *vara* (approximately 10 cm) respectively (Connors McQuade 2015: 137). Categories or "grades" of tin glaze were defined (three in Mexico City and two in Puebla) based on the quantity of tin oxide added to the lead-based solution (the greater the amount of tin, the thicker, whiter, and more opaque the glaze), which also determined what combination of colors and motifs could be painted[27] (Gámez Martínez 2003: 235; Fournier et al. 2009b: 107). It is important to note that, while theoretically no deviations in stipulated colors, forms, or motifs were permitted, particle-induced X-ray emission (PIXE) analysis performed on Puebla and Mexico City majolica sherds revealed that potters often substituted alkaline material for tin oxide to achieve a surface finish that was comparable to tin-glazed ceramics but was

[27] According to the ordinances there was no difference between the clay bodies for the distinct grades of majolica (Gámez Martínez 2003: 234), thus it is theoretically likely that the paste used in different ware-types identified by archaeologists should be the same.

presumably cheaper (Monroy et al. 2005). Clearly not all potters adhered to the rules established in their own guild.

Guild ordinances also regulated social and operational aspects of majolica production in New Spain and established polices that organized the activity in workshops, where often large numbers of skilled and unskilled laborers were needed to meet the demands of an expanding market.[28] Nevertheless, it is likely that these ordinances only formalized in writing existing Spanish norms, as evidenced by the appointment of traditional regulatory officers such as *alcalde* (alderman) and *veedores* (inspectors) in Puebla 80 years before the ceramic guild was established (Connors McQuade 2015: 65, 66). Traditionally, majolica workshops were organized in a hierarchical system, whereby a *maestro* (master craftsman) oversaw the workshop's operation and could hire experienced *oficiales* (journeymen) and/or train *aprendices* (apprentices) to perform one or more skilled tasks,[29] which included throwing, painting, glazing, firing, and even stacking pots properly in kilns. In addition, *maestros* could also hire laborers to perform unskilled tasks such as procuring and transporting raw clay and fuel for the kilns (Lister and Lister 1987: 261; González Franco et al. 1994: 35; Connors McQuade 2015: 66-67).

[28] Roque de Talavera's workshop in Puebla, for example, had five kilns (each one was used for a single purpose), and a large assortment of tools related to ceramic production testifies to the scale of operation a workshop could achieve (Lister and Lister 1987: 222, 293).
[29] Historical documents reveal that specializations in ceramic production tasks existed, thus there were potters who were trained only to paint or throw majolica vessels (Connors McQuade 2015: 66-67).

Under both Puebla's and Mexico City's ordinances, apprenticeships—an important element of Spanish vocational occupations—were formally structured and the obligations of *maestros* and apprentices were even enumerated. A legally binding document had to be signed by both parties, in which the *maestro* agreed to "feed, house, and clothe his charge and to care for him in times of illness," set a good moral example, instruct in the Christian doctrine, and educate him in all or select facets of the craft. In return, the apprentice had to "promise to work diligently to learn the trade as instructed, to be loyal to the family but not to intrude on its privacy, to aid in case of fire or flood, to be respectful of the master, to take care of his tools, and not to attempt to desert" (Lister and Lister 1987: 299-300). During the 17th century, 79 documented ceramic apprentices were reported in Puebla, most of whom were orphaned residents between the ages of 11 and 18 and predominantly of Spanish descent, although mestizos, mulattos, and sons of slaves were also present[30] (Lister and Lister 1987: 300; Castro 2002: 59). At the end of the apprenticeship term, which among potters typically lasted between three to five years, the apprentice could opt to be examined[31] by a group of selected peers to be promoted to journeyman (where he could be paid to work at a workshop under the condition that he would not perform his craft in his residence or accept other jobs), and eventually to

[30] Apprentices, particularly trained slaves, were also a lucrative business for artisans as these could be sold along with the workshop to assure buyers that operations would remain unchanged despite the managerial change. So much was the appeal that during the first half of the 16th century Lima's artisans were the second largest holders of slaves in Peru, second to only to *encomenderos* (Lockhart 1994: 112).

[31] Article eight of the Mexico City guild ordinance indicates "that none shall pass the exam without proficiency in the potter's wheel and those that only perform painting will not be approved," thus those that were only skilled at painting vessels were not considered for examination (Gámez Martínez 2003: 233)

*maestro* (Castillo Cárdenas 2007: 27). However, while guilds in New Spain allowed advancement within their ranks, the ordinances were explicit that only members of certain castes could occupy the top rank.

The s*istema de castas* was a complex hierarchal scheme used to classify Colonial Spanish American society into defined caste groups whose membership was determined by an individual's racial and ethnic ancestry. At the top of this system were "Spaniards" followed by "Indians," "Mestizos," "Mulattos," and "Negroes" at the bottom, with a myriad of "mixed" categories in between (Burkholder and Johnson 2008). Both the Puebla and Mexico City ordinances clearly stipulated that only Spaniards and mestizos were eligible to become *maestros*, while Blacks and mulattos could only aspire to become journeymen[32] (Gámez Martínez 2003: 233; Connors McQuade 2015: 86). Thus, while any colonial majolica workshop was likely heterogenous in its composition—as were those in Andalusia (Lister and Lister 1987: 274)— an individual's position in its operational scheme was determined by both his skill and his socioracial designation.

These racially-based restrictions in the potting hierarchy were likely modelled after the Iberian concept of blood purity, which judged an individual's "blood cleanliness" through the absence of non-Christian ancestors. This concept had been incorporated in Spanish guilds since their inception to protect Spanish artisans from non-Christian competitors (Lister and Lister 1987: 290). In the colonial setting, this discriminatory mechanism was adapted to the *sistema de castas* to restrict certain non-

[32] There were no social restrictions when it came to unskilled labor, which could be performed by Natives and freed and enslaved Blacks (Lister and Lister 1987: 13; Connors McQuade 2015: 60).

Spanish potters from the craft's highest rank and thus prohibit them from operating their own workshops (Pleguezuelo 2003: 117). Fears of non-Spanish competition are reflected in contemporary attempts to conceal European production practices and knowledge (particularly in the preparation of the glaze) from indigenous people (Lister and Lister 1982: 98). The secrecy surrounding ceramic production was best captured by Alfonso de Zorita, New Spain's *oidor* between 1556 and 1566, who described how:

> When the Spaniards started to produce glazed vessels, they would hide and lock themselves in their residences so the Indians wouldn't steal their craft, however some of them were able to secretly climb to the roof and bore a hole through the ceiling where they learned how the glaze was made and started to sell their own glazed products in the streets and plazas…(Zorita 1909: 299, my translation).

This was a legitimate concern for New Spain's potting *maestros*, for it was reported that Natives often "undersold their white competition" in markets with their lead-glazed vessels (Lister and Lister 1987: 223; Connors McQuade 2015: 62). As Lister and Lister (1987: 298-299) argue, in an ethnically plural society the existence of both racial discrimination in the division of labor and the use of proficiency examinations provided a "social insurance" for New Spain's majolica *maestros* against unwanted competition, for no one could make majolica vessels without being a guild member.

*Ceramic Production at Asunción de Panamá*

Unlike the case of New Spain's ceramic production centers, where the local industry is well documented, at Asunción de Panamá this type of information has largely remained elusive to researchers. For example, censuses conducted in 1575 (Criado de Castilla 1986) and in 1607 (Audiencia de Panamá 1908) did not report ceramic manufacture as an economic activity in which either the city's free Blacks and mulattos

or its white male *vecinos* were engaged. Since both records are incomplete, the absence of potters from these lists does not mean that the occupation was not practiced at Asunción de Panamá as both records are incomplete.[33]

In fact, two memorials testify to the existence of architectural ceramic production at Asunción de Panamá. The first was written by an *oidor* who stated that by 1541 "there are four *tejares* [brickyards]" in the city that could "produce enough roofing tiles for the entire city in a year" (Pérez de Robles quoted in Mena García 1992: 119, my translation). The second is a 1617 document which stated that the nuns at the Conception Convent owned "a *tejar* to manufacture bricks that is next to this city along with its kiln and hut" where "eight *bozal*[34] slaves labored in the service of and occupation of producing bricks" (Castillero Calvo 1994: 131, my translation). Despite the relatively soft footprint that local ceramic industry left on the historical record,[35] the archaeological record has provided the strongest evidence in support of pottery making's presence in the city.

In 1958, a production context that included the identification of a "large colonial kiln" and high concentrations of "Spanish rubbish" was reported from the northwestern

[33] The 1607 census only provided occupational data of 424 of 545 the city's white male residents, thus it not only does it fail to provide information on the remaining 121 members of that category but more importantly on the rest of the city's population, which was approximately 5708 residents. The 1575 census only provided the occupations of 54 of the approximately 300 free Blacks and *mulatos* that were accounted for. It is possible that in the latter case Spanish officials only provided occupational data of only the freed Blacks and *mulatos* that were financially solvent and could consequently pay tribute (Castillero Calvo 2006: 854).
[34] The term "*bozal*" in relation to African slaves was used to refer to individuals that did not undergo any seasoning process before being brought to the colonies, thus they were neither "properly" Christianized nor spoke Spanish (Santa Cruz 1988: 25).
[35] Some of the city's records have been lost due to an array of adverse factors such as humidity, negligence, and multiple fires (Mena García 1992: 29).

edge of Panamá la Vieja in a low-lying area adjacent to the Abajo River, a short distance from the city's center (Figure 6) (Biese 1964: 7, 10, 12). Two separate expeditions were subsequently carried out in 1962 and 1979, in which several more kilns were identified (Fairbanks 1966: 430; Dirección Nacional de Patrimonio Histórico[36] 1979: 25). These researchers were only allowed to carry out surface collections because the area was outside of the limits of the archaeological site and its proprietor was in the process of leveling the terrain with heavy machinery to expand a cemetery, which unfortunately destroyed some of these structures (Long 1964: 104; DNPH 1979: 25). However, recent rescue excavations in this area uncovered[37] the foundations of two circular-shaped kilns and an associated rectangular structure constructed using brick, stone and mortar (Mendizábal and Gómez 2015: 65-66). The artifacts recovered in this production context included discarded ceramics (or wasters), unglazed pottery (at the bisque and final stage of production), and different forms of kiln furniture (Long 1964: 105; Long 1967: 32-36; DNPH 1979: 25; Mendizábal and Gómez 2015: 61, 85-87). Among these were samples of both Panama Blue-on-White and Polychrome wasters, and Blue and White glaze drippings on some of the saggar parts (Long 1964: 105; Fairbanks 1966: 432; Tomás Mendizábal 2017, personal communication). Such findings clearly demonstrate that tin-glazed pottery production occurred at Asunción de Panamá.

[36] Henceforth, DNPH.
[37] According to the description given by two members who participated in the 1962 and 1979, these two kilns appear to be one of the structures that the latter survey had reported (Mendizábal and Gómez 2015: 60).

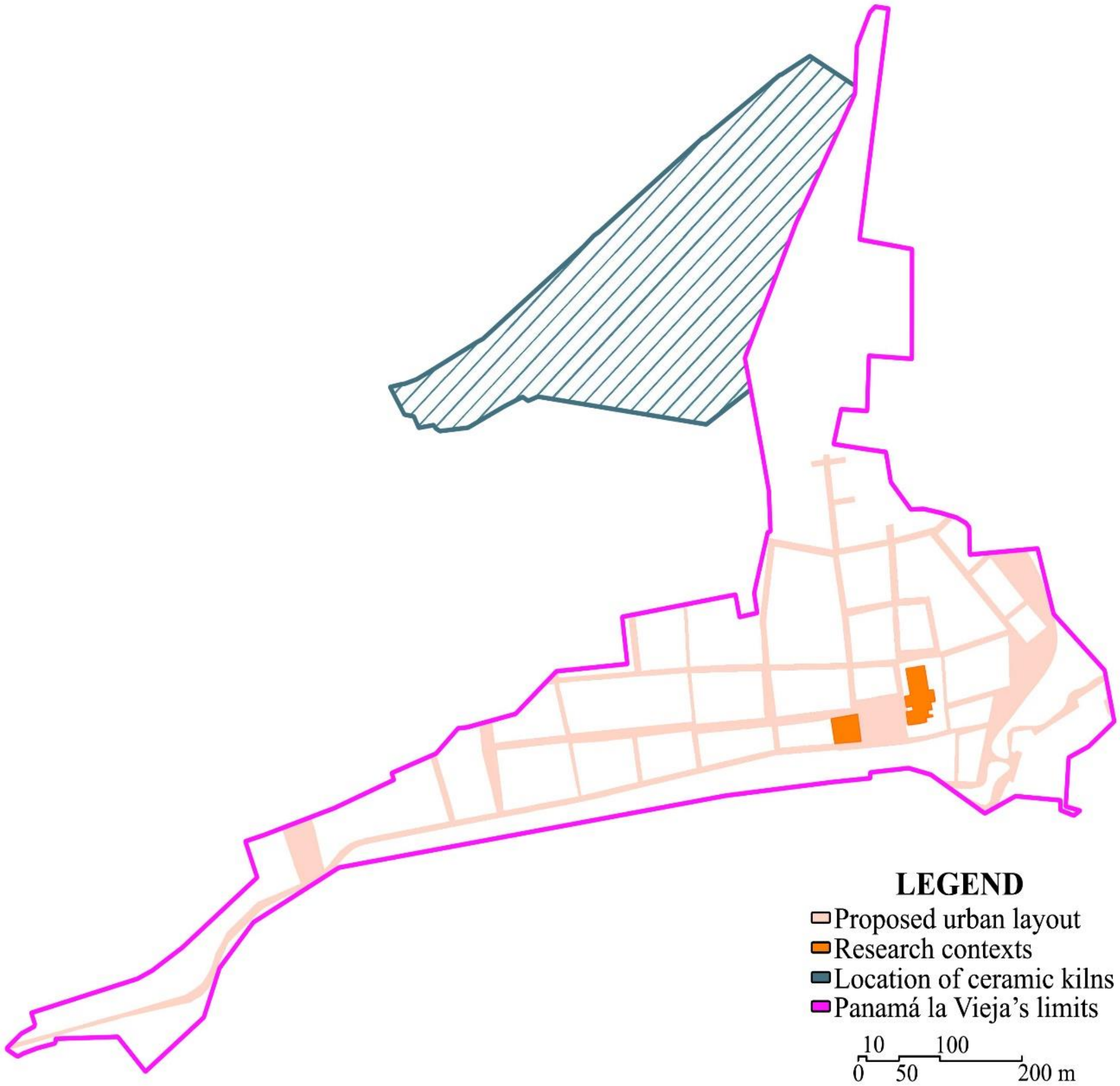


**Figure 6** Plan of Panamá la Vieja's site limit along with its proposed street layout, location of the Western Houses and Cathedral, and area where kilns have been reported by archaeologists (Biese 1964; Long 1964; DNPH 1979; Mendizábal and Gómez 2015). Researchers believe that this location was ideal for the establishment of ceramic workshops due to security (kilns are a fire hazard), public health (smoke that it produces), and economic (close to a water, fuel and possible clay sources) reasons (Long 1964: 104; Rovira et al. 2006: 108). It is important to note that a large portion of land that was originally occupied by the colonial city is outside the boundaries of the archaeological site. Source: Patronato Panamá Viejo.

It is likely that Asunción de Panamá's geographic location played a decisive role in the establishment of a tin-glazed potting industry in the city. Its position in the transcontinental commercial network not only made other markets accessible but also

allowed potters to “undercut the cost of shipping ceramics from Iberia, creating a local supply” to these markets, particularly those in the Pacific (Jamieson 2001: 48). Not surprisingly, Panamanian Majolica Ware (henceforth, Panamanian Majolica) has been widely reported in colonies under the jurisdiction of the Viceroyalty of Peru, which included Asunción de Panamá from 1542 until 1718, such as Lima[38] and Callao in Perú, Quito and Cuenca in Ecuador, and Potosí in Bolivia. To a lesser extent Panamanian Majolica has also been found in Puebla and other cities belonging to the Viceroyalty of New Spain, as well as St. Augustine in Florida (Jamieson 2001: 51; Rovira 2001b: 297, 298) (Figure 5). It is possible that this distribution pattern reflects the Crown’s mercantilist policies, which “frowned on direct trade between colonial viceroyalties” (Jamieson 2001: 50), and the high freight cost of transporting these vessels through the trans-Isthmic trails—in Portobelo, for instance, Panamanian Majolica sherds are virtually absent (Rovira 2001b: 300, 301). Being located at this crossroad also granted potters access to some of the raw material required to produce their wares, such as lead and tin, which were reported as cargo in Asunción de Panamá from South American colonies (Castillero Calvo 2004: 374; 2006: 542). A recent non-destructive, laser ablation multi-collector ICP-MS study performed on the lead isotopic composition of 30 Panamanian

[38] In 1630, a friar in Lima stated that “many baskets and ceramic *bateas* [basins], glass and many kinds of painted and glazed vessels, from this tierra [country] and outside of it [arrive to Lima] …from Panamá, China, Portugal, Benecia [Venice], and Vizcaya” (Salinas y Córdoba et al. 1957: 254 as cited in Acevedo 1986: 19, my translation). While the author does not explicitly refer to the importation of glazed or unglazed vessels (or both) from Asunción de Panamá, an INAA study revealed that all 68 tin-glazed sherds recovered from Lima’s Santo Domingo convent were produced in Asunción de Panamá (Iñañez et al. 2012).

Majolica sherds revealed that the lead source was predominantly Andean (n=25) and Spanish to a lesser extent (n=5) (Iñañez et al. 2016).

The demise of Asunción de Panamá's tin-glazed ceramic industry appears to have coincided with the city's abandonment, for the archaeological record at the site of Panamá la Nueva (colloquially known as *Casco Antiguo* or Old Quarter) indicates that, while Panamanian Majolica was still present in the earliest stratigraphic sequences, by at least the mid-18th century it was completely replaced by English- and French-produced tableware (Rovira 1981: 38-39; 1984: 287). While it is possible that Asunción de Panamá's kilns might have been used to produce the large amount of clay bricks and tiles required to rebuild the new city (Mendizábal and Gómez 2015: 96, 97), archaeological data indicate that the production of tin-glazed vessels ceased.[39] One can speculate whether the cause of this demise was related to the death and/or immigration of potters (Lister and Lister 1974: 47-48), or to the high cost of reestablishing production coupled with the bad economic state of the surviving residents (Rovira 2001b: 302).

At present, at least four wares are considered to have been produced by potters at Asunción de Panamá ranging from low- to high-fired glazed and unglazed ceramics. Of these, Panamanian Majolica is among the most recognizable and diagnostic of local wares.

[39] Other ceramics may have been produced nearby, as maps from 1765 (drawn by Manuel Hernández) indicate the presence of a *tejar* in the outskirts (Mendizábal and Gómez 2015: 97-98), and from 1778 (unknown authorship) reference a locality called "*Lozeria*", the Spanish word for pottery factory, several km from the city.

*Characterization of Panamanian Majolica Ware*

Panamanian Majolica refers to a type of tin-glazed pottery produced exclusively[40] in the city of Asunción de Panamá from either the mid- (Deagan 1987: 71) or late-16th century (Lister and Lister 1974: 45; Rovira 2001b: 291) until the late-17th century. These vessels are characterized by a glossy and opaque, white-colored, vitreous enamel coating over a fine and compact paste containing mineral inclusions (or temper) (Deagan 1987: 91). Panamanian Majolica is "easily recognized" due to its "bright brick red" (Lister and Lister 1974: 44) or "dark brick red" (Deagan 1987: 48) paste color, in contrast to the white-, yellow-, and cream-colored pastes of Sevillian, Mexican, and *Poblano* tin-glazed wares respectively (Long 1967: 12). Panamanian Majolica is subdivided into six types[41] (or variations according to Jamieson 2001), differentiated by the combination of colors applied as part of their painted decorations: Panama Plain (*Panamá Liso*), Panama Blue (*Panamá Azul*), Panama Blue-on-White (*Panamá Azul sobre Blanco*), Panama Blue-on-Blue (*Panamá Azul sobre Azul*), Panama Polychrome Type A, and Type B (*Panamá Policromo Tipo A*, and *Tipo B*) (Figure 7) (Jamieson 2001: 48; Rovira 2001a: 183-184; Rovira et al. 2006: 106). Table 4 lists the diagnostic characteristics of each:

[40] José María Cruxent (in DNPH 1979: 22, 27) claims that historical records suggest that another colonial tin-glazed production center was located in the city of Natá de los Caballeros (approximately 184 km southwest of Asunción de Panamá) where he conducted excavations and recovered tin-glazed sherds that, while having a finer paste than those from Panamá la Vieja, had the same decorative elements. The existence of this tin-glazed production center has yet to be confirmed.

[41] The earliest research conducted on Panamanian Majolica recognized four (Long 1967:14) and three (Baker 1969: 69) groups. Later studies, predominantly conducted by Beatriz Rovira, expanded the typology to the six categories currently in use.


**Figure 7** Photograph of an assortment of Plain, Blue-on-White, Polychrome Type A and B Panamanian Majolica bowls, plates and cups recovered in Panamá la Vieja.

**Table 4** Panamanian Majolica attributes.

| Type | Background color(s) | Motif color(s) |
|---|---|---|
| **Plain** | White | None |
| **Blue** | White (interior)<br>Blue (exterior) | None |
| **Blue-on-White** | White | Blue |
| **Blue-on-Blue** | Blue | Blue |
| **Polychrome Type A** | White | Combination of blue, green, and/or brown |
| **Polychrome Type B** | White | Combination of blue, green, and/or brown, and yellow |

The pigments used for these motifs were prepared by grinding cobalt for blue, copper for green, manganese for brown, and possibly lead antimonite for yellow. The ground pigment was applied under the enamel coating, with the exception of the latter color which was applied over it (Deagan 1987: 91-92). The hand-painted iconography on both dichromatic and polychromatic vessels (which included floral, geometric, scrolls, loops, lace-like, and landscape motifs) was inspired by medieval and, to a lesser extent, Renaissance themes reproduced in Spanish ceramics of the Castile, Andalusia, and

especially Aragón[42] regions (Rovira and Mojica 2007:89-93). American-inspired motifs (such as the "corn plant") have been reported in a Panamanian Majolica plate recovered at St. Augustine, Florida (Deagan 1987: 92) but are absent at Panamá la Vieja (Rovira and Mojica 2007: 94). The iconography in Panama Blue-on-White vessels mirrored that of a type of Chinese porcelain produced during the Wang Li period (1573-1619) called Kraak (Rovira 2001b: 297; Rovira and Mojica 2007: 86), thus continuing Europe and New Spain's tradition of imitating Chinese styles (Lister and Lister 1978: 11; Rovira 2001a: 190-191). The stylistic homogeneity of Panamanian Majolica might reflect the short period in which it was manufactured and suggests the existence of guild-like regulation in its production, despite the lack of documentary records to support this claim (Rovira 2001a: 197; 2001b: 291).

Panamanian Majolica vessels were manufactured following Spanish tin-glazed production conventions, including the use of a potter's wheel (Jamieson 2001: 45). Most Panamanian Majolica vessels, like their European and Mexican tin-glazed counterparts, are tableware; brimmed plates, bowls, porringers, and cups are the most common forms (Figure 8) (Jamieson 2001: 53; Rovira 2001a: 188). Utilitarian forms associated with personal hygiene (such as chamber pots) have been reported in Panamá la Vieja but are rare (Patronato Panamá Viejo: 2013). Stratigraphic evidence and diachronically-established changes in vessel morphology[43] suggests that Panama Plain was the first type

[42] Researchers have suggested the close decorative affinity that exist between tin-glazed brown and green-colored vessels produced in the Aragonian production centers of Teruel and Muel with those in Asunción de Panamá (DNPH 1979: 27; Rovira and Mojica 2007: 92, 93).
[43] Flat base plates are a form that is attributed to an early Moorish-style, tin-glazed type produced in Spain known as Columbia Plain (whose temporal frame spanned from 16$^{th}$ to

to be produced and was soon followed by the others (Long 1967: 21-22; Rovira 2001a: 187, 188-189; 2001b: 302) Broader patterns in the stratigraphy show that European-produced tin-glazed types were abundant in the earliest levels but were gradually replaced by Panamanian Majolica which, by the time of the city's abandonment, completely dominated the stratigraphic sequence (Long 1967: 22; Rovira 2001a: 186; 2001b: 301). This indicates that during the initial occupation of the site tin-glazed vessels were predominantly imported from Europe to meet residents' demand until the establishment of the local tin-glazed industry.

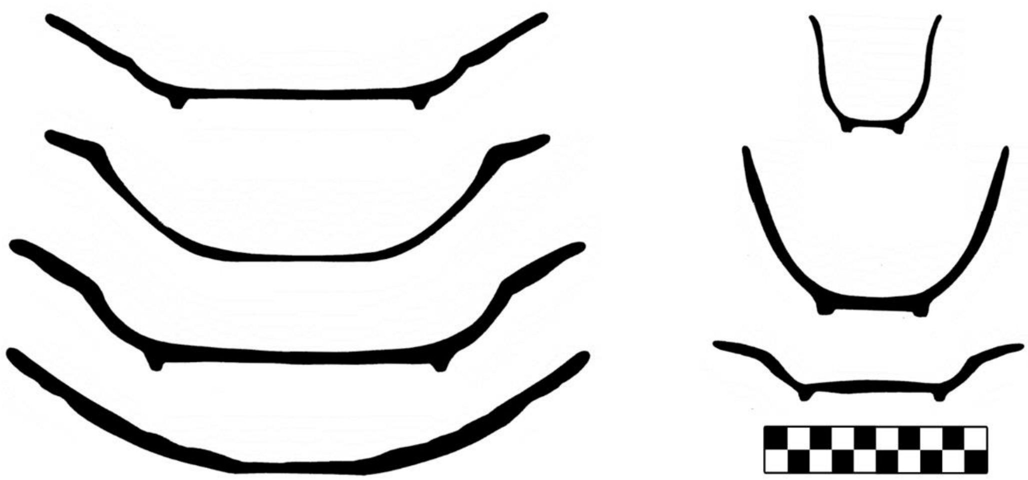

**Figure 8** Drawing of an assortment of Panamanian Majolica plate, cup, and bowl profiles. Source: Rovira (2001a: 188).

Chemical characterization studies using INAA provide a second line of evidence for a Panamanian production center. Olin et al.'s (1978: 225) initial results, while based on a small sample size, indicated that tin-glazed sherds recovered at Panamá la Vieja could be chemically discriminated from those recovered in Mexico, Guatemala, Cuzco (in Peru), and Quito, based on high concentrations of cesium (Cs) oxide. In subsequent

---

the early 17th century) that was later replaced by ringed-based brimmed plates (Deagan 1987: 56, 57).

decades, this interpretation has been validated using a total of 129 sherds recovered from Cuenca, Quito (Jamieson and Hancock 2004), Lima (Iñañez et al. 2012), and Panamá la Vieja (Rovira et al. 2006) (Figure 9), all of which had been classified as Panamanian Majolica. These results indicate that, despite their typological differences, the ware forms a cohesive and distinct chemical group characterized by its "very high As [Arsenic] and Cs concentrations" (Jamieson and Hancock 2004: 573). Furthermore, other locally-produced unglazed ware types (referred to as Redware and Redware Containers) shared a similar chemical signature with the Panamanian Majolica and were also sorted into the same group (Jamieson and Hancock 2004: 580; Rovira et al. 2006: 114; Jamieson et al. 2013: 203). Among the analyzed sherds there were several samples that were initially not considered to be Panamanian because their "paste colour seemed to be too light an orange," (Jamieson and Hancock 2004: 573) but their chemistry indicated they were produced in Asunción de Panamá.

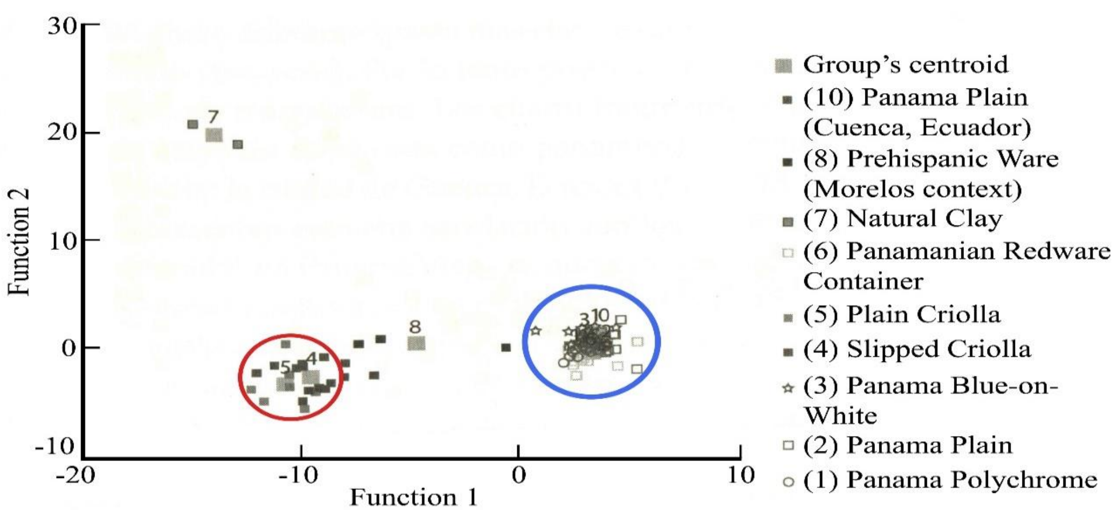


**Figure 9** Results of Rovira et al. (2006: 115) INAA study on the composition of different ceramics recovered from Panamá la Vieja (and Cuenca, Ecuador to a lesser extent). The clusters in the blue circle are comprised of three types of Panamanian Majolica and Panamanian Redware Container sherds, and the red circle of Plain and Slipped Criolla sherds.

# CHAPTER 5

# PANAMANIAN MAJOLICA RESULTS AND DISCUSSION

Microscopic characterization of the 30 analyzed Panamanian Majolica sherds confirmed the ware's clear compositional and technological affinity, since each sherd conformed to a single fabric group, referred to as Fabric 1. These results indicate that a single paste recipe and production sequence was used at Asunción de Panamá's majolica workshops for this ware's manufacture. Fabric 1 is characterized by a fine-textured fabric, whose paste was decanted of coarse sand-sized (0.5-2 mm) inclusions, formed by wheel, and fired in kilns under oxidizing conditions to maximum temperatures that were not sustained above 1100ºC for a long period of time. The raw clay appears to have derived from a sedimentary deposit of an intermediate igneous source composed of coarse-grained intermediate igneous rocks (likely from either granodiorite or tonalite), plagioclase feldspar, quartz, hornblende, and biotite minerals (see Table 1 in Appendix 3 for details). The sample's compositional cohesion mirrors Panamanian Majolica's strong chemical affinity, as previously determined through INAA by several authors, and further supports the hypothesis that this ware's clay was procured from a single deposit. A detailed description of Fabric 1's main microscopic and mineralogical characteristic follows, before turning to an examination of the technological and social implications of the ware's production process.

*Microscopic Characterization of Panamanian Majolica Fabrics*

While the relatively low proportion of the coarse fraction[44] (16% on average) and small grain size (ranging between fine sand, 0.06-0.25 mm, and medium sand, 0.25-0.5 mm, sizes) in Panamanian Majolica fabrics complicates the establishment of this group's clay provenience, data obtained from a coarser-textured but compositionally-related fabric group (referred to as Fabric 2) reveal significant information on the geological origin of the ware's raw clay. Fabric 2 is composed of a sample of three Panamanian Redware Container sherds that are believed to have been produced in the same workshops as Panamanian Majolica vessels, given their macroscopic (Rovira et al. 2006: 110) and microscopic similarities (Pourcelot 2017), and chemical affinities (Jamieson and Hancock 2004: 573, 580; Rovira et al. 2006: 114; Jamieson et al. 2013: 203). Petrographic analysis revealed that both fabric groups share the same mineralogical constituents, but coarse sand-sized inclusions are naturally more predominant in Fabric 2 (Figure 11) (Pourcelot 2017: 20). The dominant presence of coarse-grained intermediate igneous rock, plagioclase feldspar, quartz, hornblende, and biotite crystals in almost equal proportions in Fabrics 1 and 2 indicates that the clay used in both groups derived from the breakdown of an intermediate igneous source.

While Fabric 1's predominant textural uniformity, unimodal grain size distribution, and low proportionality of its coarse fraction strongly suggest that a

[44] For this thesis, only inclusions whose size were above the very fine sand-sized limit were considered part of a fabric's coarse fraction.

refinement technique[45] (either levigation or sieving) was applied to produce its fine-textured paste, this interpretation can only be conclusively determined through the analysis of raw clay samples, given that fine-textured clay deposits are known to exist in nature (Quinn 2013: 156). Nonetheless, a compelling argument in support of this hypothesis is the proportional changes of specific lithic inclusions observed in Fabric 1 and Fabric 2 sherds, since paste refinement processes can alter the mineralogical composition of a clay body by "concentrating inclusion types that occur as small clast in the clay material" (Quinn 2013: 156). Fabric 2 contains two main types of lithic inclusions whose size fractions are clearly distinct: the finer micro-crypto crystalline granular rocks[46] whose grains are largely between the fine to medium sand size range, and the coarser coarse-grained intermediate igneous rocks whose clasts are predominantly in the coarse sand size range (Figure 10). In Fabric 1 the latter rock fragments are largely absent while the former, which are of a similar size range to those in Fabric 2, become the fabric's predominant lithic inclusion. Therefore, the significant decrease in the frequency of coarse-grained intermediate igneous rock clasts in Fabric 1 suggests that a decanting technique was applied, for these larger-sized inclusions are more likely to be removed by potters.

[45] Petrographic evidence leaves open the possibility that, apart from this refinement process, two different clay sources were mixed together (a possibility that might be confirmed with future research). A more detailed description and discussion is available in the "OBSERVATION" section of Table 1 in Appendix 3.

[46] Term used in this project to refer to clasts that are composed solely of granular-textured microcrystalline to cryptocrystalline first order interference color minerals (quartz, plagioclase feldspar, and/or orthopyroxene).

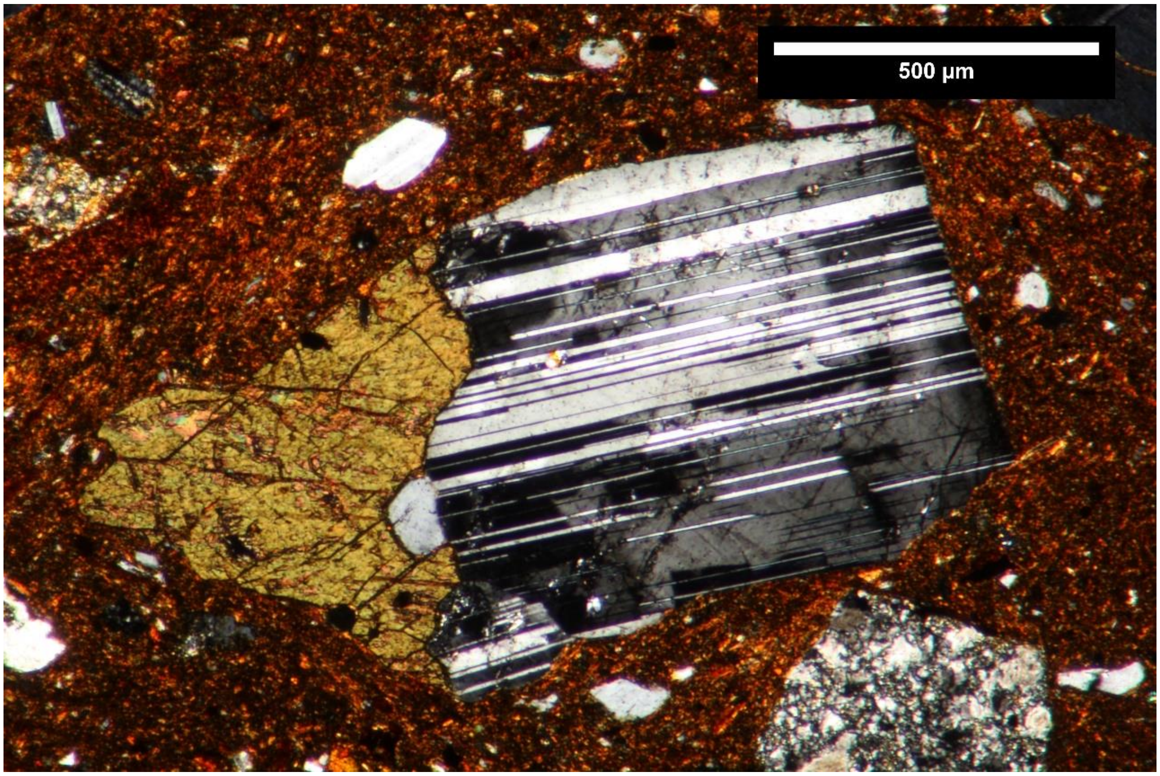


**Figure 10** Photomicrograph of a coarse-grained intermediate igneous rock clast (center) and a micro-crypto crystalline granular rock clast (bottom right) found in a Fabric 2 sherd (TPPV-14). Note the significant size difference between these two inclusions.

Fabric 1 sherds appear to have commonly sustained maximum firing temperatures above 1000ºC given the matrices' predominant very low to low optical activity, evidence of mineralogical alterations,[47] and the presence of a tin-glaze layer which requires sustained temperatures above that threshold to properly mature and adhere to the clay body (Lister and Lister 1982: 87; 1987: 266). The absence of melted plagioclase feldspar crystals in the entire sample indicates that temperatures were not sustained above 1100ºC

[47] The prevalence of hornblende crystals with a change of their color in PPL (turning brown instead of green) as well as biotite crystals with splits along cleavage planes indicate that temperatures above 750ºC and 900-1000ºC were sustained to cause these respective alterations (Quinn 2013: 191).

long enough to allow this alteration to occur (Quinn 2013: 185, 191). Further macroscopic evidence, such as the paste's uniform color and lack of firing cores, indicates that oxidizing conditions were sustained long enough to allow the sherds' complete oxidation. Finally, the high maximum firing temperature estimate points to the use of a closed firing regime (a kiln), and the absence of firing clouds in the entire sample suggests that the firebox and chamber were separate.

*Technological and Social Implications*

The entire sample's sorting into a single group indicates that the same paste was used to produce Panamanian Majolica independent of the presence or absence of painted decoration and color combinations. Thus the ware's typological distinctions reflect decorative choices and not significant technological variances. Nonetheless within Fabric 1 there were subtle but visible variations that prompted the establishment of three sub-groups referred to as 1a, 1b, and 1c (Figure 11) (most of the sample (n=28) sorted into the first two sub-fabrics). Table 5 presents each sub-fabric's main characteristics:

**Table 5** Characterization of Panamanian Majolica sub-fabric groups.

| Sub-Fabric | Defining attributes | Sample size |
|---|---|---|
| **1a** | Well to very well sorted and single-spaced fabrics that contain a high frequency of very-fine sand sized (0.064-0.125 mm) inclusions. | 12 |
| **1b** | Well to very well sorted and double-spaced fabrics that contain a low frequency of very-fine sand sized inclusions. | 16 |
| **1c** | Moderately sorted and single-spaced fabrics that exhibit a weakly bimodal particle distribution.[48] | 2 |

[48] Sub-Fabric 1c's sorting, particle distribution, and rare incidence in the sample likely represents clay bodies that were less thoroughly refined, resulting in a higher frequency of coarse sand-sized inclusions than that found in sub-fabrics 1a or 1b.

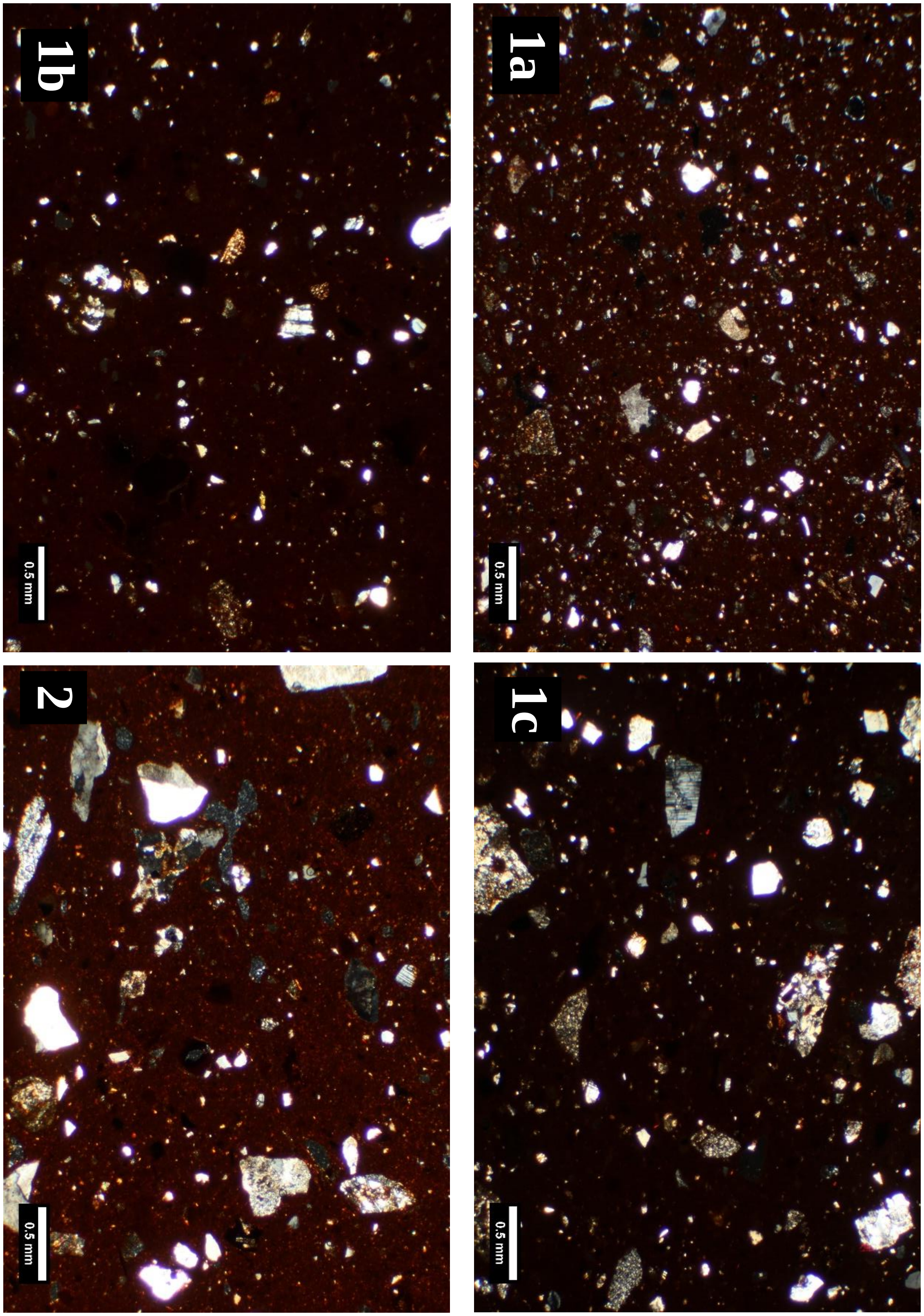

**Figure 11** Photomicrographs of the matrices of a Fabric 1a (TPPV-5), 1b (TPPV-9), 1c (TPPV-23), and 2 (TPPV-12) sherds in XPL.

When the distribution of these sub-fabrics is examined by context and type of ware, two correlations can be discerned. First is an evident association between one of the fabric subgroups and a specific majolica type, for all Polychrome Type A sherds sorted into the 1b group. The second is the influence temporality appears to exercise in this patterning: Sub-Fabric 1a is slightly more common in samples recovered from the early context, while Sub-Fabric 1b becomes more frequent in the late context (Figure 12). This suggests that potters at these workshops may have gradually changed the source (though not the deposit itself) where they procured their clay over time, going from one rich in very fine sand-sized grains in the early 17th century to one with fewer inclusions in that size range in the late 17th century. Building on this association, the predominance of Polychrome Type A sherds with 1b fabrics could indicate that this type of majolica was produced at a slightly later time than Plain and Blue-on-White types. This inference coincides with Long's (1967: 18) and Baker's (1969: 45) hypotheses, in which they argued that polychromatic vessels were a later product of the workshops, based on their presence in the middle and upper levels of the stratigraphic sequences they analyzed (Pourcelot 2017). Nevertheless, the analysis of additional samples is required to more conclusively determine whether this minor compositional variation can be attributed to temporality.

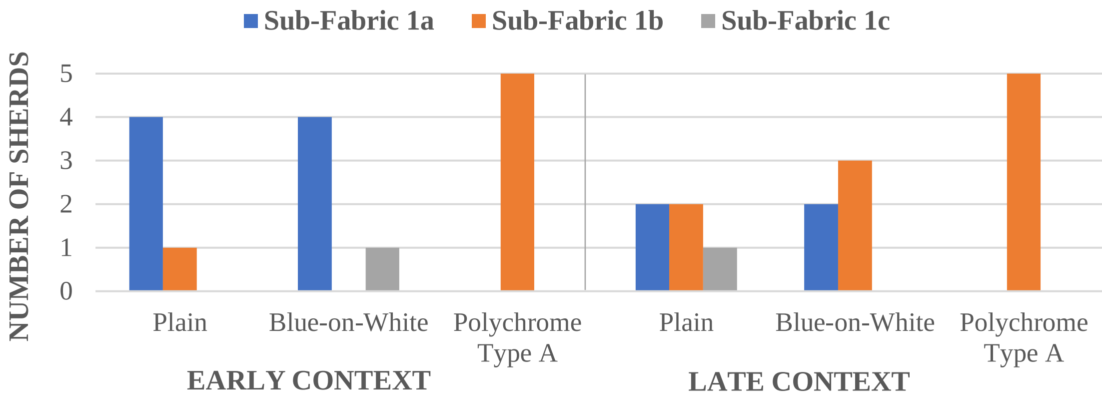


**Figure 11** Distribution of Panamanian Majolica sub-fabric groups by type over time.

It is worth noting that the ware's compositional and technological uniformity contrasts with observed diachronic changes in Panamanian Majolica's iconography and morphology in the archaeological record (Rovira 2001b; Rovira and Mojica 2007). While potters at Asunción de Panamá's workshops adapted their vessels' forms and decorations to the market's changing stylistic demands, they appear to have maintained the paste recipe and production sequence intact. Such a pattern is consistent with the notion discussed in Chapter 1 that certain stages in the production process (such as the primary forming technique and paste preparation) are less likely to be modified than a vessel's more visible attributes (such as decorative technique and iconography), because the latter superficial elements are more affected by changes in consumer taste (Gosselain 2000).

Arguably the most significant implication of these results is that the use of a single paste recipe reflects a diachronic continuity of production practices maintained when *all* potters adhered to a set of established norms to produce tin-glazed vessels. This temporal consistency strongly indicates that knowledge related to the production of this ware was successfully transferred from one generation to the next without discernable

degrees of variation or innovation either in the original paste recipe or in other stages in the manufacturing process[49]. While historical information related to the specific setting in which this transmission took place in Asunción de Panamá is currently lacking, there are many reasons to suppose that the training of majolica potters occurred through structured apprenticeships, as happened in the coeval production centers of New Spain.

Apprenticeships promote adequate training and proper technical execution through regular supervision of the trainee by an experienced potter and long terms of training (Livingstone-Smith 2000). Historical data from New Spain's majolica production centers reveal that a hierarchical training system composed of *maestros* and apprentices (who were usually adolescents) was in place, a system that required the former to provide the latter with proper training and housing in exchange for specialized labor in the workshop for a term that typically lasted between three to four years (Lister and Lister 1987: 299-300; Castro 2002: 59; Castillo Cardenas 2007: 27). Through recurrent, prolonged, and supervised practice, apprentices eventually internalized both technical gestures and production procedures until these became part of their unconscious behavior and action or habitus. Over time the *maestro*'s *chaîne opératoire* became doxic, to draw on Bourdieu's terminology. Changes or innovations in the established norms were unlikely to occur, especially in those stages of the manufacturing process that are more connected to a potter's technical behavior, such as the primary forming technique or paste preparation (Gosselain 2000). It is this set of instructed and internalized knowledge that

[49] While the low variability of Panamanian Majolica fabrics in this research sample strongly supports this statement, I recognize that additional samples need to be analyzed to confirm the observed pattern of compositional and technological uniformity.

would be transmitted to another generation of potters by now-skilled apprentices through a similar learning context (Dietler and Herbich 1998; Dobres 2000).

The existence of a structured training system in Asunción de Panamá's majolica workshops would account for Fabric 1's strong diachronic compositional and technological consistency, as it reflects a *maestro*'s control over the technological choices that were taught by means of direct supervision, thereby also guaranteeing adherence to a set of established norms. The existence of a supervised learning context would also explain the lack of significant technological and compositional variation in a span of 50 to 59 years of Panamanian Majolica production, as it would have deterred any modifications of the established *chaîne opératoire* without the explicit approval of the workshop's *maestro*, thus discouraging innovation from an early stage of a potter's training. The rigid adherence to a single production sequence for Panamanian Majolica vessels in itself suggests that a tightly controlled learning context prevailed, alluding to the existence of such a training system in Asunción de Panamá's workshops.

While the establishment and maintenance of a single paste recipe for Panamanian Majolica vessels may have been the result of the potters' unconscious behavior or habitus, it could have also been influenced by conscious economic choices. Neither cultural nor functional factors explaining the low variability of the analyzed fabrics are mutually exclusive, for both can play an equally influential role in the formation of standardized products (Longacre 1999). Nevertheless, I believe that given the specialized nature of tin glaze production in Spain and New Spain (Lister and Lister 1987; Connors McQuade 2005), possible economic factors warrant consideration.

The consolidation of colonies in the Americas generated a widespread demand among immigrating Spaniards for commodities they were accustomed to in their Iberian homes, commodities which included the tin-glazed vessels initially supplied from Europe and later supplanted by local production centers (Rice 2013). It is possible that the development of various local workshops provoked competition among artisans who, in turn, may have sought to standardize their production practices in order to guarantee a consistent quality of the vessels they sold in the local and international markets (Longacre 1999). In this sense, the establishment and strong adherence to a *chaîne opératoire* could represent a conscious effort by Asunción de Panamá's potters to ensure their product's quality and thereby its marketability.

In addition, the use of a single paste recipe for tin-glazed vessels might have served as a mechanism to prevent possible economic losses during the firing stage. Firing is arguably the most critical process in the ceramic production sequence, as it is in this stage that clay loses its plasticity and is transformed to a synthetic material. If potters fail to adequately control several variables, including temperature, atmosphere, and firing rate, they risk causing irreparable damage to their vessels (Rye 1988: 96-122; Rice 2005: 152-164). This risk would have been particularly significant for majolica potters[50] in Asunción de Panamá, as it appears likely that some of the raw materials they needed for the glaze recipe and painted decoration (tin, lead, and cobalt oxides) were not procured locally and had to be imported instead. Since different clays contain distinct

[50] Historical documents reveal that workshops often hired individuals who were only specialized in handling or stacking vessels inside the kiln, further evidencing the critical nature of this stage (Lister and Lister 1987: 261).

physicochemical properties that can react differently to the effects of firing, scholars such as Van der Leeuw (1984) observe that some contemporary potting communities (particularly those who engage in communal firings) tend to decrease the variability of their pastes to reduce failures in this stage of the ceramic production sequence. It could be argued that by standardizing Panamanian Majolica's paste, potters sought to ensure that every tin-glazed vessel loaded in the kiln had nearly identical physicochemical properties, thereby reducing the economic risk of firing failures.

Independent of the conscious and unconscious factors that might have influenced the establishment and maintenance of a single clay recipe in Asunción de Panamá's majolica workshops, its successful generational transmission reflects the formation of a technological tradition in this city. Technological traditions refer to a consensus regarding the set technological choices (or the *chaîne opératoire*) required in the production of ceramics that are "socially significant in a given context" and are characterized by assemblages exhibiting low variability in paste recipes (Albero 2014: 241). The presence of a clear technological tradition in Asunción de Panamá likely reflects a stable organization of Panamanian Majolica production whereby social norms persisted over time without significant modifications.

# CHAPTER 6

# LOCAL CERAMIC PRODUCTION OUTSIDE OF THE SPANISH-TRADITION WORKSHOPS IN 16TH AND 17TH CENTURY SPANISH AMERICA AND ASUNCIÓN DE PANAMÁ

Prior to the arrival of Europeans, ceramics were profusely produced in many regions across the Americas with varying degrees of artistry and sophistication. As colonization consolidated, some indigenous potting communities came into contact with migrating artisans from Europe, Africa, as well as other regions in America, who brought along with them novel technologies, techniques, and knowledge. At this crossroad where different ceramic traditions met, potters from different communities were exposed to new practices in ceramic production, which they could consciously choose to incorporate in their craft or not. While not all potters had equal access to the knowledge and resources required to adopt some of the modifications they wished to make to their repertoire, the Colonial period as a whole marked an era of rapid and profound changes in the ceramic record across the American continent.

This chapter's opening section explores how potters in the Americas actively responded to the multiplicity of production practices available, some of which were

novel. I present descriptions of local ceramic assemblages that were produced outside of the traditional Spanish workshops during the 16th and 17th centuries across Spanish America (Figure 13). This generalized category is meant to group local wares whose combination of production practices and morphology is distinct from that of the specialized Spanish ceramic repertoires manufactured in workshops such as those described in Chapter 4, where locally-produced assemblages very closely resembled those from Spain. Given that these wares produced outside of the Spanish-tradition workshops largely did not follow European-derived production practices, such as the use of a potter's wheel, they are commonly regarded by academics to have been manufactured by indigenous or African potters.[51] Nonetheless, the participation of informal Spanish potters in the production of some of these assemblages should not be discarded peremptorily.

The selected case studies focus on technological continuity and change in the ceramic record before the 17th century and are presented to illustrate the multiplicity of responses by potters during the early Colonial period, especially those of presumed indigenous and African ancestry.[52] The final section examines in detail Asunción de

[51] Although terms such as "Colonoware," "Indo-Hispanic," and "Criollo" are widely employed in the academic literature to refer to wares that were presumably produced by non-European potters during the Colonial period, their often perfunctory usage has been criticized for essentializing technological and decorative attributes and using these as ethnic markers in ways that neither reflect the complex relationships in colonial society nor are strongly supported by archaeological evidence (Hauser and DeCorse 2003). I have opted not to use the aforementioned labels as a grouping term in this thesis in an effort to avoid their problematic associations, but I will retain any such names already used by scholars in my case studies to avoid further confusion.

[52] Other important case studies (especially Elpidio Ortega's research in the Dominican Republic among other Circum-Caribbean region studies) were not included in the final

Panamá's Criolla Ware, for which a thorough characterization of its main macroscopical, typological, stylistic, morphological, and chemical attributes is provided and the issue of its provenience and temporality is introduced.


**Figure 12** Map of Spanish America showing the production centers of the assemblages mentioned in this chapter.

*Ceramic Production Outside of the Spanish-Tradition Workshops in Spanish America*

Archaeological findings and archival documents reveal that, in at least five towns surrounding the viceregal capital of Mexico City, ceramics continued to be manufactured in which vessels and their *chaîne opératoire* remained largely consistent with the preceding Aztec potting traditions. Researchers have found that certain stages in the

selection, because either their scope was limited to a description of the ceramic's physical attributes or I was not able to access them.

production sequence of late pre-Hispanic wares, principally Red Ware and Aztec Black-on-Orange, were not modified during the 16th and 17th centuries, such as the clay recipe,[53] firing strategy, primary forming technique, vessel morphology, and decorative color palate (Charlton et al. 2007: 436, 439-440; Charlton and Fournier 2010: 134; Hernández Sánchez 2011: 107, 109, 120-121). Conversely, other elements in the *chaîne opératoire* did vary during this time period, notably the diminished quality of the vessel luster obtained through burnishing, a decline of Aztec-inspired designs (particularly religious motifs), and the appearance of new decorative techniques in these assemblages. Furthermore, forms and iconographic elements that were once exclusive to Aztec Black-on-Orange began to be applied in Red Ware vessels during the Colonial period (Charlton et al. 2007: 439-440, 446-447; Charlton and Fournier 2010: 133; Hernández Sánchez 2011: 111, 113-114). While some researchers have suggested that these changes imply a decline in Aztec potting traditions (Charlton et al. 2007), Hernández Sánchez (2011) argues that it could indicate a disruption of pre-Hispanic "guild-like" norms that restricted morphological and decorative elements to specific ware-types.

In addition to these changes, the morphological repertoire of the Aztec-tradition assemblages increased, as indigenous potters incorporated European-styled forms such as candleholders and basins to suit the needs of both Spanish and Native clientele (Lister and Lister 1982: 98; Hernández Sánchez 2011: 136). Possibly the most significant technology adoption made by indigenous potters was the application of lead-based glazes

[53] The referenced resemblance between pre-Hispanic and Colonial clay recipes in Hernández Sánchez (2011: 108) is based on the similarity of the pastes' physical attributes and not determined by compositional analysis.

to their vessels (Aguirre 1997: 29; Gómez et al. 2001: 33; Charlton et al. 2007: 485-488; Hernández Sánchez 2011: 118, 119). This type of glaze was achieved after a bisque or unfired (known as green ware) vessel was either brushed or dipped into a solution containing lead oxide and fine silica sand and fired at a low temperature to produce a glossy vitreous coating. The glaze could be tinted by adding copper or iron oxides to the solution, obtaining a green- or amber-colored surface respectively (Lister and Lister 1982: 81). The widespread acceptance of lead glaze by indigenous potters was noted by 16th century chroniclers (Torquemeda 1977: 255; Gámez Martínez 2003: 231), some of whom maintained that while these potters "were not familiar with glazing, they learned this process later from the first *maestro* who arrived from Spain, no matter how much he guarded and protected it from them" (Gerónimo de Mendieta[54] quoted in Connors McQuade 2015: 62). It is also possible that indigenous laborers in Spanish workshops might have had access to this new technology and used it in their own assemblages.

While the historical record does not make any reference to the organization of indigenous production centers, the existence of distinct but concurrent production sequences, morphology, and decorations suggests that indigenous and Spanish workshops were separate. As a result, both Aztec and Spanish ceramic traditions in the Valley of Mexico "existed at the same time but were maintained separately, and for this reason, their products maintained their own dynamics of development" (Hernández Sánchez 2011: 94, 142, 150, 217). Furthermore, Hernández Sánchez (2011: 101) argues that Native workshops were confined to the domestic sphere and would have been operated

[54] Mendieta's account, titled *Historia eclesiástica Indiana*, was written between 1571 and 1596.

by members of a single family, as they are today in the Valley of Mexico's rural centers, where knowledge related to ceramic production is transmitted among family members.

Unlike Red Ware and Aztec Black-on-Orange, Indígena Ware was a hand-made ceramic ware with no pre-Hispanic precursors, covered in a white-colored slip under a lead-glazed surface. It has been reported in several 16th and 17th centuries contexts in New Spain. While its provenience was once attributed to the Iberian Peninsula by Rodríguez-Alegría et al. (2003), subsequent INAA tests have situated its production in the Patzcuaro Basin of Michoacán, Mexico,[55] which still is predominantly inhabited by indigenous Purepecha communities (Fournier et al. 2007). Indígena Ware was modelled into European-styled forms (e.g. brimmed plates, basins, and *escudillas)* through coiling or molding, as evidenced by the absence of throwing marks on the vessel's surface. It may have been fired in kilns, evidenced by the lack of firing clouds and presence of cockspurs scars, and vessels were occasionally decorated with indigenous iconography using a *sgraffito* technique widely-considered[56] to be of European derivation (Lister and Lister 1982: 96, 97; Fournier et al. 2007: 199; Hernández Sánchez 2011: 113). Researchers agree that this ware represents an attempt by Purepecha potters to imitate the physical attributes of majolica using white-colored slips, often referred to as a "false

[55] Laser ablation, multi-collector, inductively coupled plasma-mass spectrometry (LA-MC-ICP-MS) tests on this ware's glaze indicates that the composition of the lead isotope is similar to that used in other wares produced in Puebla, thus further supporting evidence that Indigena Ware was produced in New Spain (Iñañez et al. 2010).

[56] It is worth noting that while *sgraffito* is common in European assemblages, Mesoamerican archaeologists have reported the use of similar techniques of incising decorations through slipped surfaces prior to firing in vessels recovered from Middle and Late Formative sites in Oaxaca (R. Zeitlin 1994), and from Early Postclassic sites in the southern Isthmus of Tehuantepec, Mexico (J. Zeitlin 1978). Therefore, it is also possible that *sgraffito* was already known to indigenous potters.

majolica" (Lister and Lister 1978: 21; Gómez et al. 2001: 34; Charlton et al. 2007: 470-471). This interpretation appears to be supported in the historical record, for according to a 1583 complaint, lead glaze journeymen (*oficiales*) from Patzcuaro protested against the presence of indigenous potters, as they couldn't be "…journeymen of this craft nor do they even know how to properly make plates and from which results in *fraud and deception* to the republic…," and argued that Native ceramics should not be allowed to be produced and sold (Martín López de Gaona quoted in Connors McQuade 2005: 84, my translation and emphasis).

Turning briefly to the Andean region, mid- to late-16th century archaeological assemblages from the Zaña and Chicama valleys in Peru include vessels called Early Green Glazed (EGG) Ware that were predominantly modeled in pre-Hispanic Chimu-Inka forms (though European-styled vessels have also been identified) and are covered in a green-colored lead glaze. These rural sites appear to have been predominantly inhabited by indigenous populations, and EGG Ware's compositional data obtained from INAA and Inductively Coupled Plasma-Mass Spectrometer (IA-ICP-MS) tests suggest that it was produced in several workshops, due to the diversity of chemical groups, and in open firing regimes, as indicated by differences in paste color, states of vitrification, and temperatures. No information regarding its primary forming technique was provided (VanValkenburgh et al. 2015; 2017).

Finally, I present two separate examples of colonial pottery outside of the European tradition from the Caribbean. In the Dominican Republic, comparative petrographic analysis was performed on both pre-Hispanic and 16th century indigenous

Black Ware and Red Ware assemblages from the mining site of Cotuí Viejo (1505-1562), which indicated that these wares' production sequence largely remained consistent over both periods. Procurement strategies (that is the use of local raw clays from multiple sources), primary forming technique (coiling), low maximum firing temperatures achieved in open firing regimes, and Black Ware's clay paste preparation (characterized by heterogeneity in the overall abundance, size, and sorting of inclusions) appeared to have persisted into the Colonial period. Nonetheless, certain elements in the *chaîne opératoire* did vary, as Red Ware exhibited a more homogeneous paste than before, red-colored slip began to be applied, decorations on both wares became scant, and firing atmosphere exhibited more consistency. Black Ware began to be fired mostly in a reducing atmosphere, while Red Ware was fired in a completely oxidizing atmosphere during the Colonial period. These results indicate that indigenous potters in Cotuí Viejo selectively maintained certain aspects of the Native potting tradition while changing others (Ting et al. 2018).

In Haiti, the short-lived Spanish town of Puerto Real (1502-1578) represents one of the few areas in the Spanish Caribbean where changing demographics have been well documented archaeologically, due to the dramatic decline in 1520 of the indigenous Taino population (caused by diseases and brutal labor conditions) and their subsequent replacement by African slaves. Thus, the appearance and increasing temporal frequency of ceramic wares in the archaeological record whose physical attributes do not resemble either European or indigenous traditions have led researchers to suggest that they are products of African potters. The most prevalent of these wares, called Christophe Plain, is characterized by undecorated, thick-walled hemispherical bowls that were formed

through coiling, using a very coarse paste that, according to macroscopic observation, was procured from a single clay source and fired at very low temperatures (approximately 500° to 575° C according to re-firing experiments). The function of Christophe Plain was likely associated with cooking, due to the large percentage of sherds with sooty surfaces (Smith 1986; 1995).

This collection of case studies demonstrates that while some indigenous and African potters "openly and selectively incorporated or reinterpreted a number of elements of Spanish ceramic technology" (Hernández Sánchez 2011: 144), others opted not to do so. Depending on the local context of production, a potter's response to the introduction of novel technology and techniques as well as his or her displacement to a foreign setting was diverse and, in some ways, unique. Nonetheless, one commonality that emerged in this review was that the most visible stages in the production sequence (e.g. vessel form, surface treatment, and decoration) were the most prone to modification, while those that are more deeply rooted and internalized in a potter's training (e.g. primary forming technique and firing strategy) remained consistent. Of the three most significant technological developments brought by the Spanish to the Americas, lead glazing appears to be the only one that was widely incorporated in local assemblages,[57] while the potting wheel and two-chambered kiln were not broadly adopted during the 16th and 17th centuries (Indígena Ware being the notable exception). As Hernández Sánchez' (2011: 145) concludes, indigenous potters in the Valley of Mexico "worked following the

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[57] The practice of lead glazing wares produced by African potters has also been reported in Jamaica, an English colony, from the 17th century (Hauser 2013), but for this chapter I am only considering sites in Spanish American colonies.

same dynamics as in ancient times, that is, they conserved their familiar methods of forming while they adapted the visible aspects of the vessels to the situation of the present time" (2011: 145). This observation, while preliminary until more case studies are reviewed, is consistent with Gosselain's (2000) notion that a vessel's most superficial attributes are more prone to change than stages in the production sequence that leave little to no visible traces in the finished product.

*Characterization of Criolla Ware*

As in the aforementioned colonial sites, ceramic production at Panamá la Vieja long preceded the arrival of Spaniards to its shores. Although the details of the local pre-Hispanic assemblages are beyond the scope of this thesis,[58] at least four wares have been identified whose stylistic attributes closely resemble those of other assemblages in the Gran Darién in their profuse and elaborate application of plastic decoration (such as reliefs, incisions, impressions) and scant use of painted motifs (Mendizábal and Gómez 2015: 17-23). While it is still unclear whether any of these traditions persisted through the initial years of Spanish occupation, the presence of vessels that seemingly did not follow European production practices in Asunción de Panamá's archaeological record has been widely reported.

Criolla Ware[59] (henceforth Criolla) refers to a handmade coarse earthenware that was scantly decorated with plastic designs and fired at low temperature. The small range

[58] For detailed characterizations of Panamá la Vieja's pre-Hispanic ceramic assemblages see Biese (1964), Mendizábal (2004), and Martín-Rincón (2006).
[59] This ware has been referred to as "Colono Indian Ware" (Long 1967; Baker 1969), "Cerámica Hispano Indígena" (Rovira 1984), and "Panamanian Coarse Handmade Earthenware" (Schreg 2010), before the term Criolla (or creole) was used to include the

of forms and presence of soot and chalk deposition in Criolla vessels indicate a utilitarian use associated with the preparation, storage, and serving of food (Baker 1969: 19, 20; Schreg 2010: 136, 145). The technology used in its production (either coil- or slab-building) is generally regarded as being non-European, which along with the plastic-decorated iconography, is used to argue that it was manufactured by Natives and/or Africans (Linero Baroni 2001: 149; Schreg 2010: 141; Gaitán-Amaan 2012: 184, 185), though the socioracial identity of its potters has yet to be determined. Currently the typological grouping of this ware is based on the presence or absence of a red-colored slip—Plain Criolla (*Criolla sin Engobe*) and Slipped Criolla (*Criolla con Engobe*) (Linero Baroni 2001: 150-151; Rovira and Gaitán 2010: 46). Although lead-glazed sherds have reportedly been identified (Schreg 2010: 154), these are exceptional cases and it appears that glazing was not prevalent, unlike the case of other assemblages produced outside of Spanish-tradition workshops that were reviewed in the previous section.

Due to the variations in color, thickness, and surface finish that can be found "within the construct of a single vessel" and "do not lend themselves easily to the formation of exclusive 'types'" (Baker 1969: 28), listing the full range of characteristic features can be a confusing undertaking. To demonstrate this, Table 6 compiles the different formal attributes of both types of Criolla based on the data published in six monographs that examined samples recovered from Panamá la Vieja:

possibility that African potters were involved in its production (Linero Baroni 2001: 149). While I believe that this ware's nomenclature requires revising, I have opted to maintain it until the ware's production centers are identified, as their establishment may provide a better understanding of these vessels' production and circulation.

**Table 6** List of Criolla attributes by type.

| Attribute | | Slipped Criolla L | Slipped Criolla B | Slipped Criolla LB | Slipped Criolla Z | Slipped Criolla GA | Plain Criolla L | Plain Criolla B | Plain Criolla LB | Plain Criolla S | Plain Criolla GA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Paste color** | Orange | | | | ■ | | | | | | |
| | Red | | ■ | | ■ | | | ■ | | | |
| | Red-buff | | ■ | | | | | ■ | | | |
| | Light buff | | ■ | | | | | ■ | | | |
| | Tan | ■ | | | | ■ | ■ | | | | ■ |
| | Light brown | | | | ■ | | | | | | |
| | Dark brown | | | | | ■ | | | | | ■ |
| | Grey-black | | ■ | | | | | ■ | | | |
| | Black | ■ | ■ | | | | ■ | ■ | ■ | | |
| **Vessel form** | Globular jar (or *olla*) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Semi-globular bowl | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Plate? | | | | ■ | | | | | ■ | |
| | Lid? | | | | | | | | | ■ | |
| **Surface finish** | Smoothened | ■ | | ■ | ■ | | ■ | | ■ | ■ | |
| | Polished | | ■ | ■ | ■ | | | ■ | ■ | | |
| | Burnished | ■ | | ■ | | ■ | ■ | | ■ | ■ | ■ |
| | Rough | ■ | | ■ | | | ■ | | ■ | | |
| **Decoration type** | Incision | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Applique | | | | ■ | | | | | ■ | |
| | Relief | | | ■ | ■ | | | | ■ | | |
| | Impression | | ■ | ■ | ■ | | | ■ | ■ | ■ | |
| | Piercing | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| **Handle type** | Lug | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Strap | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| | Ring | | | ■ | ■ | | | | | | |

**Authors**

L: Long 1967 B: Baker 1969 LB: Linero Baroni 2001 Z: Zárate 2004 S: Schreg 2010 GA: Gaitan-Amaan 2012

While the color of the paste varies significantly, many studies note that firing cores and various types of medium- to large-sized inclusions (or temper) are commonly present (Baker 1969: 21; Linero Baroni 2001: 50; Zárate 2004; Schreg 2010: 141). Criolla vessels were predominantly shaped into globular jars (or *ollas*) and hemispherical bowls with convex bases, with and without necks with everted, inverted, or upright rims,

and rounded or beveled lips (Linero Baroni 2001: 155; Zárate 2004; Schreg 2010: 141-142, 145). Some of these jars resemble that of European-styled *ollas* in form, with the notable exception that the latter have flat bases. Plates and/or lids have also been reported but they are rare (Figure 14) (Zárate 2004; Schreg 2010: 145). The surface of these vessels was frequently smoothed, polished, or burnished, but some pots have a rough finish (Long 1967: 28; Linero Baroni 2001: 150). These vessels were fired either in residential settings (Long 1967: 29; Rovira 1984: 288) or possibly in workshops, given supposed evidence of lead glazing found in a few samples[60] (Schreg 2010: 154). Plain Criolla appears to have been largely fired under a reducing atmosphere, as indicated by the total or partially black-color of its paste (Schreg 2010: 141). Firing clouds caused by the contact with a heat source, associated with either the vessel's production (Rovira 1984: 288) or its use in the kitchen (Linero Baroni 2001: 153-154), are common.


**Figure 13** Photograph of an assortment of Plain and Slipped Criolla bowls, plates and appendages recovered in Panamá la Vieja.

[60] No Criolla sherds were recovered in the 2015 kiln excavation (Mendizábal and Gómez 2015: 91-92).

Though rare, the addition of functional appendages (such as handles) and use of different forms of plastic decoration are among the most diagnostic features of this ware (Linero Baroni 2001: 162-163). The two most common handles are strap and lug handles; the former is commonly found on globular jars and consist of an approximately 20 mm wide rectangular-shaped pad attached to everted or straight rims just below the neck, while the latter consist of straight or wavy short horizontal strips of clay applied beneath the rim (Linero Baroni 2001: 154, 162; Schreg 2010: 145, 146). In some cases, the strap handles are decorated with circular-shaped punctures and appliques of one or more small clay ellipsoids with shallow impressions (referred to as “coffee bean” appliques), while some of the lug handles may be pinched (Linero Baroni 2001: 152, 155; Gaitán-Amaan 2012: 285). Ring-shaped handles have been reported only on Slipped Criolla but these are rare (Linero Baroni 2001: 152; Zárate 2004). Incisions in the form of comb-stamping, lineal hatching of a series of parallel lines, and circular-shaped punctures are usually located on the lip and below the neck (Long 1967: 28; Linero Baroni 2001: 155; Schreg 2010: 146). Impressions, reliefs and appliques have been reported but are uncommon (Linero Baroni 2001: 151; Zárate 2004; Schreg 2010: 146) (Figure 15).

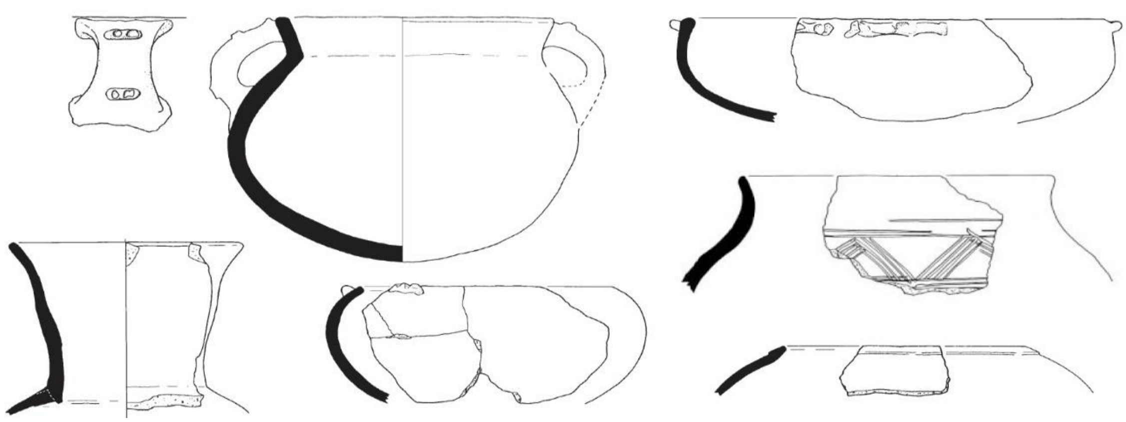


**Figure 14** Drawing of an assortment of Plain Criolla bowl, *olla*, and jar profiles. Source: Shreg 2010: 143-145.

Efforts have been made to use the technological and decorative features of this ware as proxies for alternative production centers, because some of these attributes are not common in Panamá la Vieja's pre-Hispanic assemblages (Long 1967: 28). Resemblances between Criolla and other colonial assemblages in Panama recovered as far as 280 km from Panamá la Vieja have been noted, and perhaps none has been more strongly advocated than that with a Central Region ware called El Tigre Plain (or Olá Ware), whose production has been argued to have lasted well into the $19^{th}$ and $20^{th}$ century (Rovira 1984: 288; Schreg 2010: 140, 147, 149, 155). Similarities in the paste color, tempering, presence of undecorated strap handles, surface appearance, and rim and vessel form have been used to relate these two wares (Rovira 1981: 37-38; Schreg 2010: 142, 147), with one author arguing that both are the same ceramic ware but with different names (Rovira et al. 2006: 109).

In addition, an INAA study performed on a typologically-diverse sample composed of pre-Hispanic and Colonial sherds and two natural clays specimens recovered at Panamá la Vieja revealed that both Plain and Slipped Criolla conformed to a single chemical group that was different from those of other wares, including Panamanian Majolica (Figure 9) (Rovira et al. 2006: 114). This distinctive chemical grouping was interpreted as evidence that Criolla and Panamanian Majolica were manufactured in different localities which, given the range of indicators that support the existence of a local tin-glaze industry, implicitly suggested that Criolla vessels were not produced locally (Rovira et al. 2006: 117). This position's fundamental claims will be examined in the following chapter in light of the new compositional data obtained from the petrographic analysis of Criolla sherds.

The establishment of a temporal range for Criolla is a complex task which is still the subject of debate. Well-dated contexts at Panamá la Vieja place Criolla in the archaeological record by the late 16th century (Linero Baroni 2001; Zárate 2004), however it is possible that they were being produced at an earlier date. Stronger contention emerges when attempting to assign a period for its "termination:" did Criolla production cease after the abandonment of Asunción de Panamá or did it persist after Morgan's attack? Unlike the case of the tin-glazed industry, local coarse handmade low-fired, undecorated vessels continued being produced in Panamá (particularly in the Central region) as late as the 18th and 19th centuries, as evidenced by archaeological, historical and ethnographic records (Rovira 1981: 37; Griggs et al. 2006: 50). Excavations at Panamá la Nueva, for instance, reveal the presence in 18th century contexts of sherds that physically resemble Criolla (referred to as Loza de Tierra) but that have observable morphological changes (Schreg 2010: 142). Whether these sherds are a temporal variation of the Criolla vessels or a different ware, and whether Criolla is part of a long-lasting tradition are still questions that can only be answered by future research.

When compared to the assemblages that were reviewed in the first section, Criolla's characteristics appears to most closely align with Puerto Real's Christophe Plain given that in both cases no discernable pre-Hispanic precursor can be identified and both were recovered from localities whose population was predominantly of African ancestry, due to the decimation of the local indigenous population. However, it is important to emphasize that until a thorough comparative study of Criolla and other pre-Hispanic assemblages is carried out, we cannot rule out any Native involvement in its production. Further discussion regarding Criolla's provenience will be addressed in the next chapter.

# CHAPTER 7

# CRIOLLA RESULTS AND DISCUSSION

Criolla fabrics exhibit pronounced compositional and technological variations, and this is reflected in the sorting of its 30 sherds into 18 fabric groups (Figure 20). The largest group is Fabric 12 which is composed of seven sherds (accounting for 23.3% of the sample), followed by fabrics 3 and 4 with three each, and fabrics 7 and 10 with two each (Figure 18). The remaining 13 fabrics could not be paired, thus, they are considered "loners"—a term used to refer to a classification category that is only comprised of a single sample (Quinn 2013: 79). Table 7 summarizes each of the 18 fabric groups main characteristics. The high degree of variation in Criolla fabrics contrasts markedly with the ware's cohesive chemical affinity, as determined by Rovira et al. (2006) through INAA. While sub-fabric groups were further established for Fabrics 4, 7, and 12, these subtle variations are not included in the subsequent discussion in an effort to avoid muddling the broader patterning of fabric groups. A synthesized characterization of the main mineralogical and microscopic attributes follows,[61] before turning to an examination of notable typological differences in technological choices, an in-depth discussion of the ware's provenience, and the social implications of these results.

[61] For a detailed description of each individual fabric group, refer to Appendix 3.

**Table 7** Characterization of Criolla fabric groups.

| Fabric | Defining attributes | Sample size |
|---|---|---|
| **3** | Unimodal and single-spaced fabrics predominantly composed of fine to medium sand-sized basic igneous origin minerals, such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical alteration and zoning), olivine, orthopyroxene, and clinopyroxene. | 3 |
| **4** | Unimodal and well to moderately sorted fabrics predominantly composed of fine to medium sand-sized basic igneous origin minerals, such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical alteration and zoning), clinopyroxene, and orthopyroxene, and fine sand-sized opaque minerals. | 3 |
| **5** | Unimodal, single-spaced, and very well sorted fabric predominantly composed of fine to medium sand-sized opaque minerals and orthopyroxene. | 1 |
| **6** | Unimodal, single-spaced, and very well sorted fabric predominantly composed of fine to medium sand-sized basic igneous origins minerals, such as clinopyroxene and orthopyroxene, and opaque minerals. | 1 |
| **7** | Unimodal and double-spaced fabrics with a small coarse fraction (less than 10% of the total area) that are predominantly composed of argillaceous inclusions. The paste appears to have been refined. | 2 |
| **8** | Unimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as plagioclase feldspar, quartz, clinopyroxene, and hornblende, to which coarse sand-sized grog inclusions were added as temper. | 1 |
| **9** | Unimodal, single-spaced, and well sorted fabric predominantly composed of intermediate igneous origin minerals, such as fine to medium sand-sized plagioclase feldspar (whose crystals exhibit varying degrees of chemical zoning) and quartz, and very fine to fine sand-sized hornblende. | 1 |
| **10** | Weakly to moderately bimodal and moderately to poorly sorted fabrics derived from the breakdown of a non-calcareous marine clay predominantly composed of basic igneous origin minerals, such as medium sand-sized plagioclase feldspar and clinopyroxene, very fine to fine sand-sized quartz, and bioclast (foraminifera). | 2 |
| **11** | Unimodal, single-spaced, and well sorted fabric derived from the breakdown of a non-calcareous marine clay predominantly composed of fine to medium sand-sized basic igneous origin minerals, such as plagioclase feldspar and clinopyroxene, medium to coarse sand-sized fine-grained igneous rocks (likely andesite and/or dacite) and bioclast (foraminifera). | 1 |

| Fabric | Defining attributes | Sample size |
|---|---|---|
| **12** | Weakly to moderately bimodal, single-spaced, and moderately sorted fabrics predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as quartz, plagioclase feldspar, and chemically altered biotite, to which crushed coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. | 7 |
| **13** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as plagioclase feldspar, quartz, and hornblende, to which crushed coarse sand-sized quartz and plagioclase feldspar (whose crystals exhibit varying degrees of physical alteration and chemical zoning) inclusions were added as temper. | 1 |
| **14** | Strongly bimodal, close-spaced, and poorly sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as plagioclase feldspar, quartz, and hornblende, to which large quantities of eroded medium to coarse sand-sized quartz and plagioclase feldspar (whose crystals exhibit varying degrees of physical alteration and chemical zoning) inclusions were added as temper. | 1 |
| **15** | Moderately bimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as plagioclase feldspar, quartz, and hornblende, to which crushed coarse sand-sized coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. | 1 |
| **16** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized acid igneous origin minerals, such as quartz and potassium feldspar, to which crushed and chemically altered medium to coarse sand-sized coarse-grained acid rock (possibly granite) inclusions were added as temper. | 1 |
| **17** | Moderately bimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals, such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical zoning), quartz, and biotite, and medium to coarse sand-sized fine-grained intermediate rock inclusions. | 1 |
| **18** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized intermediate igneous origin minerals, such as quartz and biotite, to which crushed medium to very coarse sand-sized coarse-grained acid rock (possibly granite) were added as temper. | 1 |

| Fabric | Defining attributes | Sample size |
|---|---|---|
| **19** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized quartz crystals to which crushed medium to coarse sand-sized coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. | 1 |
| **20** | Weakly bimodal, single-spaced, and moderately sorted fabric predominantly composed of coarse sand-sized fine-grained basic rocks and fine-grained igneous rock inclusions, and fine to medium sand-sized plagioclase feldspar crystals and glassy rock inclusions. | 1 |

*Synthesized Microscopic Characterization of Criolla Fabrics*

Most Criolla fabrics are composed of non-calcareous sedimentary clays of either intermediate or basic igneous origins, whose pastes were either tempered or not processed in any way (except for a group that may have been refined). Crushed rock and minerals were the most common material used for tempering, followed by sand and grog. The primary forming technique was the most elusive element to determine, as both macroscopic and microscopic evidence could only be discerned in 10 sherds (belonging to 8 groups), of which all exhibited evidence of being formed through coiling. Most samples were fired at low maximum temperatures (below 850º C) under predominantly oxidizing conditions (albeit at varying consistencies and rates) in open firing regimes. It remains possible that two samples were fired using a closed regime or kiln, based on evidence of high firing temperatures, complete oxidation, and lack of firing cloud[62] (Table 8). In two Plain Criolla samples, a thin smudged layer was detected (TPPV-48) as well as a thin and heavily eroded glaze layer of probable lead-based origins (TPPV-63).

[62] While difficult to achieve, it is possible to obtain these conditions in an open firing regime (Rye 1988: 98).

**Table 8** Geological and technological attributes of the Criolla sample.

| GEOLOGIC SOURCE | Groups | Sherds |
|---|---|---|
| Basic | **7** | **13** |
| Intermediate | **8** | **14** |
| Unknown[63] | **3** | **3** |
| **BODY PREPARATION TECHNIQUES** | **Groups** | **Sherds** |
| Refinement | **1** | **2** |
| Tempering | **8** | **14** |
| *Crushed rock or mineral* | 5 | 11 |
| *Grog* | 1 | 1 |
| *Sand* | 2 | 2 |
| No processing | **9** | **14** |
| **MAXIMUM FIRING TEMPERATURE** | **Groups** | **Sherds** |
| Low (<850º C) | **13** | **25** |
| High (>850º C) | **5** | **5** |
| **ATMOSPHERIC CONDITIONS** | **Groups** | **Sherds** |
| Oxidizing | **16** | **27** |
| *Complete oxidation* | 9 | 13 |
| *Incomplete oxidation* | 9 | 14 |
| Reducing | **3** | **3** |
| **FIRING REGIME** | **Groups** | **Sherds** |
| Open | **16** | **28** |
| Closed | **2?** | **2?** |

When temporality is examined, it is apparent that some aspects of Criolla's production sequence remained stable over time, while others may have varied. On the one hand, the firing strategy was remarkably consistent, as low maximum firing temperature, the preference for oxidizing over reducing atmospheric conditions, and open firing regimes were predominant in both early and late 17$^{th}$ century sherds (Figure 16).

[63] Due to some of the fabric's mineralogical composition, it was not possible to determine the likely geological origin of its raw clay.

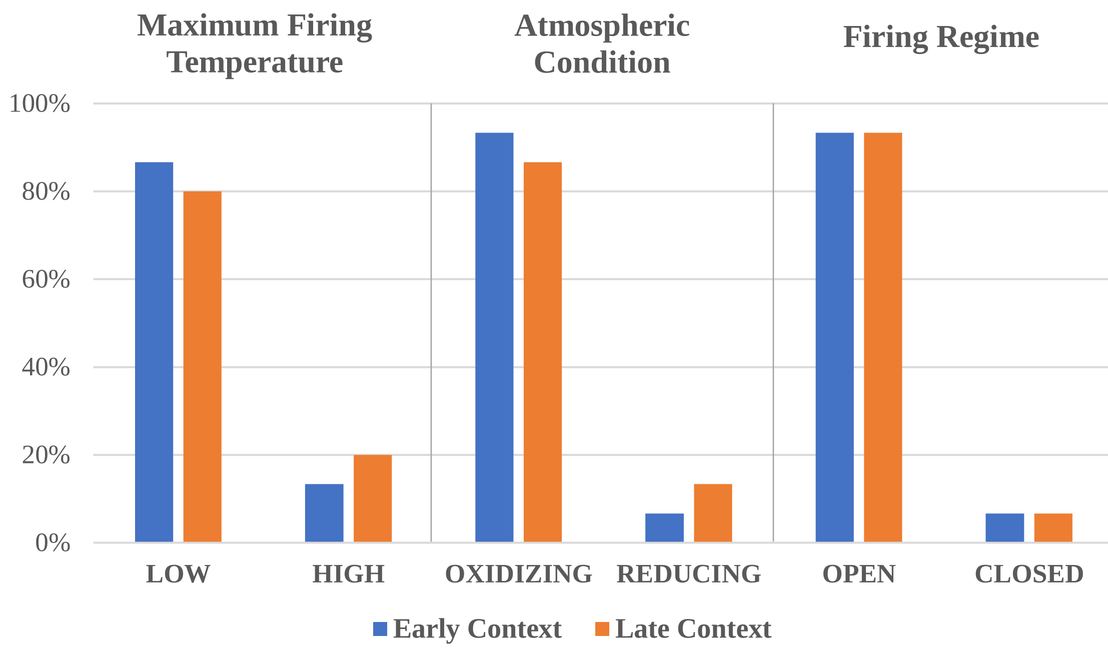



**Figure 15** Proportion of sherds by firing strategy over time.

On the other hand, the raw clay's geological provenience as well as the preference for paste preparation technique appear to have changed considerably over time. In the early context, 64% of Criolla sherds used clays that derived from deposits of intermediate igneous origins, while the remaining 36% were made from basic igneous origins. In the late context these proportions are inverted, as 62% of the Criolla fabrics were produced from a basic source and the remaining 38% from an intermediate source[64]. This exact pattern is mirrored in the body preparation technique; tempered sherds were proportionally more frequent (60%) than non-processed fabrics (33%) in the early 17th century, but by the late 17th century the latter technological choice became more common (60%) than the former (33%). Refined fabrics remained stable over that same timespan

[64] The three fabrics whose raw clays' geological provenience could not be determined were excluded from this calculation.

(7%) (Figure 17). While this preliminary pattern can be partially explained by the virtual disappearance of Fabric 12 sherds, characterized by a paste composed of intermediate igneous origin clay tempered with crushed coarse-grained intermediate igneous rocks, in the late context (Figure 20), the temporal surge of basic-derived raw clay sources and non-processed fabrics is difficult to explain based on the available data. Additional samples must be analyzed to confirm the observed pattern, and additional research needs to be performed to accurately establish the provenience of these fabric groups (more on that discussion to follow).

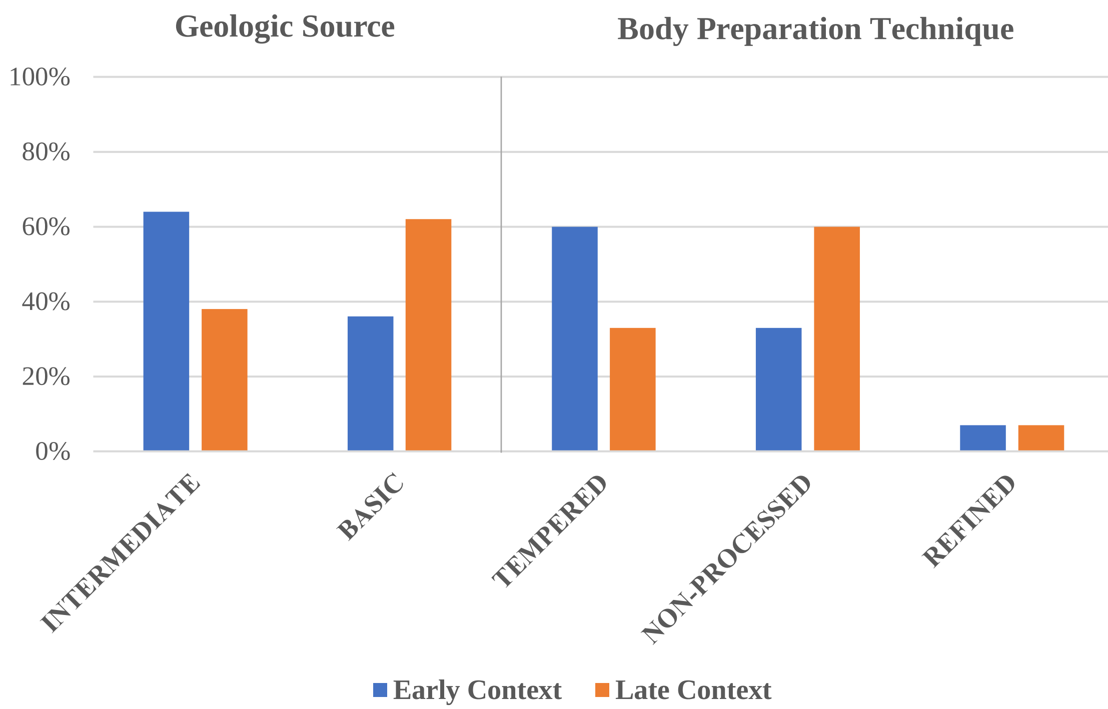



**Figure 16** Proportion of sherds by raw clay geological source and body preparation technique over time.

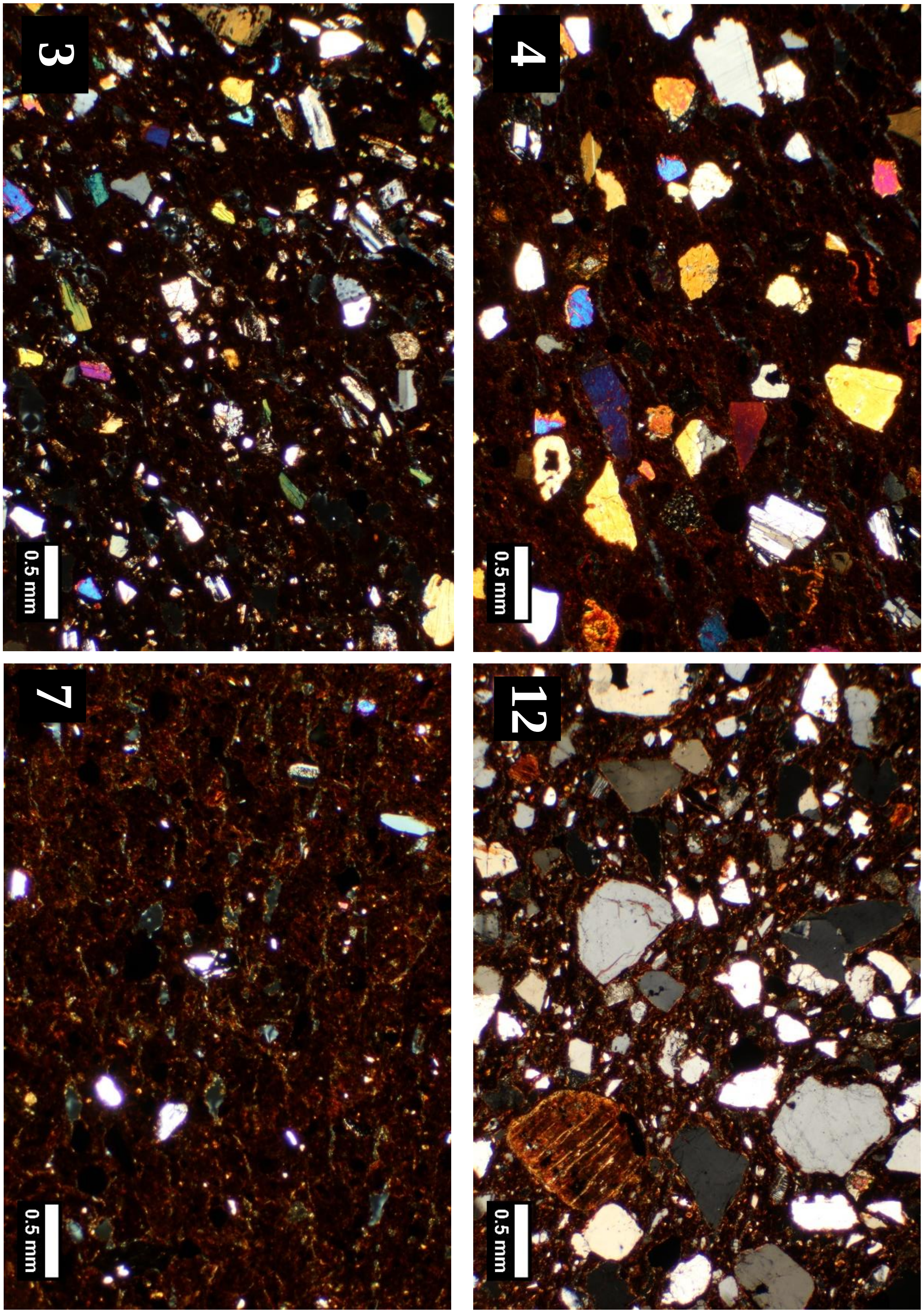



**Figure 18** Photomicrographs of the matrices of a Fabric 3 (TPPV-37), 4 (TPPV-58), 7 (TPPV-45), and 12 (TPPV-59) sherds in XPL.

Overall, the high variability of paste recipes suggests that Criolla production was decentralized and that each potter was a discrete unit independent from the rest. Each potter developed a distinct recipe that reflected his or her unique preferences regarding clay sources, body preparation technique, and temper material. This proliferation of fabric groups within Criolla ware in itself suggests a potting industry that was much more ad hoc and transitory. However, it is important to bear in mind that it is common in petrographic analysis to merge initially different fabric groups when additional samples are analyzed because as it allows for the end members of a larger group to be seen as part of a continuum rather than separate fabrics (Jennifer Meanwell 2019, personal communication). Thus, further analysis is required to corroborate these interpretations.

*Typological and Temporal Variances*

The fabric grouping revealed little overlap between Slipped and Plain sherds, as only three groups (fabrics 3, 7, and 12) comprised of both types could be established. Despite Criolla's typological cohesion as determined by INAA (Rovira et al. 2006), the same recipe was used in only three of the 18 groups to produce both Slipped and Plain Criolla vessels.

Several preliminary patterns were observed that appear to be typologically-dependent. Foremost, it is apparent that intermediate derived clays were preferred over basic deposits to produce Slipped Criolla (63% versus 37% respectively), while Plain vessels tended to be slightly more basic (53%) than intermediate (47%). Similarly, a preference for a specific body preparation technique was noted, as 70% of the Slipped fabrics were tempered versus 35% of the Plain and, conversely, non-processed fabrics

were a lot more common among the latter type (60%) than the former (20%), with the remainder corresponding to refined sherds. Unsurprisingly, the firing stage was consistent in both types, which exhibited similar proportions of low-fired and oxidized sherds fired in an open-firing regime. Nonetheless, a typologically dependent variation was noted in the rate of oxidation, as Slipped fabrics were proportionally more completely oxidized (60%) than Plain fabrics (35%) (Figure 19). Moreover, I observed that on every incompletely oxidized Slipped sherd, the side of the vessel's wall where the slip layer was applied was *always* oxidized. Coupled with the absence of reduced Slipped fabrics in the sample, it appears that Criolla potters understood the firing atmosphere's effect on slip properties and that they took precautions to position Slipped Criolla vessels in an area within the firing pit where the exposure to circulating oxygen could be guaranteed (Albero 2014: 82). In contrast, the high frequency of incompletely oxidized and reduced Plain fabrics (50% and 15% respectively) suggests that their surface appearance was likely not a crucial consideration for potters

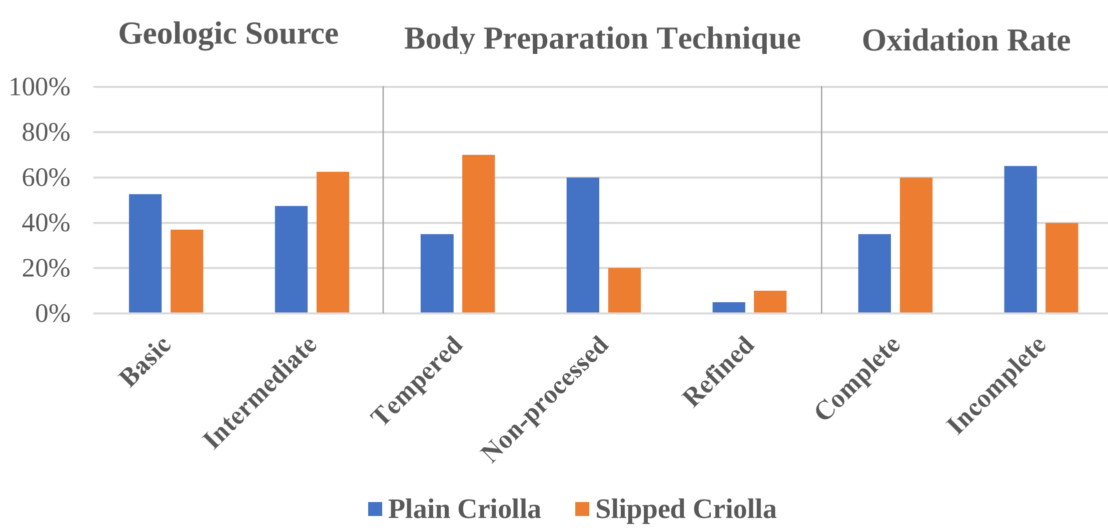



**Figure 17** Proportion of sherds' raw clay geological source, body preparation technique, and rate of oxidation by type of Criolla.

Another salient aspect of these results is the very low degree of diachronic continuity of fabric groups, for only three of the 18 groups (fabrics 4, 7, and 12) contain at least an early and a late context sherd (Figure 20). While certain elements of the *chaîne-opératoire* persisted more than others, such as the firing strategy, it is evident that a specific combination of raw clay and body preparation technique did not prevail temporally in this sample. Furthermore, an increase in the number of temporally-restricted fabrics (groups or loners that are only represented by sherds from a single context) from four to 10 between the early and late 17$^{th}$ century was also noted. While the sample size is not large, these preliminary results suggest that Criolla fabrics may have had limited lifespans and their numbers proliferated over time. However, before even considering what factors could have influenced these patterns, further research is required to verify both the low degree of diachronic continuity and increasing number of temporally-restricted fabrics observed in this study sample.

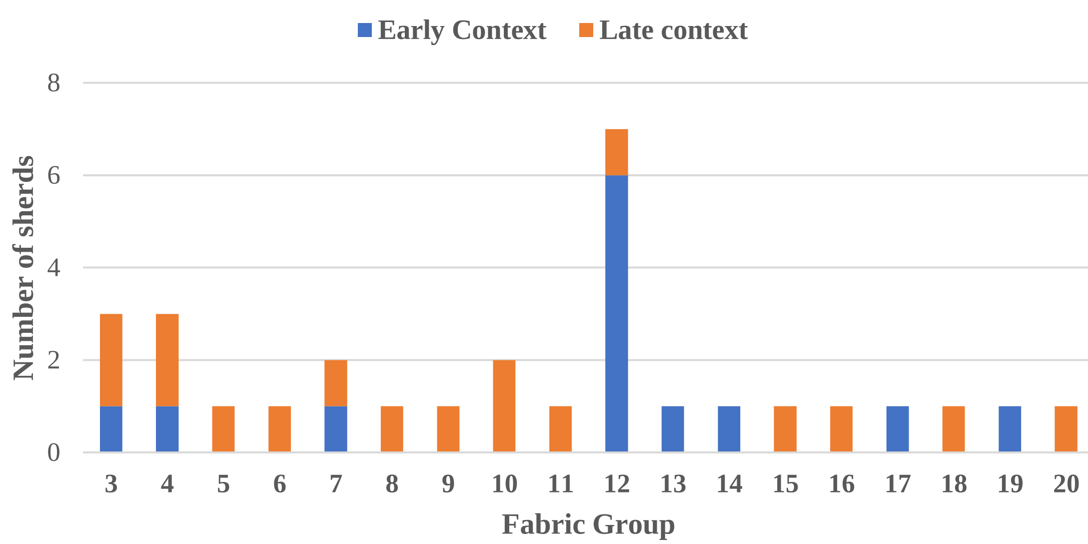



**Figure 18** Distribution of number of sherds by fabric group over time.

*Criolla Provenience*

The sample's notable geological diversity, reflected in the use of both intermediate and basic igneous-derived deposits in eight and seven fabric groups respectively, indicates that different clay sources were procured to produce Criolla vessels. While it is possible that a small number of these fabric groups may have come from the same clay source given their mineralogical similarities,[65] the sample's high degree of compositional variation was a surprising discovery. The petrographic results are at odds with the ware's cohesive chemical affinity exhibited in the previously cited INAA study (Rovira et al. 2006).

Although the exact provenience of Criolla vessels requires additional research, the results obtained from my petrographic analysis indicate that this ware was probably manufactured in multiple localities. While this interpretation is consistent with the claim that Criolla vessels were imported to Asunción de Panamá from colonial towns in the Central region (Rovira 1984; Rovira et al. 2006; Schreg 2010), certain elements in this position need to be addressed before definitively discarding the likelihood of local Criolla production.

Foremost, a study of the total number of ceramic sherds recovered in five different contexts from Panamá la Vieja revealed that Plain Criolla sherds accounted on

[65] Fabrics 4, 5, and 6, as well as Fabrics 13 and 14 share similar mineralogical constituents which could indicate a compositional relationship among their respective clay sources. However, given that the texture and the presence and absence of some mineral inclusions in the former groups, and the amount of temper added to the pastes of the latter groups varied, each was sorted individually. The analysis of additional samples is required to validate this possible composition relationship.

average for 48% (ranging from 18% to 63%) of the entire sample, once shipping containers are removed from the count[66] (Schreg 2010: 153). Given the prominence of Criolla vessels in the collection, I believe that there is reason to suspect that not all these vessels were imported,[67] especially when we know that potters resided in the city. Furthermore, while morphological and decorative parallels between Criolla and the Central region pottery type El Tigre Plain may exist, one must be cautious in relying on attributes that are so diverse within Criolla ware, such as paste color, inclusion type and size, and surface finish (Table 5), to establish a connection between these two assemblages. More distinctive decorated appendages, such as incised and impressed strap handles have so far *only* been reported on Criolla sherds recovered in Panamá la Vieja (Figure 21) (Schreg 2010: 147, 149).

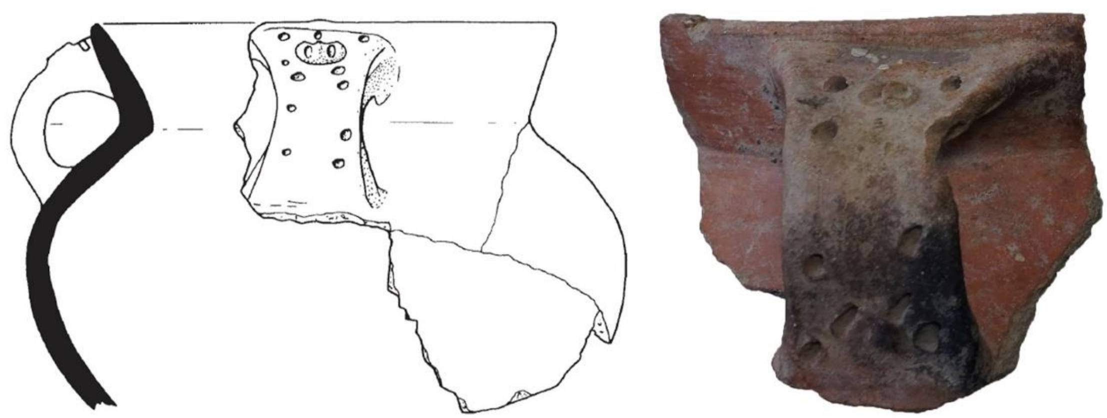


**Figure 19** Profile drawing a Plain and photograph of a Slipped Criolla *ollas*' decorated strap handle style that has only been recovered in Panamá la Vieja.

[66] Locally-produced and imported containers account for the vast majority of the ceramic artifacts recovered in Panamá la Vieja (Gaitán-Ammann 2012: 278) and it was not an exception at these five contexts where they composed 65% of the sample. Therefore, to better illustrate the relative proportion of Criolla vessels in these contexts, Schreg did not include containers in the total from which the percentages were calculated.

[67] It is worth noting that the presence of imported ceramic assemblages in Asunción de Panamá in the archaeological and historical records, as unglazed utilitarian pottery has been reported in shipment manifests from Nicaragua, Nicoya, and Callao (Castillero Calvo 2006: 337, 338).

In addition, while Rovira et al.'s (2006) INAA study clearly indicated that the chemical composition of the sampled Criolla sherds was distinct from that of other locally-manufactured wares, this fact on its own does not conclusively prove the existence of separate production centers. Rather, what this result indicates is that the potters who produced Criolla and Panamanian Majolica (among other wares) used clays whose chemical composition was sufficiently different that they could be sorted into distinct groups. Correlating distinct chemical groups with the existence of different production centers before establishing the geographical location of each group's clay source would be premature. Ethnographically, it has been reported that potters within a single community may exploit different clay sources, some of which can even have distinct chemical compositions despite being located just 2 km apart (Neupert 2000). Based on the available data, I consider there to be insufficient evidence to conclude that Criolla vessels were *definitively* not produced at Asunción de Panamá.

Some vessels currently classified as Criolla may have been imported to Asunción de Panamá, but local production could still account for one or more of the identified fabric groups, given the geologically heterogenous composition of the landscape surrounding the city (Figure 22). Multiple clay sources could have been exploited to produce Criolla vessels. The procurement of raw clay has been documented historically at distances as far as 16 km away from Asunción de Panamá—its transportation was facilitated by the deposit's accessibility by sea[68] (Mena García 1992: 119). Within 16 km

[68] "…and to make them [masonry houses], I looked and found in this land the materials I needed for my industry because I attempted to make tiles and bricks. So I set up a brickyard [*tejar*] and brought the clay by sea from a distance of four leagues [16 km] from the city." (Pérez de Robles quoted in Mena García 1992: 119, my translation).

from the city, 12 different geological formations exist. Most are located in the city's western hinterland, an area commonly frequented by its residents due to the location of cattle ranches in the Mansanillo Plains (Ruiz de Campos 1986: 53; Audiencia de Panamá 1908: 170-171), its proximity to the Perico Island port, and the existence of roads that connected Asunción de Panamá to towns in the Central region (Figure 22).

The application of an integrated approach for pottery provenience, one that employs both chemical and mineralogical analyses, is required to establish a correlation between clay sources available near Asunción de Panamá and the identified Criolla fabrics (Tite 1999). Such an approach should be followed by more holistic research performed at a regional scale to refine the ware's typology and explore the possibility that multiple centers produced vessels following similar morphological, and functional conventions (a tradition which Criolla and El Tigre Plain could have been a part of).


**Figure 20** Color-coded geological map of Panama City (Stewart et al. 1980) with radius circles at 4 km increments, colonial and modern spatial references, and approximate location of colonial road systems. Note that various geologic formations are available west of the city, an area that was frequently transited by its residents for commercial and agricultural purposes. Near Asunción de Panamá, the light blue-colored formation is predominantly comprised of agglomerates with intermediate igneous composition, the purple-colored formation represents sedimentary rocks, and the yellow-colored formation is comprised of undivided alluvium sediments.

# CHAPTER 8

# CONCLUSION

Situated at the crossroads of early Spanish colonial expansion into Central and South America, Asunción de Panamá quickly rose to prominence as a strategic geopolitical and commercial port in the region from which conquest expeditions departed and both European and American goods transited. Given its renowned role as a commercial hub, ceramic workshops dedicated to the production of Spanish-tradition ceramics were established in the city to supply both local and South American demand, fueled by immigrating Spanish *vecinos*, for pottery that was reminiscent of that they possessed at home. As appeared to have occurred in other coeval production centers in New Spain, the newly established potters brought with them the know-how and operational organization required to produce Spanish-styled vessels and successfully "implanted" it in this new setting. While multiple wares were produced in Asunción de Panamá's workshops until its abandonment in the late 17$^{th}$ century, the high-fired, wheel-thrown, and tin-glazed vessels known as Panamanian Majolica were dominant, their remains were not only prevalent in Panamá la Vieja but have also been recovered from sites in other colonies across the American continent and the Caribbean.

Contemporary with this industry was a low-fired and handmade coarse ceramic craft that specialized in the production of both slipped and unslipped utilitarian vessels called Criolla Ware that were used for the preparation, storage, and serving of food in Asunción de Panamá. Criolla shares similar characteristics with other wares recovered throughout the Spanish Empire whose production has been largely attributed to either African or indigenous potters on technological and iconographic grounds. While assigning of Asunción de Panamá as the production center of this ware has been questioned by archaeologists due to Criolla's resemblance to other colonial assemblages within Panama, the exclusive presence of sherds with distinctive decorated appendages such as incised and impressed strap handles in Panamá la Vieja's assemblages suggest the existence of local production in the urban center.

Panamá la Vieja's ceramic record presents an opportunity to study how coexisting but distinct potting communities organized their craft in a colonial context, given the existence of wares that were produced both within and outside Spanish-tradition workshops. To explore this issue, a sample of 60 sherds of which 30 correspond to the three main types of Panamanian Majolica and the remaining 30 to the two types of Criolla was selected for petrographic analysis. To incorporate temporality as an analytical variable, half of the sample was recovered from a well-established early 17$^{th}$ century while the other half was recovered from a late 17$^{th}$ century context in Panamá la Vieja. This research's macroscopic and microscopic analyses revealed the existence of highly divergent potting communities in Asunción de Panamá during the 16$^{th}$ and 17$^{th}$ centuries, whose productions practices and craft organization varied drastically and are reflected in the assemblages they produced.

On the one hand, Panamanian Majolica fabrics exhibited a low degree of compositional and technological variability, revealed in the sorting of the 30 analyzed sherds into a single fabric group. This indicates that tin-glaze potters in Asuncion de Panama's workshops established and maintained a *chaîne-opératoire* for tin-glazed vessels regardless of the decorative type that was being produced, one which was successfully transferred in a time span of 51 to 59 years without any notable variation in either the paste recipe or the production sequence. To achieve this diachronic consistency, knowledge transmission likely occurred through a strictly-supervised learning context similar to that of guild apprenticeships which, according to historical accounts, were commonly used in the coeval production centers of Mexico City and Puebla. Under this hierarchical training system, an experienced potter (*maestro*) had direct control over the technological choices that were taught to apprentices and ultimately this training served as a mechanism of adherence to a set of established production norms. Years of consistent practice would promote both technical gestures and production procedures that become part of the apprentices' unconscious behavior or habitus until eventually the *maestro*'s *chaîne-opératoire* became doxic. The successful generational transmission of Panamanian Majolica production knowledge clearly points to the development of a technological tradition in the city's workshops associated with a stable organization of production norms that persisted virtually unaltered over time.

On the other hand, Criolla fabrics exhibited a high degree of compositional and technological variability, as evidenced by the sorting of the 30 analyzed sherds into 18 fabric groups, of which 13 were loners. This diversity reflects notable differences in both the geological provenience of the raw clay and the body preparation techniques used to

produce the vessels, as other stages in the production sequence, such as the firing strategy, remained strongly consistent throughout the sample. Furthermore, the fabric grouping also revealed very little overlap between the sample's Slipped and Plain sherds, for only three groups contained at least a specimen of each. These findings contrast starkly with the compositional and typological cohesion that had been initially attributed to this ware through chemical analysis. The results call for additional research on this ware to better understand both its production and circulation in colonial Panama, for there are strong indications that it might have been produced in multiple localities, of which Asunción de Panamá may have been only one. Finally, the very low degree of diachronic continuity of Criolla fabric in this sample, where only three of the 18 groups contained at least an early and a late context sherd, indicates that most paste recipes discontinued in a time span of 51 to 59 years. While additional sherds need to be analyzed to corroborate these preliminary patterns, this sample's proliferation of fabric groups in itself suggests a potting industry that was much more ad hoc and transitory, as each potter developed a distinct *chaîne-opératoire* that reflected his or her unique preferences regarding clay sources, body preparation technique, and temper material.

In essence, these findings demonstrate that the production of Panamanian Majolica and Criolla differed greatly, not just in terms of the technological choices that were employed but most notably in the way each craft was organized and transmitted. In the case of the former, a centralized system was in place where social control was exerted by an established social hierarchy inside the workshop which ensured the adherence to a set of established production norms and is reflected in the low degree of compositional and technological variability of the analyzed sample. The transmission of potting

knowledge and practices of Panamanian Majolica appears to have also been structured through a strictly supervised learning context that ensured the temporal consistency of a single paste recipe. In the case of Criolla Ware, production was decentralized and each potter appears to have been free to produce pots following his or her unique *chaîne-opératoire* without being subject to any form of political, social, or economic control, and this is reflected in the high variability of fabrics that were identified. This lack of collective understanding or consensus regarding technological choices involved in certain stages of Criolla production (raw materials used, body preparation technique applied, and even vessel morphology) would explain why macroscopic attributes in Criolla vessels are so diverse. However, it is important to note that the high number of identified Criolla fabric groups could also reflect the regional importation of utilitarian vessels to Asunción de Panamá, given the geological diversity that was identified in the analyzed sample. Additional research is required to corroborate the aforementioned patterns and interpretations.

While both the macroscopic and microscopic evidence appears to indicate that Panamanian Majolica and Criolla production developed and remained independent from one another (whether due to social, political, economic, or geographical factors), it is worth mentioning that one Plain Criolla sherd in the sample shows evidence of possible lead glazing[69] (TPPV-63) corresponding to the lone sample in Fabric 18 (Figure 23). If further provenience analyses can prove that this sherd was produced in Asunción de

[69] Schreg (2010: 154) claims to have identified some Plain Criolla sherds with splashes of green-colored glaze at Panamá la Vieja in a trash midden belonging to an early 17th century context.

Panamá, it could suggest that some degree (albeit very small) of interaction[70] between the Panamanian Majolica and Criolla potting communities occurred, for they indicate the application of one of the three forms of Spanish-introduced ceramic technology into the production of the latter's ceramic repertoire.[71]

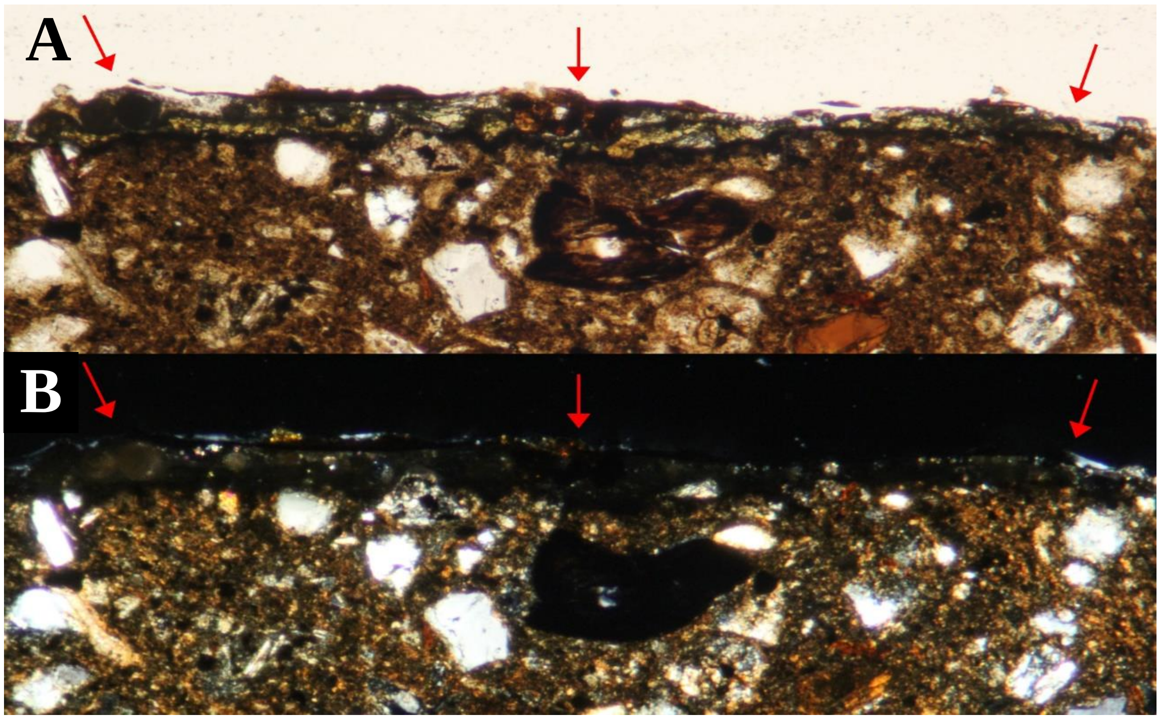



**Figure 21** Photomicrographs of TPPV-63's possible glaze layer (indicated by red arrows) in PPL (A) and XPL (B). Glass has isotropic properties, thus it is transparent in PPL and opaque in XPL (only the mineral inclusions within it are optically active in XPL).

[70] While the word interaction suggests a direct involvement of Spanish potters in training of these methods to Criolla potters, it is necessary to bear in mind that the latter could have obtained the know-how through observational insights or espionage, as appears to have occurred in New Spain (Lister and Lister 1982: 98).

[71] The interior surface of another Plain Criolla Sherd (TPPV-54) contained a series of faint parallel grooves that resemble the typical riling marks left by wheel thrown vessels. However, given these grooves are not very pronounced, it is also possible that these marks were created if a wheel (or another rotation device) was used as the vessel was smoothed.

The results obtained from this research contribute to an understanding not only of production processes and the organization of various forms of the potting craft in Asunción de Panamá, but they also highlight the divergence of these industries, a divergence reflective of the potting communities that produced the vessels. While the sample size can and should be expanded to corroborate the patterns and interpretations elaborated in this thesis, the data produced in this study serve as a baseline from which future compositional studies of colonial assemblages in Panama and the Spanish American region can compare multiple themes related to ceramic production. The availability of a comparative database opens possibilities for future archaeological research, from establishing the existence of regional *chaîne-opératoires* in Spanish-tradition workshops across the Spanish Empire to examining the continuity and change in production practices among late pre-Hispanic assemblages in Panamá la Vieja during the Spanish occupation.

APPENDIX 1

SAMPLE DESCRIPTION

| Sample | ID | Context | Ware | Sherd | Vessel form |
|---|---|---|---|---|---|
| **1** | **TPPV-1** | Cathedral | Panama Plain | Flat base | Plate |
| **2** | **TPPV-2** | Cathedral | Panama Plain | Body | Unknown |
| **3** | **TPPV-3** | Cathedral | Panama Plain | *Arista*[72] | Plate |
| **4** | **TPPV-4** | Cathedral | Panama Plain | Body | Unknown |
| **5** | **TPPV-5** | Cathedral | Panama Blue on White | Ring base | Unknown |
| **6** | **TPPV-6** | Cathedral | Panama Blue on White | Body | Unknown |
| **7** | **TPPV-7** | Cathedral | Panama Blue on White | Rim | Cup? |
| **8** | **TPPV-8** | Cathedral | Panama Polychrome Type A | Brim | Brimmed plate |
| **9** | **TPPV-9** | Cathedral | Panama Polychrome Type A | Brim | Brimmed plate |
| **10** | **TPPV-10** | Cathedral | Panama Polychrome Type A | Brim | Unknown |
| **11** | **TPPV-11** | Cathedral | Panama Polychrome Type A | Body | Unknown |
| **12** | **TPPV-16** | Cathedral | Panama Plain | Body | Unknown |
| **13** | **TPPV-17** | Cathedral | Panama Blue on White | Body | Unknown |
| **14** | **TPPV-18** | Cathedral | Panama Blue on White | Rim | Plate |
| **15** | **TPPV-19** | Cathedral | Panama Polychrome Type A | Body | Unknown |
| **16** | **TPPV-20** | Western Houses | Panama Plain | Body | Unknown |
| **17** | **TPPV-21** | Western Houses | Panama Plain | Body | Unknown |
| **18** | **TPPV-22** | Western Houses | Panama Plain | Body | Unknown |
| **19** | **TPPV-23** | Western Houses | Panama Plain | Body | Unknown |
| **20** | **TPPV-24** | Western Houses | Panama Plain | Body | Unknown |
| **21** | **TPPV-25** | Western Houses | Panama Blue on White | Body | Unknown |
| **22** | **TPPV-26** | Western Houses | Panama Blue on White | Brim | Brimmed plate |

[72] **Arista:** "Arris, or the salient angle where two edges meet. In Spanish ceramics this word refers to the pronounced angle in some bowl or plate profiles between concave interior wells and flared horizontal rims." (Lister & Lister 1976: 19).

| Sample | ID | Context | Ware | Sherd | Vessel form |
|---|---|---|---|---|---|
| **23** | **TPPV-27** | Western Houses | Panama Blue on White | Body | Unknown |
| **24** | **TPPV-28** | Western Houses | Panama Blue on White | Rim | Plate |
| **25** | **TPPV-29** | Western Houses | Panama Blue on White | Body | Unknown |
| **26** | **TPPV-30** | Western Houses | Panama Polychrome Type A | *Arista* | Plate |
| **27** | **TPPV-31** | Western Houses | Panama Polychrome Type A | Body | Unknown |
| **28** | **TPPV-32** | Western Houses | Panama Polychrome Type A | Body | Unknown |
| **29** | **TPPV-33** | Western Houses | Panama Polychrome Type A | Body | Unknown |
| **30** | **TPPV-34** | Western Houses | Panama Polychrome Type A | *Arista* | Plate |
| **31** | **TPPV-35** | Western Houses | Slipped Criolla | Body | Unknown |
| **32** | **TPPV-36** | Western Houses | Slipped Criolla | Body | Unknown |
| **33** | **TPPV-37** | Western Houses | Slipped Criolla | Body | Unknown |
| **34** | **TPPV-38** | Western Houses | Slipped Criolla | Body | Unknown |
| **35** | **TPPV-39** | Western Houses | Slipped Criolla | Body | Unknown |
| **36** | **TPPV-40** | Cathedral | Slipped Criolla | Body | Unknown |
| **37** | **TPPV-41** | Cathedral | Slipped Criolla | Body | Unknown |
| **38** | **TPPV-42** | Cathedral | Slipped Criolla | Body | Unknown |
| **39** | **TPPV-43** | Cathedral | Slipped Criolla | Body | Unknown |
| **40** | **TPPV-44** | Cathedral | Slipped Criolla | Body | Unknown |
| **41** | **TPPV-45** | Western Houses | Unslipped Criolla | Body | Unknown |
| **42** | **TPPV-46** | Western Houses | Unslipped Criolla | Body | Unknown |
| **43** | **TPPV-47** | Western Houses | Unslipped Criolla | Body | Unknown |
| **44** | **TPPV-48** | Western Houses | Unslipped Criolla | Body | Unknown |
| **45** | **TPPV-49** | Western Houses | Unslipped Criolla | Body | Unknown |
| **46** | **TPPV-50** | Western Houses | Unslipped Criolla | Body | Unknown |

| Sample | ID | Context | Ware | Sherd | Vessel form |
|---|---|---|---|---|---|
| **47** | **TPPV-51** | Western Houses | Unslipped Criolla | Body | Unknown |
| **48** | **TPPV-52** | Western Houses | Unslipped Criolla | Body | Unknown |
| **49** | **TPPV-53** | Western Houses | Unslipped Criolla | Body | Unknown |
| **50** | **TPPV-54** | Western Houses | Unslipped Criolla | Body | Unknown |
| **51** | **TPPV-55** | Cathedral | Unslipped Criolla | Body | Unknown |
| **52** | **TPPV-56** | Cathedral | Unslipped Criolla | Body | Unknown |
| **53** | **TPPV-57** | Cathedral | Unslipped Criolla | Body | Unknown |
| **54** | **TPPV-58** | Cathedral | Unslipped Criolla | Body | Unknown |
| **55** | **TPPV-59** | Cathedral | Unslipped Criolla | Body | Unknown |
| **56** | **TPPV-60** | Cathedral | Unslipped Criolla | Body | Unknown |
| **57** | **TPPV-61** | Cathedral | Unslipped Criolla | Body | Unknown |
| **58** | **TPPV-62** | Cathedral | Unslipped Criolla | Body | Unknown |
| **59** | **TPPV-63** | Cathedral | Unslipped Criolla | Body | Unknown |
| **60** | **TPPV-64** | Cathedral | Unslipped Criolla | Body | Unknown |

APPENDIX 2

MODEL MICROSCOPIC ANALYSIS SHEET

| MICROSTRUCTURE | | | |
|---|---|---|---|
| **Void shapes (sizes in µm)** | | | |
| **Relative void distribution (size and shape)** | | | |
| **Area estimate (Coarse:Fine:Void)** | | | |
| **Spacing between particles** | | | |
| **Sorting** | | | |
| **Grain size distribution** | | | |
| **Alignment** | | | |

| GROUND MASS | | |
|---|---|---|
| **Optical Activity** | **Color(s), PPL** | **Color(s), XPL** |
| | | |

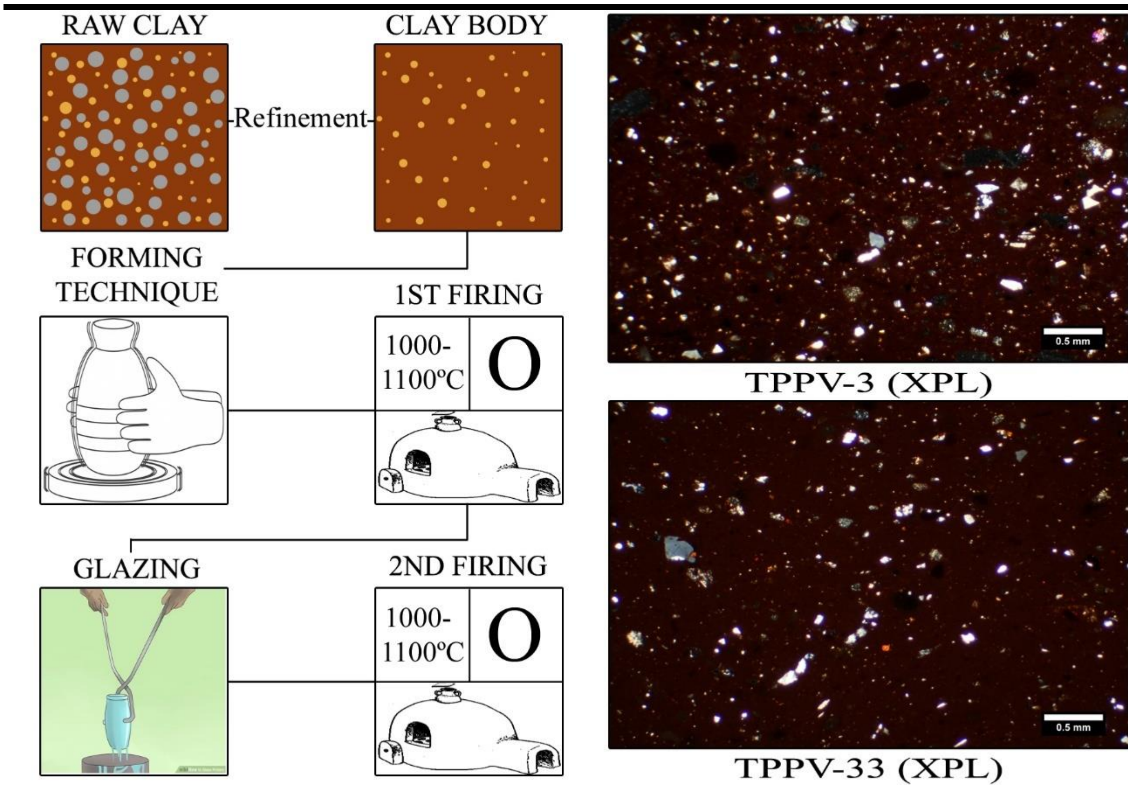
| INCLUSIONS | | | |
|---|---|---|---|
| **Type** | **Freq. (%)** | **Size range** | **Shape/Angularity (Sphericity)** |
| | | | |

| OBSERVATIONS |
|---|
| |

APPENDIX 3

DETAILED FABRIC GROUP SUMMARY

**Table 1** Fabric 1 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Homogenously oxidized paste whose mineralogical constituents are predominantly composed of uniformly-sorted fine to medium sand-sized inclusions and a low frequency of voids. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) Due to the coarse fraction's small proportion (on average 16%) as well as its relatively small grain size (predominantly fine sand-sized and medium sand), it is difficult to accurately determine the provenience of this group's clay. However, the data obtained from a coarser-textured but compositionally-related fabric group—referred to as Fabric 2—reveals significant information on the geological origin of the raw clay which can be extrapolated to Fabric 1.<br>a) Fabric 2 is composed of Panamanian Redware Container (hereafter, PRC) vessels, and this ware is believed to have been produced in the same workshops as Panamanian Majolica because of their macroscopic (Rovira et al. 2006: |

110) and microscopic similarities (Pourcelot 2017), and chemical affinities (Jamieson & Hancock 2004: 573, 580; Rovira et al. 2006: 114; Jamieson et al 2012: 203). While both fabric groups share the same mineralogical constituents, coarse sand-sized inclusions are more predominant in Fabric 2 and there are strong indications that these were natural constituents of the clay (Pourcelot 2017) which enable a more precise determination of the clay's provenience that was used for both PRC's and Panamanian Majolica's paste. The dominant presence of coarse-grained intermediate igneous rock (likely from either granodiorite or tonalite), plagioclase feldspar, quartz, hornblende, and biotite crystals in almost equal proportions—combined they account for an approximate average of 82% of the coarse fraction of Fabric 2's samples— indicate that the clay used for both fabric groups derived from the breakdown of an intermediate igneous source.

b) The respective low and moderate to high degrees of angularity and sphericity exhibited by most inclusions indicate that the clay derived from a sedimentary deposit.

**BODY PREPARATION**

| | |
|---|---|
| **Refinement technique** | 1) The textural uniformity of the fabrics' whose inclusions are either very well or well sorted (in 25 of the 30 samples), their unimodal grain size distribution (in 27 of the samples) composed fine to medium sand-sized grains, and the coarse fraction's low proportion (on average 16%) suggest that refinement technique (either levigation or sieving) was applied to produce this fine-textured paste. However, as with the provenience data, the compositionally-related Fabric 2 provides additional compositional and textural evidence to support this interpretation of Fabric 1's body preparation practice.<br>a) Given that paste refinement processes can alter the mineralogical composition of a body by "concentrating inclusion types that occur as small clast in the clay material" (Quinn 2013: 156), changes in the relative frequency of specific lithic constituents of Fabric 1 and Fabric 2 strongly indicate that these techniques were applied on the former's group. Fabric 2 contains two main types of lithic inclusions present whose size fractions are clearly distinct: the finer micro-crypto crystalline granular rocks[73] whose grains are largely between the fine to medium sand size range and the |

[73] Term used in this thesis to refer to rock clasts that are composed solely of granular-textured microcrystalline to cryptocrystalline first order interference color minerals (quartz, plagioclase feldspar, and/or orthopyroxene).

| | |
|---|---|
| | coarser coarse-grained intermediate igneous rocks (likely from either granodiorite or tonalite) whose clasts are predominantly in the coarse sand size range. In Fabric 1, the latter rock fragments are largely absent and the former—with a similar size range—become the fabric's predominant lithic inclusion. Given that coarse-grained intermediate igneous rock clasts are on average larger in size than those of micro-crypto crystalline granular rock, I argue that the former inclusions were more susceptible to being removed by potters who were intentionally seeking to obtain a finer body for the tin-glazed vessels.<br>2) The conspicuous presence of clay pellets in Fabric 1, indicating the inadequate hydration of crushed clay whose dry lumps were not allowed to completely soak when wetting of the body (Quinn 2013: 171, 173), further supports this interpretation as the powdering of raw clay is a necessary step prior to levigation or sieving processes. |
| **PRIMARY FORMING TECHNIQUE** | |
| **Wheel throwing** | 1) While neither macroscopic nor microscopic evidence was found to establish the primary forming technique, the recovery of unglazed vessels with distinct marks left by wheel throwing (that were discarded as wasters) in Panama la Vieja's ceramic workshops (Tomás Mendizábal 2018, personal communication) which are morphologically-similar to the vessels examined in this thesis suggest that wheel-throwing was used. |
| **FIRING STRATEGY** | |
| **1000-1100ºC** | 1) The presence of a of a tin glaze layer—its thickness measuring 379 µm on average—in every sample indicates that the group's most commonly achieved maximum firing temperature was above 1000ºC was sustained for enough time to allow the glaze to mature and adhere to the clay body (Lister & Lister 1982: 87; 1987: 266; Quinn 2013: 185).<br>a) The presence of biotite crystals with splits along its cleavage planes further supports that temperatures above 900-1000ºC were sustained.<br>b) The matrices' optical activity vary slightly between sherds where 28 samples exhibit either very low to low and only 2 exhibit moderate degrees. As the majority are in the former range, it further supports that temperatures above 850-800ºC were sustained.<br>c) The presence of hornblende crystals with an alteration of their color in PPL (turning brown instead of green) further supports that temperatures above 750ºC were sustained. |

| | |
|---|---|
| | 2) Melted plagioclase feldspar crystals were not observed in any of the samples, thus it is likely that that temperatures were not sustained beyond 1100ºC. |
| **Oxidizing atmosphere** | 1) The paste's uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Closed firing** | 1) The presence of a high-fired glaze layer, the high maximum firing temperature estimate as well as the complete oxidation of all of the samples indicate that a closed firing regime involving a kiln was employed.<br>a) The lack of firing clouds or defects associated to the firing stage in all of the samples suggest that it is probable the firebox and chamber were physically separate in order to avoid flames from damaging the vessels. |

**WARE TYPES (SAMPLE I.D.)**

**30 samples:** Panama Plain (TPPV-1, -2, -3, -4, -16, -20, -21, -22, -23, -24)

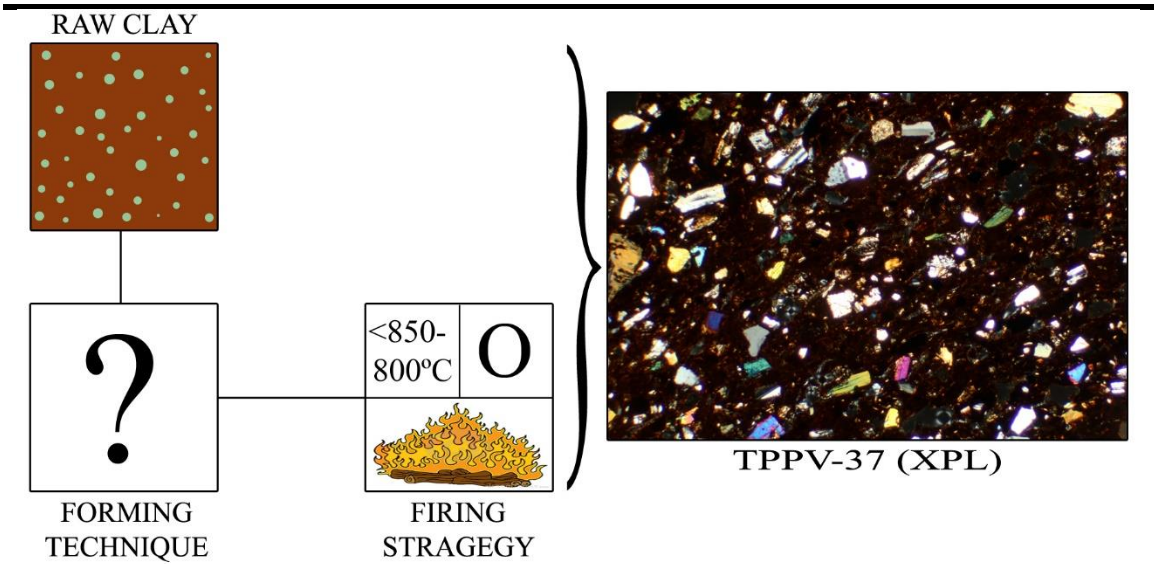
Panama Blue on White (TPPV-5, -6, -7, -17, -18, -25, -26, -27, -28, -29)

Panama Polychrome Type A (TPPV-8, -9, -10, -11, -19, -30, -31, -32, -33, -34).

**OBSERVATION**

It is possible that two different clay sources were mixed in order to obtain the paste used in this fabric given the presence of small and inconspicuous dark olive-colored features (in both PPL and XPL) in the matrix that contained neither discernable optical properties nor crystalline structures in several sherds. At high magnification (20x) it appears that these are composed of a series of cryptocrystalline yellow-colored crystals that could suggest these are the remnants of microcrystalline limestone clasts. Quinn has noted that at high temperatures calcite begins to "melt and combine with the vitrified clay matrix" giving the "matrix a blotched, olive coloured appearance" (2013: 191, 199). Therefore, it is possible that these features are the remains of a calcareous clay that was not adequately mixed with a ferruginous clay leaving behind these inconspicuous spots of dark olive-colored cryptocrystalline features in the groundmass of some of these fabrics. However, the lack of a reference collection to which to compare the state of calcareous material in high fired ceramics impedes the precise determination of the presence of this kind of material in the matrix.

**Table 2** Fabric 3 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Unimodal and single-spaced fabrics predominantly composed of fine to medium sand-sized basic igneous origin minerals such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical alteration and zoning), olivine, orthopyroxene, and clinopyroxene. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The dominant presence of plagioclase feldspar along with olivine, orthopyroxene and clinopyroxene crystals to a lesser extent—combined they account an approximate average of 59% of the coarse fraction in the three samples—indicate that the clay derived from the breakdown of a basic igneous source.<br>a) It is important to note that while the frequency of plagioclase feldspar grains is relatively uniform, significant variations exist in the frequencies of olivine (absent in TPPV-54) and clinopyroxene (virtually absent in TPPV-51 and -54) crystals.<br>b) The respective low and moderate degrees of angularity and sphericity exhibited by most inclusions as well as their well to moderate sorted textures indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **No process** | 1) While the fabric's texture such as the unimodal grain size distribution and its well sorted inclusions (only in TPPV-37, and -54) hint that a paste refinement technique could have been employed to produce this relatively fine-textured body, the sedimentary nature of the raw clay—whose grains are transported through erosion thus can naturally produce a "refined"-textured |

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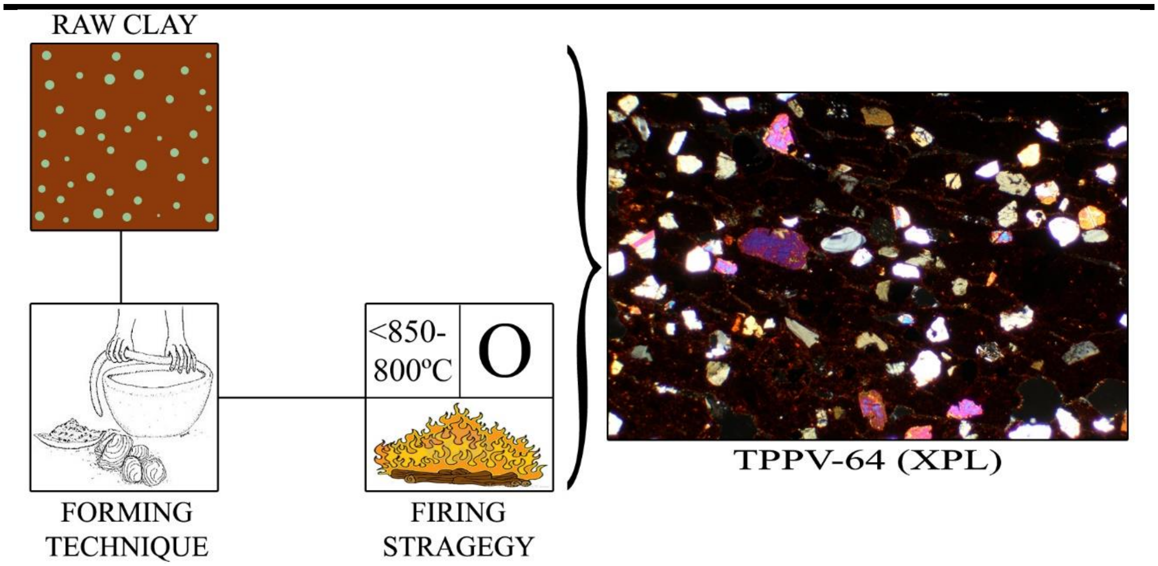
| | | clay—can also account for the aforementioned textural characteristics. Thus, at this moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel. |
| **PRIMARY FORMING TECHNIQUE** | | |
| **Undetermined** | 1) | Neither macroscopic nor microscopic evidence was found to determine the vessels' forming technique. |
| **FIRING STRATEGY** | | |
| **<850-800ºC** | 1. | With the exception of a small area in TPPV-37's matrix which exhibited a low degree of optical activity, in the majority of the samples' matrices the grade was either moderate or high which indicates the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The pastes' color and the lack of a firing cores indicate that oxidizing conditions prevailed, however only in TPPV-51 were these sustained long enough to allow the complete oxidation of the sherd as evidenced by the uniformity of its color.<br>a) TPPV-37's and -54's paste color transition—gradating from red to brownish tones—indicate that oxygen was not able to fully penetrate these pastes—likely caused by a short firing period (Quinn 2013:200)—resulting in an incomplete oxidation of the sherd. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate as well as the incomplete oxidation of some of the sherds due to a short firing period indicate that an open firing regime was employed. |

**WARE TYPES (SAMPLE I.D.)**

**3 samples:** Plain Criolla (TPPV-51, -54)

Slipped Criolla (TPPV-37).

**Table 3** Fabric 4 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Unimodal and well to moderately sorted fabrics predominantly composed of fine to medium sand-sized basic igneous origin minerals such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical alteration and zoning), clinopyroxene, and orthopyroxene, and fine sand-sized opaque minerals. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The dominant presence of clinopyroxene and orthopyroxene along with plagioclase feldspar, fine-grained basic igneous rock (likely from basalt), and opaque mineral crystals to a lesser extent—combined they account an approximate average of 71% of the coarse fraction in the three samples— indicate that the clay derived from the breakdown of a basic igneous source.<br>a) It is important to note that while the frequency of the pyroxenes is relative uniform, significant variations exist in the frequencies of plagioclase feldspar and opaque mineral (absent in TPPV-53) crystals.<br>b) While rare, the presence of glassy rock clasts in every fabric further support the geological correlation between this group's samples and extrusive origin of the raw clay.<br>c) The respective low and moderate degrees of angularity and sphericity exhibited by most inclusions as well as their very well to moderate sorted textures indicate that the clay derived from a sedimentary deposit. However, it is possible that the clay used for TPPV-53 was obtained from a deposit closer to the parent rock since some of the inclusions exhibit higher |

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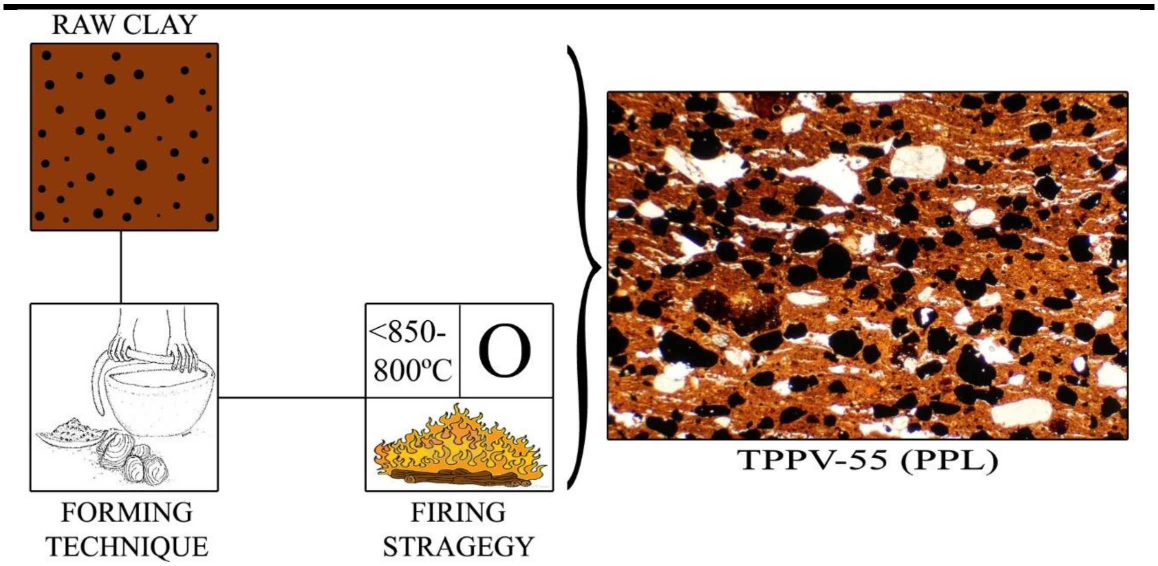
| | | degrees of angularity and sphericity as well as a moderate sorting of its coarse fraction. |
| | **BODY PREPARATION** | |
| **No process** | 1) | While a size fraction (very fine sand) appears to be virtually absent in this fabric there are not clear indications that its inclusions were added as temper given their relative small size as grains above the medium sand size range are rare. There are no indications that the clay was refined or mixed either. |
| | **PRIMARY FORMING TECHNIQUE** | |
| **Coiling** | 1) | Modelling evidence could only be discerned in one sample (TPPV-58) where a large void appears to delineate the juncture of two coils indicating that the vessel was formed through coiling. |
| | **FIRING STRATEGY** | |
| **<850-800ºC** | 1) | With the exception of small areas in TPPV-53's and -64's matrices which exhibited a low and no (inactive) degrees of optical activity respectively, in the majority of the samples' matrices the grade was either moderate or high which indicates the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The pastes' color and the lack of a firing cores indicate that oxidizing conditions prevailed, however only in TPPV-53 and -64 were these sustained long enough to allow the complete oxidation of the sherds as evidenced by their color uniformity.<br>a) TPPV-58's paste color transition—gradating from different brown tones—indicate that oxygen was not able to fully penetrate these pastes resulting in an incomplete oxidation of the sherd. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate as well as the incomplete oxidation of one of the sherds due to a short firing period indicate that an open firing regime was employed. |
| | **WARE TYPES (SAMPLE I.D.)** | |
| **3 samples:** Plain Criolla (TPPV-53, -58, -64). | | |

**Table 4** Fabric 5 characterization and production sequence




| | |
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| **Group's characteristics** | Unimodal, single-spaced, and very well sorted fabric predominantly composed of fine to medium sand-sized opaque minerals and orthopyroxene. |
| | **GEOLOGICAL PROVENIENCE** |
| **Undetermined** | 1) The coarse fraction is dominated by opaque minerals—concentrating approximately 60% of the inclusions—which do not provide any relevant information on provenience.<br>a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions as well as their very well sorted texture indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **No process** | 1) While a size fraction (very fine sand) appears to be virtually absent in this fabric there are not clear indications that its inclusions were added as temper given their relatively small size as grains above the medium sand size range are rare. There are no indications that the clay was refined or mixed either. |
| | **PRIMARY FORMING TECHNIQUE** |
| **Coiling** | 1) The concentric orientation of inclusions and voids in the matrix reveal the presence of a relic coil indicating that the vessel was formed through coiling. |
| | **FIRING STRATEGY** |
| **<850-800ºC** | 1) The matrix's high degree optical activity indicates that the maximum firing temperature was below 850-800ºC. |

| | | |
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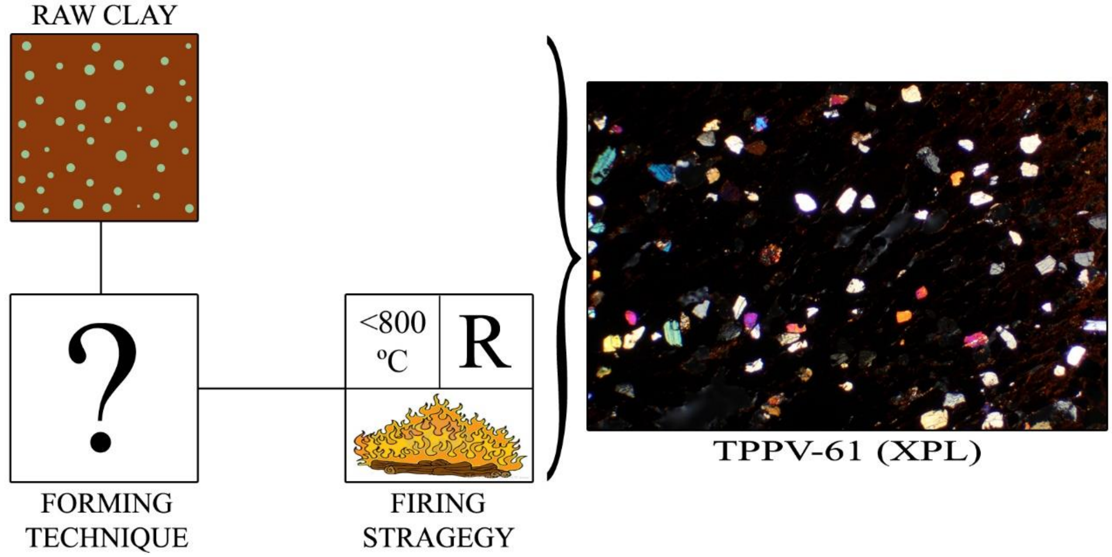
| **Oxidizing atmosphere** | 1) | The paste's uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |

**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Slipped Criolla (TPPV-55).

**Table 5** Fabric 6 characterization and production sequence




**Group's characteristics** Unimodal, single-spaced, and very well sorted fabric predominantly composed of fine to medium sand-sized basic igneous origins minerals such as clinopyroxene and orthopyroxene, and opaque minerals.

**GEOLOGICAL PROVENIENCE**

**Basic source**

1) The dominant presence of clinopyroxene and orthopyroxene crystals—combined they account for approximately 60% of the coarse fraction—along with the lack of common acid igneous rock forming minerals and the infrequency of hornblende and plagioclase feldspar grains indicate that the clay derived from the breakdown of a basic igneous source.
    a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions as well as their very well sorted texture indicate that the clay derived from a sedimentary deposit.
2) The sedimentary nature of the clay deposit might account for the presence of chalk—a carbonate rock composed of fine-grained calcite crystals—which might have been naturally transported to the clay from a different parent rock through erosive processes.

**BODY PREPARATION**

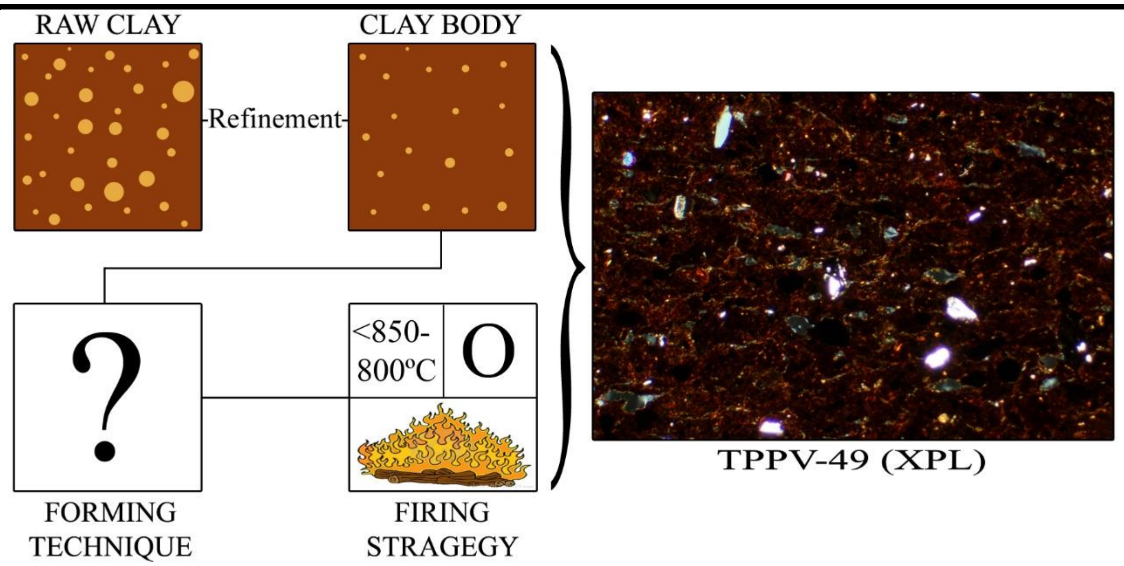
**No process**

1) While a size fraction (very fine sand) appears to be virtually absent in this fabric there are not clear indications that its inclusions were added as temper given their relative small size as grains above the medium sand size range are rare. There are no indications that the clay was refined or mixed either.

**PRIMARY FORMING TECHNIQUE**

| | | |
|---|---|---|
| **Undetermined** | 1) | Neither macroscopic nor microscopic evidence was found to determine the vessel’s forming technique. |
| | | **FIRING STRATEGY** |
| **<800ºC** | 1) | While the matrix’s lack of optical activity makes this an inadequate parameter to interpret maximum firing temperature, the presence of chalk inclusions indicates it did not reach 800ºC. because that is the threshold where calcareous material fully decomposes from the ceramic body (Albero 2014: 93-97). |
| **Reducing atmosphere** | 1) | The paste’s uniform black color as well as the matrix’s inactive optical activity indicate that reducing conditions prevailed. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |
| | | **WARE TYPES (SAMPLE I.D.)** |
| **1 sample:** Plain Criolla (TPPV-61). | | |

**Table 6** Fabric 7 characterization and production sequence

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| **Group's characteristics** | Unimodal and double-spaced fabrics with a small coarse fraction (less than 10% of the total area) that are predominantly composed of argillaceous inclusions. The paste appears to have been refined. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The presence—albeit at varying frequencies depending on the sherd—of plagioclase feldspar, quartz, hornblende, clinopyroxene, orthopyroxene, and fine-grained igneous rocks of basic origins (likely from basalt) clasts indicate that the clay derived from the breakdown of a basic igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by most inclusions indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **Refinement technique** | 1) The fabrics' double-spaced texture, their relatively low proportions (10% in each sample), and their unimodal grain size distribution—composed predominantly of very fine to fine sand-sized grains—suggest that a refinement technique was applied to produce this group's paste. Furthermore, the conspicuous presence of clay pellets, indicating the inadequate hydration of crushed clay whose dry lumps were not allowed to completely soak when wetting of the body (Quinn 2013: 171, 173), further supports this interpretation as the powdering of raw clay is a necessary step prior to levigation or sieving processes.<br>2) In TPPV-42 several fragments of grog—an inclusion of anthropogenic origins—were identified indicating that the after this paste was decanted this material was added presumably to |

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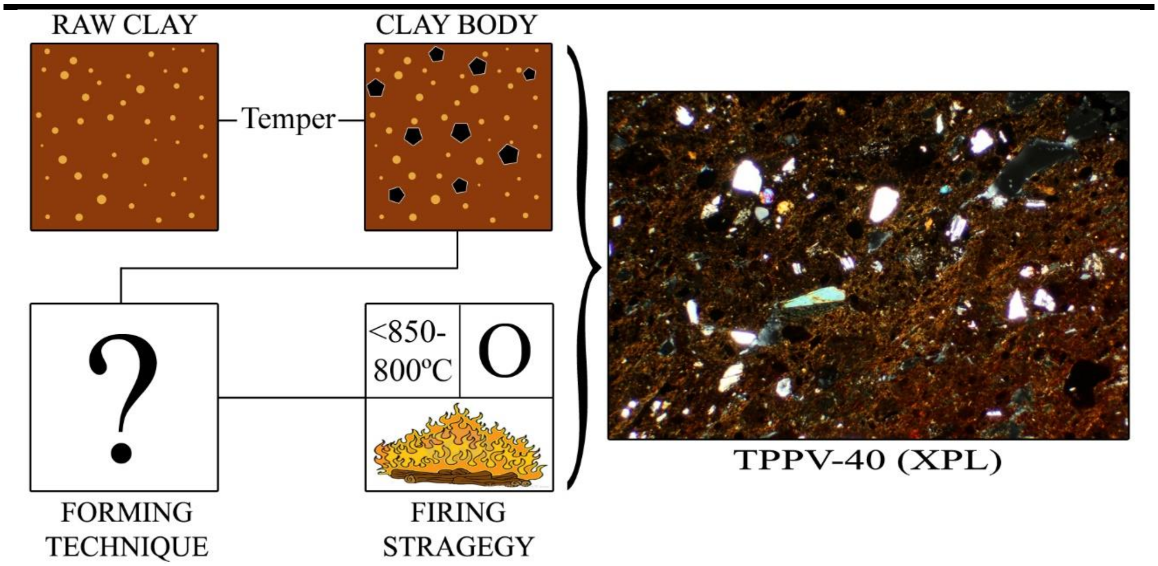
| | | improve its plasticity. Some of the grog clast have a different color than the surrounding matrix and contain minerals that are not present in the fabric; thus, it is possible that the crushed vessel corresponded to a different type of ceramic. |
| **PRIMARY FORMING TECHNIQUE** | | |
| **Undetermined** | 1) | Neither macroscopic nor microscopic evidence was found to determine the vessel's forming technique. |
| **FIRING STRATEGY** | | |
| **<850-800ºC** | 1) | The matrices' moderate degree optical activity indicates that the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The pastes' uniform color and the lack of a firing cores indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of both sherds. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |
| **WARE TYPES (SAMPLE I.D.)** | | |

**2 samples:** Plain Criolla (TPPV-49)

Slipped Criolla (TPPV-42).

**Table 7** Fabric 8 characterization and production sequence



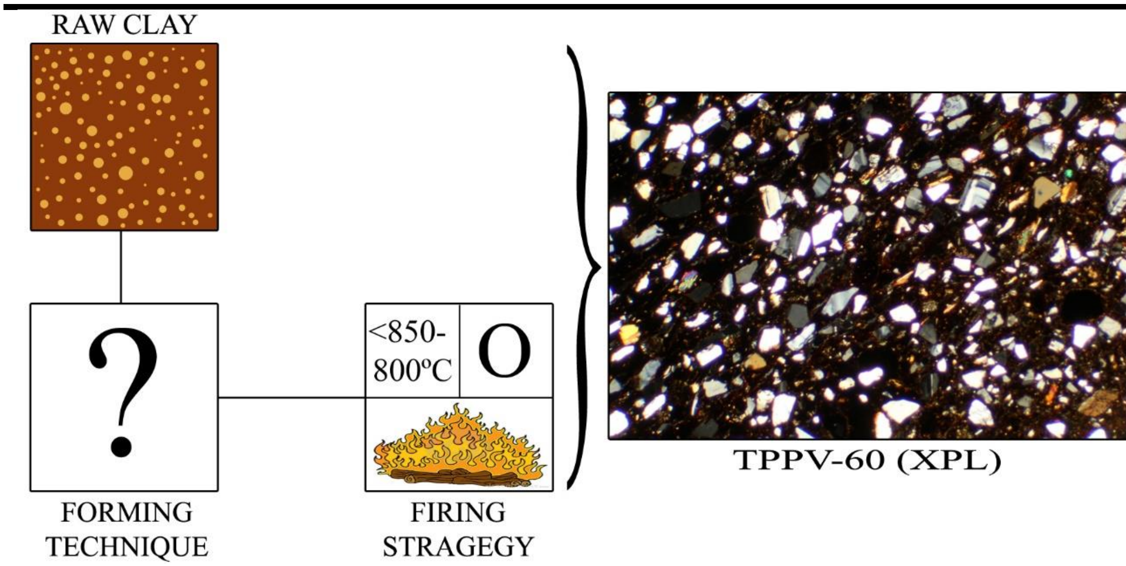

| | |
|---|---|
| **Group's characteristics** | Unimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as plagioclase feldspar, quartz, clinopyroxene, and hornblende to which coarse sand-sized grog inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) The presence of plagioclase feldspar, quartz, hornblende, clinopyroxene and orthopyroxene crystals in almost equal proportions indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions suggest that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **Tempering** | 1) The presence of grog—an inclusion of anthropogenic origins—indicates that this fabric was tempered (albeit using small quantities of it). Some of the grog clast have a different color than the surrounding matrix and contain minerals that are not present in the fabric; thus, it is possible that the crushed vessel corresponded to a different type of ceramic. |
| | **PRIMARY FORMING TECHNIQUE** |
| **Undetermined** | 1) Neither macroscopic nor microscopic evidence was found to determine the vessel's forming technique. |
| | **FIRING STRATEGY** |

| | | |
|---|---|---|
| **<850-800ºC** | 1) | The matrix’s moderate degree optical activity indicates that the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The paste’s color transition—gradating from red to buff—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate as well as the incomplete oxidation of one of the sherds due to a short firing period indicate that an open firing regime was employed. |

**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Slipped Criolla (TPPV-40).

**Table 8** Fabric 9 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Unimodal, single-spaced, and well sorted fabric predominantly composed of intermediate igneous origin minerals such as fine to medium sand-sized plagioclase feldspar (whose crystals exhibit varying degrees of chemical zoning) and quartz, and very fine to fine sand-sized hornblende. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) The dominant presence of plagioclase feldspar along with quartz, and hornblende crystals to a lesser extent—combined they account for approximately 75% of the coarse fraction— indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The moderate degrees of angularity and sphericity exhibited by most inclusions as well as their well sorted texture suggest that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **No process** | 1) While the fabric's texture such as the unimodal grain size distribution and its well sorted inclusions hint that a paste refinement technique could have been employed, the high proportion of the coarse fraction (40%) suggest that the application of said process was unlikely because techniques such as levigation and sieving tend to produce fine-textured fabrics. Thus, at this moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel. |
| | **PRIMARY FORMING TECHNIQUE** |

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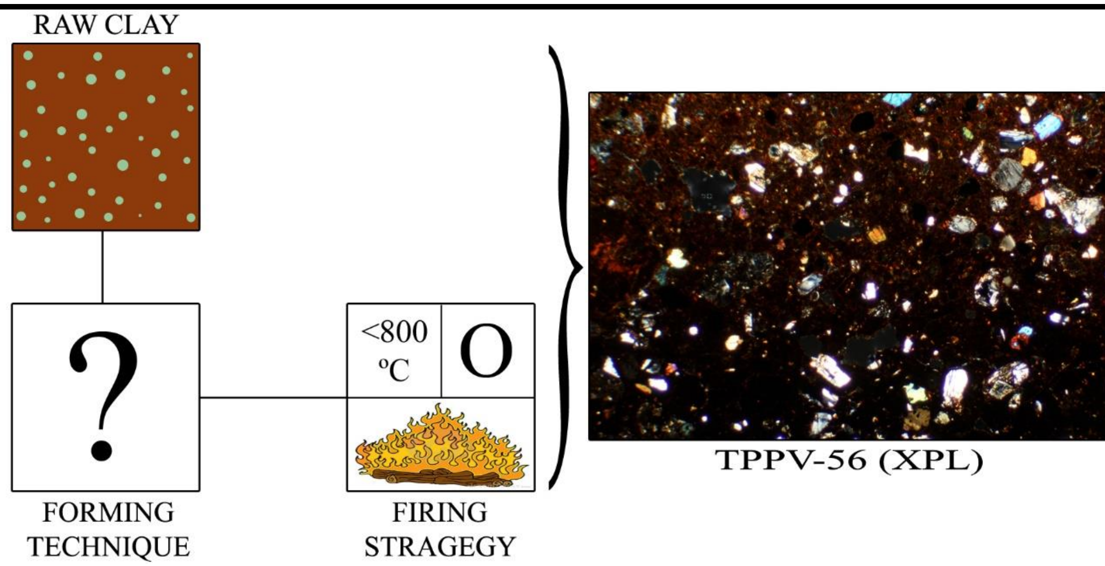
|---|---|
| **Undetermined** | 1) Neither macroscopic nor microscopic evidence was found to determine the vessel’s forming technique. |
| **FIRING STRATEGY** | |
| **<850-800ºC** | 1) While part of the matrix’s optical activity is inactive due to the firing atmosphere’s conditions, towards the sherd’s interior wall—which is partially oxidized—the degree was moderate which situates the maximum firing temperature below 850-800ºC. |
| **Oxidizing atmosphere** | 1) The paste’s color transition—gradating from buff to brownish tones—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel.<br>a) A thin layer in the exterior wall’s subsurface appears to have been exposed to reducing conditions as evidenced by the paste’s black color and matrix’s inactive optical activity. Given that the margin between this layer and the rest of the matrix is diffuse, it is likely that this event occurred during the firing stage. |
| **Open firing** | 1) The relatively low maximum firing temperature estimate, the incomplete oxidation of the sherd due to a short firing period as well as the presence of a firing cloud indicate that an open firing regime was employed. |
| **WARE TYPES (SAMPLE I.D.)** | |
| **1 sample:** Plain Criolla (TPPV-60). | |

**Table 9** Fabric 10 characterization and production sequence

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|---|---|
| **Group's characteristics** | Weakly to moderately bimodal and moderately to poorly sorted fabrics derived from the breakdown of a non-calcareous marine clay predominantly composed of basic igneous origin minerals such as medium sand-sized plagioclase feldspar and clinopyroxene, very fine to fine sand-sized quartz, and bioclast (foraminifera) remains. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The dominant presence of plagioclase feldspar along with clinopyroxene, orthopyroxene, fine-grained basic igneous rock (likely from basalt), and quartz crystals to a lesser extent—combined they account an approximate average of 71% of the coarse fraction in both samples— indicate that the clay derived from the breakdown of a basic igneous source.<br>a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions as well as their well sorted texture and the presence of calcareous and silicate microfossils indicate that the clay derived from a marine sedimentary deposit.<br>2) The absence of carbonate minerals or rocks indicate the clay is non-calcareous despite the cream-colored pastes. |
| | **BODY PREPARATION** |
| **No process** | 1) While the TPPV-56's and -62's respective moderately and poorly sorted inclusions as well as their weak and moderate bimodal grain size distribution hint that temper material could have been added to produce this group's paste, the low frequency of coarser grains along with the textural uniformity between finer-sized and coarser-sized inclusions weakens this interpretation. Thus, at this |

moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel.

**PRIMARY FORMING TECHNIQUE**

**Undetermined**

1) Neither macroscopic nor microscopic evidence was found to determine the vessel's forming technique.

**FIRING STRATEGY**

**<800ºC**

1) With the exception of a small areas in both sherds matrices which did not exhibit any degree of optical activity due to the firing atmosphere's conditions, in most of the matrices the grade was moderate which situated the maximum firing temperature below 850-800ºC. However, the presence of calcareous microfossils—in this case remains of foraminifera—in both fabrics strongly suggests that the range was below 800ºC.

**Oxidizing atmosphere**

1) The pastes' color transition—gradating from creamish to brownish tones—and lack of firing cores indicate that while the sherds were fired in oxidizing atmospheres, this condition was not sustained long enough to allow the oxygen to fully penetrate the pastes resulting in an incomplete oxidation of the vessels.
   a) A layer in the exterior walls' subsurface appears to have been exposed to reducing conditions as evidenced by the pastes' black color and matrices inactive optical activity. Given that the margins between this layer and the rest of the matrix is diffuse, it is likely that this event occurred during the firing stage.

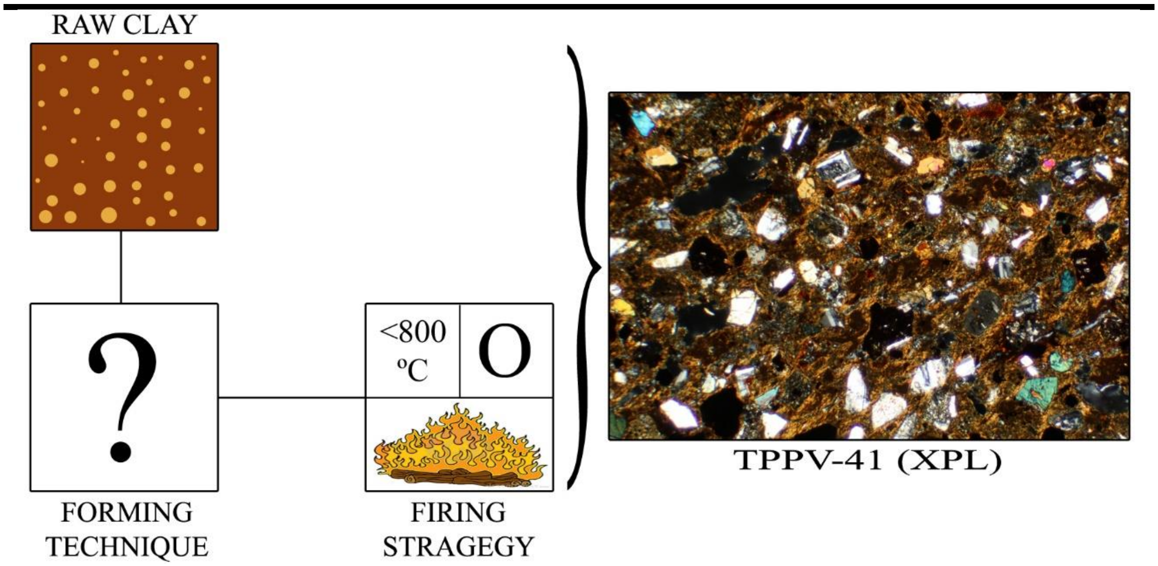
**Open firing**

1) The relatively low maximum firing temperature estimate as well as the incomplete oxidation of the sherds due to a short firing period indicate that an open firing regime was employed.

**WARE TYPES (SAMPLE I.D.)**

**2 samples:** Plain Criolla (TPPV-56, -62).

**Table 10** Fabric 11 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Unimodal, single-spaced, and well sorted fabric derived from the breakdown of a non-calcareous marine clay predominantly composed of fine to medium sand-sized basic igneous origin minerals such as plagioclase feldspar and clinopyroxene, medium to coarse sand-sized fine-grained igneous rocks (likely andesite and/or dacite), and bioclast (foraminifera) remains. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The dominant presence of fine-grained igneous rocks and plagioclase feldspar along with clinopyroxene and orthopyroxene crystals to a lesser extent—combined they account for approximately 65% of the coarse fraction— indicate that the clay derived from the breakdown of a basic igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by most inclusions as well as their well sorted texture and the presence of calcareous microfossils indicate that the clay derived from a marine sedimentary deposit.<br>2) The absence of carbonate minerals or rocks indicate the clay is non-calcareous despite its cream-colored paste. |
| | **BODY PREPARATION** |
| **No process** | 1) While the fabric's texture such as the unimodal grain size distribution and its well sorted inclusions hint that a paste refinement technique could have been employed, the high proportion of the coarse fraction (30%) and voids (15%) suggest that the application of said process was unlikely because |

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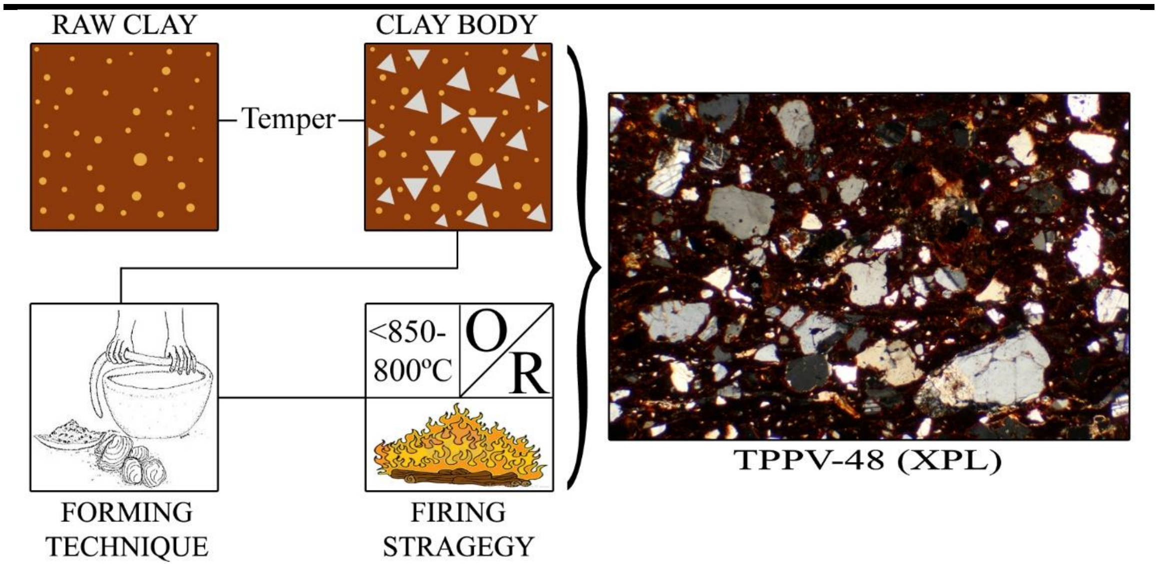
| | | techniques such as levigation and sieving tend to produce fine-textured fabrics that lack voids due to uneven drying. Thus, at this moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel. |
| **PRIMARY FORMING TECHNIQUE** | | |
| **Undetermined** | 1) | Neither macroscopic nor microscopic evidence was found to determine the vessel’s forming technique. |
| **FIRING STRATEGY** | | |
| **<800ºC** | 1) | While the matrix’s high degree optical activity indicates that the maximum firing temperature was below 850-800ºC, the presence of calcareous microfossils—in this case remains of foraminifera—in both fabrics strongly suggests that the range was below 800ºC. |
| **Oxidizing atmosphere** | 1) | The paste’s uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |
| **WARE TYPES (SAMPLE I.D.)** | | |

**1 sample:** Slipped Criolla (TPPV-41).

**Table 11** Fabric 12 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Weakly to moderately bimodal, single-spaced, and moderately sorted fabrics predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as quartz, plagioclase feldspar, and chemically altered biotite to which crushed coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) Excluding grains in the coarser fraction (explained below), the dominant presence (albeit at varying frequencies depending on the sherd) of quartz along with plagioclase feldspar and heavily-weathered biotite crystals to a lesser extent—combined they account an approximate average of 70% of the coarse fraction in the seven samples— indicate that the clay derived from the breakdown of an intermediate igneous source. Other less common minerals include clinopyroxene and hornblende which are only frequently present in TPPV-36.<br>a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions suggest that the clay derived from a sedimentary deposit |
| | **BODY PREPARATION** |
| **Tempering** | 1) With the exception of TPPV-52—whose inclusions are poorly sorted and exhibit moderate bimodal grain size distribution—the rest of the samples' are moderately sorted with weak bimodal distribution which suggest that temper material was added to produce this group's paste. Detailed examination determined the |

existence of two separate size fractions whose notable compositional and textural differences further support this interpretation:

a) The fine fraction is predominantly composed of very fine or fine to lower range medium sand-sized (<350 µm) quartz crystals while the coarse fraction of upper range medium (>400 µm) to coarse sand-sized coarse-grained intermediate igneous rocks of intermediate origins (likely from either granodiorite or tonalite) and their individual mineral constituents (quartz, plagioclase feldspar, and heavily-weathered biotite, and hornblende in TPPV-36, -39, -52, -59 and clinopyroxene in TPPV-36, -25). Unlike the fine fraction inclusions, the coarse fraction's lithic and mineral clasts alike exhibit a higher degree of angularity, a lower grade of sphericity, and varying degrees of chemical weathering in the form of sericite alteration.
b) The coarse fraction's sharp and moderately sorted inclusions indicate that either granodiorite or tonalite rocks were crushed in order to be added to the clay. Furthermore, the presence of the rock's constituent minerals with similar size and texture further supports that this process took place because it is common for the separate mineral components of the rock to break off during the crushing procedure.

2) The compositional similarity between the temper material and the clay's natural constituent, and the very high degree of alteration of biotite crystals independent of size suggest that the temper material was possibly proximate to the clay source.

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**PRIMARY FORMING TECHNIQUE**

**Coiling**

1) Modelling evidence could only be discerned in four samples (TPPV-36, -48, -50, -59) which indicate that these vessels were formed through coiling:
   a) TPPV-36 and -50 contain a concentric orientation of inclusions and voids in their matrices indicating the presence of relic coils.
   b) TPPV-48's and -59's respective exterior wall and cross section presents evidence of a coil joint.

---

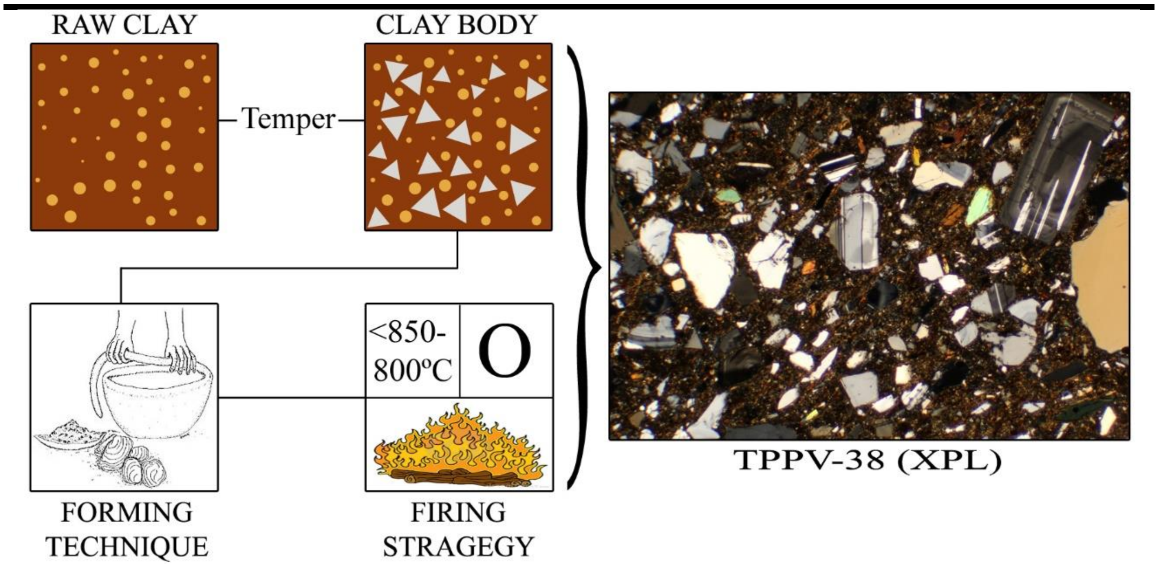
**FIRING STRATEGY**

**<850-800ºC**

1) The matrices' optical activity varies between sherds where most exhibit either moderate to high (TPPV-36, -39, -47, -48, -52, and -59) or low (TPPV-50) degrees and even within sherds where some have small inactive areas (TPPV-47, -48, -50). As the majority contain moderate to high degrees, it indicates that the group's most commonly achieved maximum firing temperature was below 850-800ºC.

| | |
|---|---|
| | a) TPPV-50 is the exception as the temperature appears to have reached above the aforementioned range.<br>b) The presence of a granule-sized sedimentary carbonate clast (possibly dolomite or siderite) in TPPV-52's fabric indicates this sherd's maximum temperature was below than 800ºC. |
| **Oxidizing and reducing atmospheres** | 1) The pastes' color and the lack of a firing cores indicate that oxidizing conditions prevailed in 5 samples, however only in TPPV-39 were these sustained long enough to allow the complete oxidation of the sherd as evidenced by its color uniformity.<br>a) TPPV-36's, -48's, 52's, and -59's pastes color transition indicate that oxygen was not able to fully penetrate these pastes resulting in an incomplete oxidation of the sherds.<br>b) TPPV-48 contains a thin black-colored layer in the exterior wall's subsurface whose margin with the surrounding matrix is sharp which could suggest that smudging was applied.<br>2) TPPV-47's black-colored paste as well as the matrix's inactive optical activity indicate that reducing conditions prevailed.<br>a) A thin layer in the exterior wall's subsurface appears to have been exposed to circulating oxygen resulting in an oxidized matrix with some degree of optical activity. Given that the margin between this layer and the rest of the matrix is sharp, it is likely that the vessel was exposed to oxidizing conditions during the cooling stage.<br>3) TPPV-50's paste color transition—gradating from black to dark brown tones—as well as its matrix's respective inactive and low degree of optical activity suggest that the firing atmosphere varied significantly where reducing conditions prevailed near the exterior wall and oxidizing towards the interior wall. |
| **Open firing** | 1) The relatively low maximum firing temperature estimate of most of the group's samples, the variability in the atmospheric conditions as well as the incomplete oxidation of some of the sherds due to a short firing period indicate that an open firing regime was employed. |
| **WARE TYPES (SAMPLE I.D.)** | |
| **7 samples:** Plain Criolla (TPPV-47, -48, -50, -52, -59)<br>Slipped Criolla (TPPV-36, -39). | |

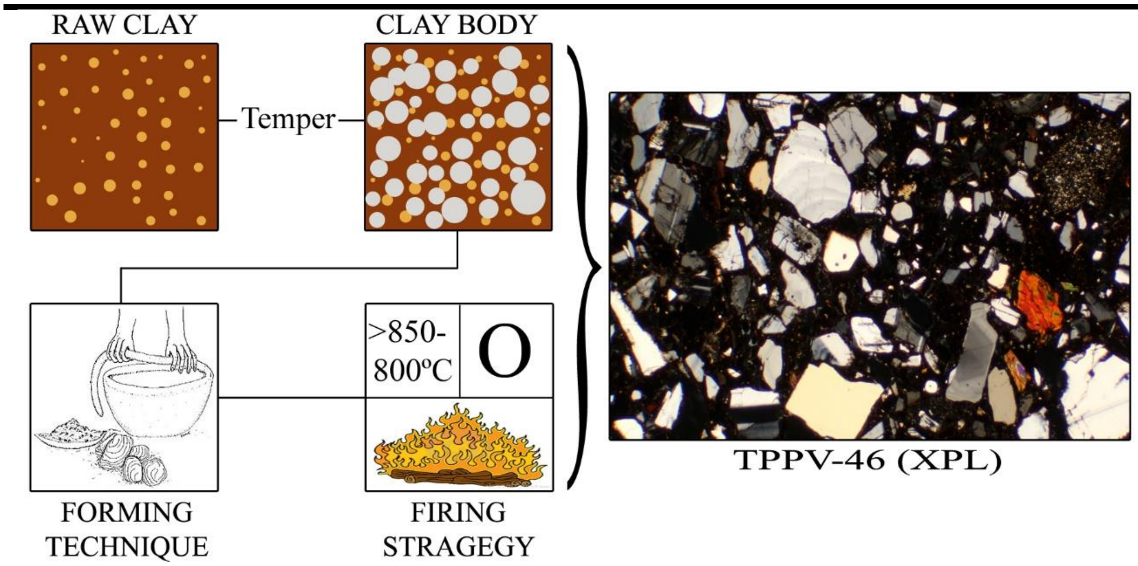
**Table 12** Fabric 13 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as plagioclase feldspar, quartz, and hornblende to which crushed coarse sand-sized quartz and plagioclase feldspars (whose crystals exhibit varying degrees of physical alteration and chemical zoning) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) Excluding grains above the medium sand size range (explained below), the dominant presence of plagioclase feldspar and quartz along with hornblende crystals to a lesser extent—combined they account for approximately 85% of the coarse fraction—indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by these inclusions indicate that the clay derived from a sedimentary deposit.<br>2) The absence of carbonate minerals or rocks indicate the clay is non-calcareous despite its cream-colored paste. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given that the clay's sedimentary nature, the fabric's poorly sorted inclusions as well as their strong bimodal grain size distribution strongly indicate that temper material was added to produce this group's paste. Detailed examination determined the existence of two separate size fractions that—while the inclusions |

| | | |
|---|---|---|
| | | are compositionally uniform—contain notable textural differences which further supports this interpretation:<br>a) The fine fraction is composed of very fine to fine sand-sized quartz and plagioclase feldspar crystals while the coarse fraction of medium to coarse (as well as several very coarse) sand-sized grains of the aforementioned minerals. Unlike the fine fraction inclusions, the coarse fraction's exhibit a higher degree of angularity, a lower grade of sphericity, and have a different shape.<br>b) The coarse fraction's sharp and poorly sorted inclusions indicate quartz and plagioclase feldspar minerals were crushed in order to be added to the clay. |
| | 2) | The compositional similarity between the temper material and the clay's natural constituent, and the presence of chemical zoning among most plagioclase feldspar crystals independent of size suggest that the temper material was possibly proximate to the clay source. |
| | **PRIMARY FORMING TECHNIQUE** | |
| **Coiling** | 1) | The concentric orientation of inclusions and voids in the matrix reveal the presence of a relic coil indicating that the vessel was formed through coiling. |
| | **FIRING STRATEGY** | |
| **<850-800ºC** | 1) | The matrix's high degree optical activity indicates that the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The paste's uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |
| | **WARE TYPES (SAMPLE I.D.)** | |
| **1 sample:** Slipped Criolla (TPPV-38). | | |

**Table 13** Fabric 14 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Strongly bimodal, close-spaced, and poorly sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as plagioclase feldspar, quartz, and hornblende to which large quantities of eroded medium to coarse sand-sized quartz and plagioclase feldspars (whose crystals exhibit varying degrees of physical alteration and chemical zoning) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) Excluding grains above the medium sand size range (explained below), the dominant presence of plagioclase feldspar and quartz along with hornblende crystals to a lesser extent—combined they account for approximately 80% of the coarse fraction— indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by these inclusions indicate that the clay derived from a sedimentary deposit.<br>2) The absence of carbonate minerals or rocks indicate the clay is non-calcareous despite its cream-colored paste. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given the clay's sedimentary nature, the fabric's poorly sorted inclusions as well as their strong bimodal grain size distribution strongly indicate that temper material was added to produce this group's paste. Detailed examination determined the existence of two separate size fractions that—while the inclusions are |

compositionally uniform—contain notable textural differences which further supports this interpretation:

   a) The fine fraction is composed of fine to medium sand-sized plagioclase feldspar, quartz, and hornblende crystals while the coarse fraction of upper range medium (>400 µm) to coarse (and several very coarse) sand-sized plagioclase feldspar and quartz grains. Unlike the fine fraction inclusions, the coarse fraction's exhibit a lower degree of angularity, and a slightly higher grade of sphericity.
   b) The coarse fraction's rounded inclusions indicate that a granitic sand deposit was added to the clay.

2) The compositional similarity between the temper material and the clay's natural constituent, and the presence of chemical zoning among most plagioclase feldspar crystals independent of size suggest that the temper material was possibly proximate to the clay source.

---

**PRIMARY FORMING TECHNIQUE**

**Coiling**

1) The concentric orientation of inclusions and voids in the matrix reveal the presence of a relic coil indicating that the vessel was formed through coiling.

---

**FIRING STRATEGY**

**>850-800ºC**

1) The matrix's degree of optical activity gradates from low near the vessel's base to moderate towards the neck (this pattern was presumably caused by the close proximity of the base to the heat source). The former's grade indicates that the maximum firing temperature was above 850-800ºC.
   a) Most of hornblende crystals exhibit an alteration of their color in PPL (turning brown instead of green) which further supports that temperatures above 750ºC were sustained.

**Oxidizing atmosphere**

1) The paste's color transition—gradating from buff to brownish tones—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel.

**Open firing**

1) The relatively low maximum firing temperature estimate as well as the incomplete oxidation of one of the sherds due to a short firing period indicate that an open firing regime was employed.

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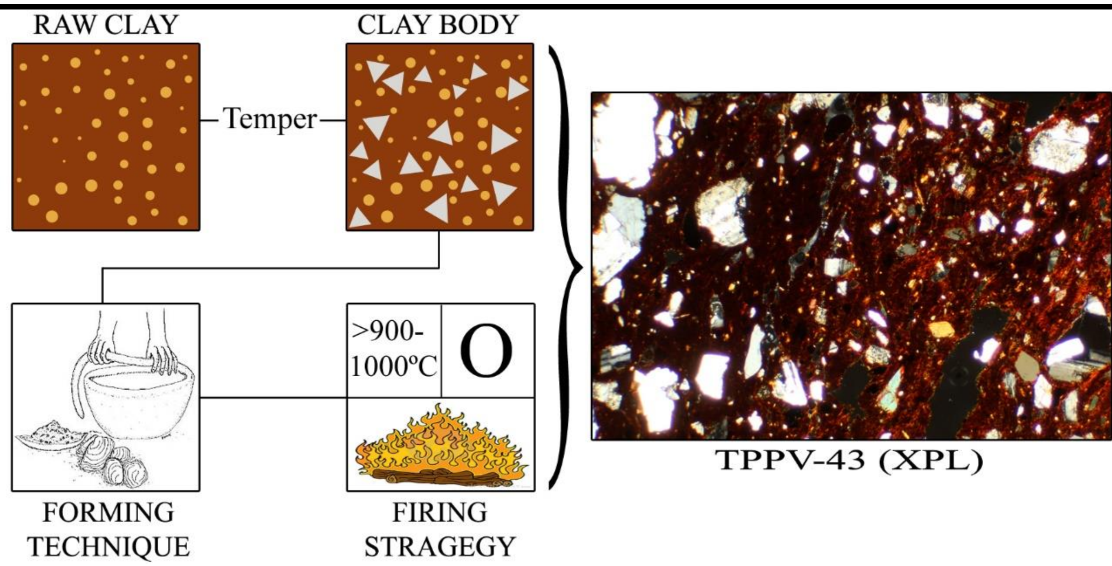
**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Plain Criolla (TPPV-46).

**Table 14** Fabric 15 characterization and production sequence

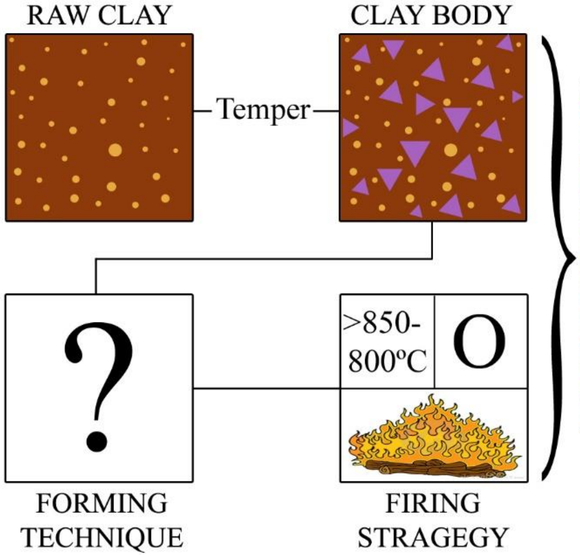


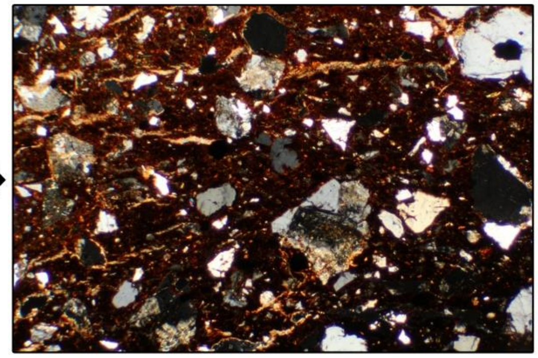

| | |
|---|---|
| **Group's characteristics** | Moderately bimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as plagioclase feldspar, quartz, and hornblende to which crushed coarse sand-sized coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) The dominant presence of plagioclase feldspar, quartz and hornblende crystals in almost equal proportions—combined they account for approximately 55% of the coarse fraction— indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The respective low and high degrees of angularity and sphericity exhibited by most inclusions indicate that the clay derived from a marine sedimentary deposit. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given the clay's sedimentary nature, the fabric's moderately sorted inclusions as well as their moderate bimodal grain size distribution suggest that temper material was added to produce this group's paste. Detailed examination determined the existence of two separate size fractions whose notable compositional and textural differences further support this interpretation:<br>a) The finer fraction is composed of very fine to fine sand-sized quartz, plagioclase feldspar, and hornblende crystals while the coarse fraction of coarse sand-sized coarse-grained |

| | |
|---|---|
| | intermediate igneous rocks of intermediate origins (likely from either granodiorite or tonalite) and their individual mineral constituents (quartz, plagioclase feldspar, and hornblende). Unlike the fine fraction inclusions, the coarse fraction's exhibit a higher degree of angularity and a lower grade of sphericity.<br>b) The coarse fraction's sharp and moderately sorted inclusions indicate that either granodiorite or tonalite rocks were crushed in order to be added to the clay. Furthermore, the presence of the rock's constituent minerals with similar size and texture further supports that this process took place because it is common for the separate mineral components of the rock to break off during the crushing procedure. |
| **PRIMARY FORMING TECHNIQUE** | |
| **Coiling** | 1) The concentric orientation of voids in cross section reveal the presence of a relic coil indicating that the vessel was formed through coiling. |
| **FIRING STRATEGY** | |
| **>900-1000ºC** | 1) Whilst few biotite grains are present, most of its crystal's cleavage planes have split which indicated that the maximum firing temperature was above 900-1000ºC.<br>a) The matrix's degree of optical activity gradates from low to moderate between the vessel's exterior and interior walls respectively (this pattern was presumably caused by the inconsistent distribution of heat during firing). The former's grade further supports that temperatures above 850-800ºC were sustained. |
| **Oxidizing atmosphere** | 1) The paste's color transition—gradating from orange to brownish tones—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel. |
| **Open firing** | 1) While a relatively high maximum firing temperature was achieved, there are strong indications that neither distribution of heat not the penetration of oxygen was consistent throughout the entire sherd. What these heterogenous features in the matrix and paste indicate is that the maximum temperature was rapidly reached but not sustained long enough to allow the matrix to achieve a uniform degree of optical activity as well as the complete oxidation of the sherd. This quick heating rate up to maximum temperature and sharp decline after it's attained is common among open firing regimes (Albero 2014: 103, 105, 106; Quinn 2013: 202). |

| WARE TYPES (SAMPLE I.D.) |
|---|
| **1 sample:** Plain Criolla (TPPV-43). |

**Table 15** Fabric 16 characterization and production sequence



TPPV-44 (XPL)

| | |
|---|---|
| **Group's characteristics** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized acid igneous origin minerals such as quartz and potassium feldspar to which crushed and chemically altered medium to coarse sand-sized coarse-grained acid rock (possibly granite) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Undetermined** | 1) Excluding the lithic clasts (explained below), the matrix is composed largely of very fine to fine sand-sized quartz and fine sand-sized potassium feldspar crystals, however further examination reveals that the latter mineral's grains not only exhibit higher degrees of angularity than the former's but also high degrees of chemical weathering—in the form of sericite alteration—which is also present in most of the coarser crystals that appear to have been added as temper. Thus, while fine-textured potassium feldspar grains are present, there is no strong indication that these are natural constituents of the clay. Therefore, as quartz is the only definable natural constituent this impedes an accurate determination of the clay's provenience.<br>a) The respective low and moderate degrees of angularity and sphericity exhibited by the quartz grains as well as their very well sorted texture indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given the clay's sedimentary nature, the fabric's poorly sorted inclusions as well as their strong bimodal grain size distribution strongly indicate that temper material was added to produce this |

group's paste. Detailed examination determined the existence of two separate size fractions whose notable compositional and textural differences further support this interpretation:

a) The finer fraction is composed of very fine to fine sand-sized quartz and several fine sand-sized potassium feldspar crystals while coarser fraction of highly chemically weathered (sericite alteration) medium to coarse sand-sized coarse-grained acid igneous rocks (likely from granite) and their individual mineral constituents (predominantly potassium feldspar). Unlike the fine fraction inclusions, the coarse fraction's exhibit a higher degree of angularity and a slightly lower grade of sphericity.

b) The coarse fraction's sharp and poorly sorted inclusions indicate that granite rocks were crushed in order to be added to the clay. Furthermore, the presence one of the rock's constituent mineral (potassium feldspar) with similar size, texture, and degree of chemical alteration further supports that this process took place because it is common for the separate mineral components of the rock to break off during the crushing procedure.

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**PRIMARY FORMING TECHNIQUE**

| | |
|---|---|
| **Undetermined** | 1) Neither macroscopic nor microscopic evidence was found to determine the vessel's forming technique. |

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**FIRING STRATEGY**

| | |
|---|---|
| **>850-800ºC** | 1. The matrix's degree of optical activity gradates from low to moderate between the vessel's interior and exterior walls respectively (this pattern was presumably caused by the inconsistent distribution of heat during firing). The former's grade indicates that the maximum firing temperature was above 850-800ºC. |
| **Oxidizing atmosphere** | 1) The paste's color transition—gradating from different brown tones—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel. |
| **Open firing** | 1) The relatively low maximum firing temperature estimate as well as the incomplete oxidation of one of the sherds due to a short firing period indicate that an open firing regime was employed. |

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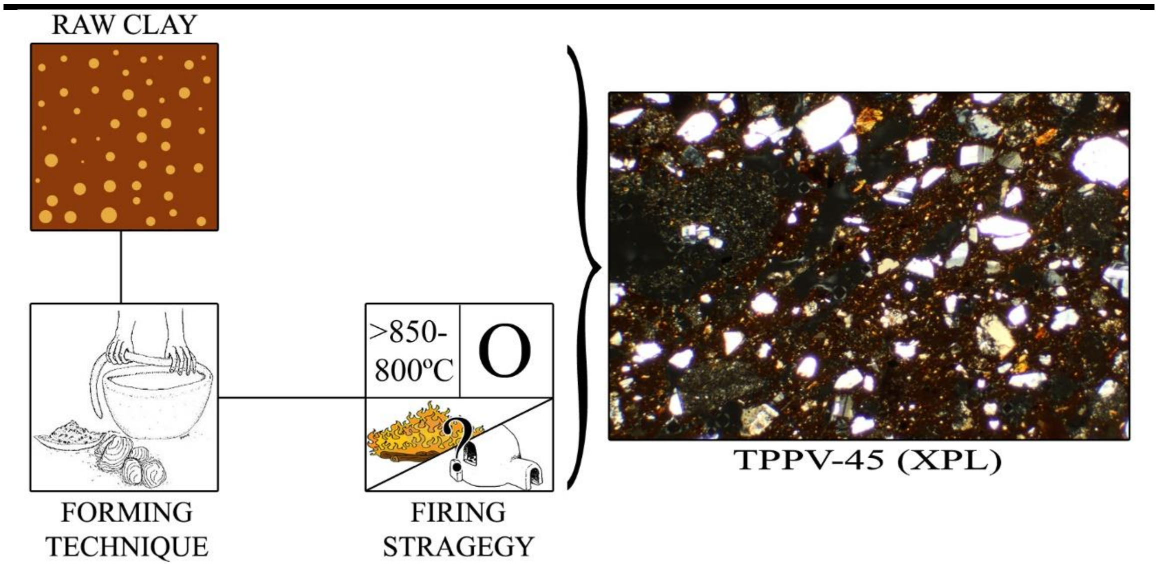
**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Slipped Criolla (TPPV-44).

**Table 16** Fabric 17 characterization and production sequence




**Group's characteristics** Moderately bimodal, single-spaced, and moderately sorted fabric predominantly composed of fine to medium sand-sized intermediate igneous origin minerals such as plagioclase feldspar (whose crystals exhibit varying degrees of chemical zoning), quartz, and biotite, and medium to coarse sand-sized fine-grained intermediate rock inclusions.

**GEOLOGICAL PROVENIENCE**

**Intermediate source**

1) The dominant presence of fine-grained intermediate igneous rocks (likely from andesite) and plagioclase feldspar along with quartz crystals to a lesser extent—combined they account for approximately 60% of the coarse fraction— indicate that the clay derived from the breakdown of an intermediate igneous source.
   a) The respective low and very high degrees of angularity and sphericity exhibited by most inclusions indicate that the clay derived from a sedimentary deposit.

**BODY PREPARATION**

**No process**

1) While the fabric's moderately sorted inclusions as well as their moderate bimodal grain size distribution hint that temper material could have been added to produce this group's paste, the compositional and textural uniformity between finer-sized and coarser-sized inclusions weakens this interpretation. Rather, it appears likely these inclusions were natural constituents of the clay. Thus, at this moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel.

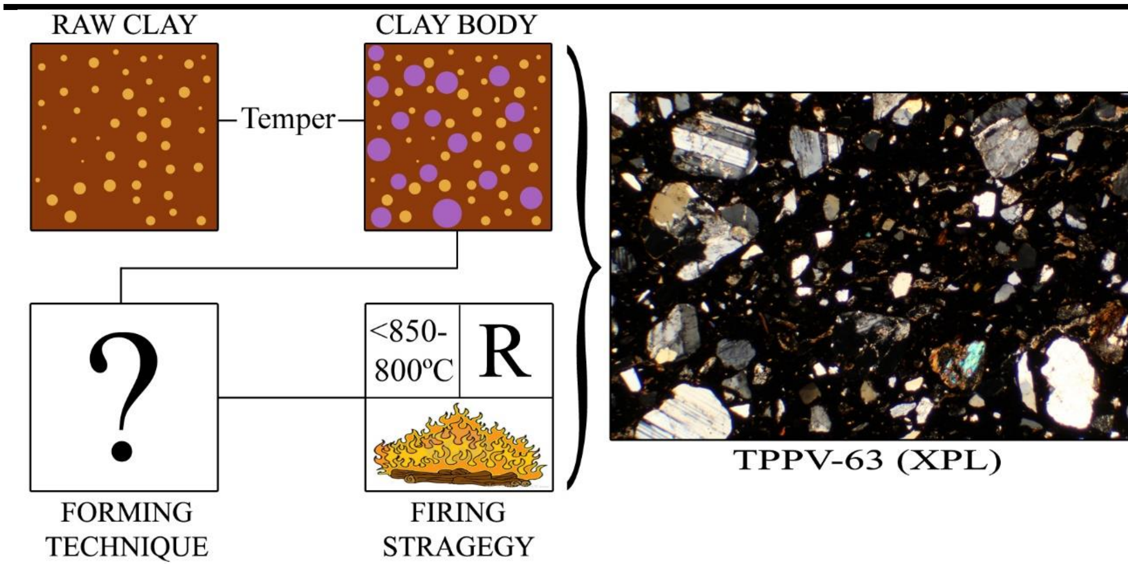
| PRIMARY FORMING TECHNIQUE | | |
|---|---|---|
| **Coiling** | 1) | The concentric orientation of inclusions and voids in the matrix reveal the presence of a relic coil indicating that the vessel was formed through coiling. |

| FIRING STRATEGY | | |
|---|---|---|
| **>850-800ºC** | 1) | The matrix's very low degree optical activity indicates that the maximum firing temperature was above 850-800ºC.<br>a) Most of hornblende crystals exhibit an alteration of their color in PPL (turning brown instead of green) which further supports that temperatures above 750ºC were sustained. |
| **Oxidizing atmosphere** | 1) | The paste's uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Undetermined** | 1) | The relatively high maximum firing temperature estimate, complete oxidation of the sherd, and the lack of firing cloud warrants the possibility that a closed firing regime might have been employed. However, while difficult to achieve, it is possible to obtain these results in an open firing (Rye 1988: 98), particularly with coarse-grained pastes with a relatively high proportion of voids like this one (approximately 20%). Thus, from the available data it is not possible to determine which regime was used. |

**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Plain Criolla (TPPV-45).

**Table 17** Fabric 18 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized intermediate igneous origin minerals such as quartz and biotite to which crushed medium to very coarse sand-sized coarse-grained acid rock (possibly granite) were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Intermediate source** | 1) Excluding grains above the fine sand size range (explained below), the dominant presence of quartz along with biotite, plagioclase feldspar and hornblende crystals to a lesser extent—combined they account for approximately 50% of the coarse fraction— indicate that the clay derived from the breakdown of an intermediate igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by these inclusions indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given the clay's sedimentary nature, the fabric's poorly sorted inclusions as well as their strong bimodal grain size distribution strongly indicate that temper material was added to produce this group's paste. Detailed examination determined the existence of two separate size fractions whose notable compositional and textural differences further support this interpretation:<br>a) The fine fraction is composed of very fine to fine sand-sized quartz, biotite, plagioclase feldspar, and hornblende crystals while coarser fraction is composed of heavy chemically-weathered—in the form of sericite alteration—medium to |

very coarse sand-sized coarse-grained acid igneous rocks (likely from granite) and their individual mineral constituents (predominantly potassium feldspar). Unlike the fine fraction inclusions, the coarse fraction's exhibit a lower degree of angularity, a very high grade of sphericity, and heavy chemical weathering.

b) The coarse fraction's rounded inclusions indicate that a granitic sand deposit was added to the clay.

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**PRIMARY FORMING TECHNIQUE**

| | |
|---|---|
| **Undetermined** | 1) Neither macroscopic nor microscopic evidence was found to determine the vessel's forming technique. |

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**FIRING STRATEGY**

| | |
|---|---|
| **<850-800ºC** | 1) While most of the matrix's optical activity is inactive due to the firing atmosphere's conditions, near the sherd's exterior wall—which is partially oxidized—the degree was moderate which situates the maximum firing temperature below 850-800ºC. |
| **Reducing atmosphere** | 1) The paste's uniform black color as well as the matrix's inactive optical activity indicate that reducing conditions prevailed.<br>a) While only observable in thin-section, a thin layer in the interior wall's subsurface appears to have been exposed to circulating oxygen resulting in an oxidized matrix with some degree of optical activity. Given that the margin between this layer and the rest of the matrix is sharp, it is likely that the vessel was exposed to oxidizing conditions during the cooling stage. |
| **Open firing** | 1) The relatively low maximum firing temperature estimate indicate that an open firing regime was employed. |

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**WARE TYPES (SAMPLE I.D.)**

**1 sample:** Plain Criolla (TPPV-63).

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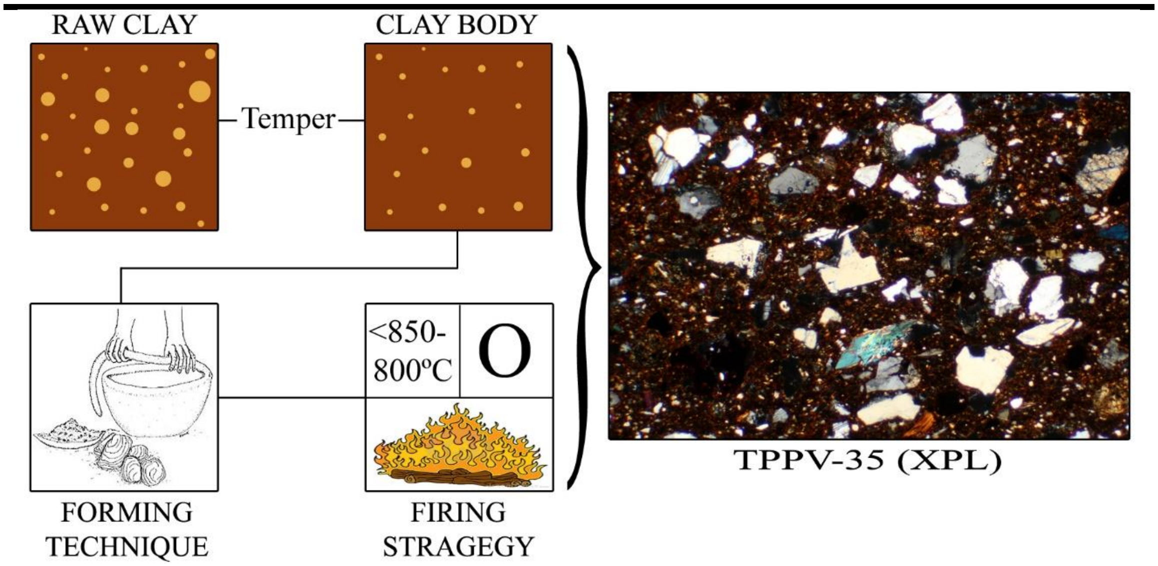
**OBSERVATION**

While difficult to distinguish macroscopically, the sherd's interior wall appears to contains a glaze layer measuring 110 µm in its thickest area. This layer has an olive-green color and contains very fine sand-sized globular-shaped inclusions with a gold-colored crystalline structure. It does not resemble the tin glaze present on the Panama Majolica samples, thus given its color and the sherd's low firing temperature estimate it seems likely that this is a lead-based glaze that could have been altered due to its exposure to high temperatures during the vessel's life span.

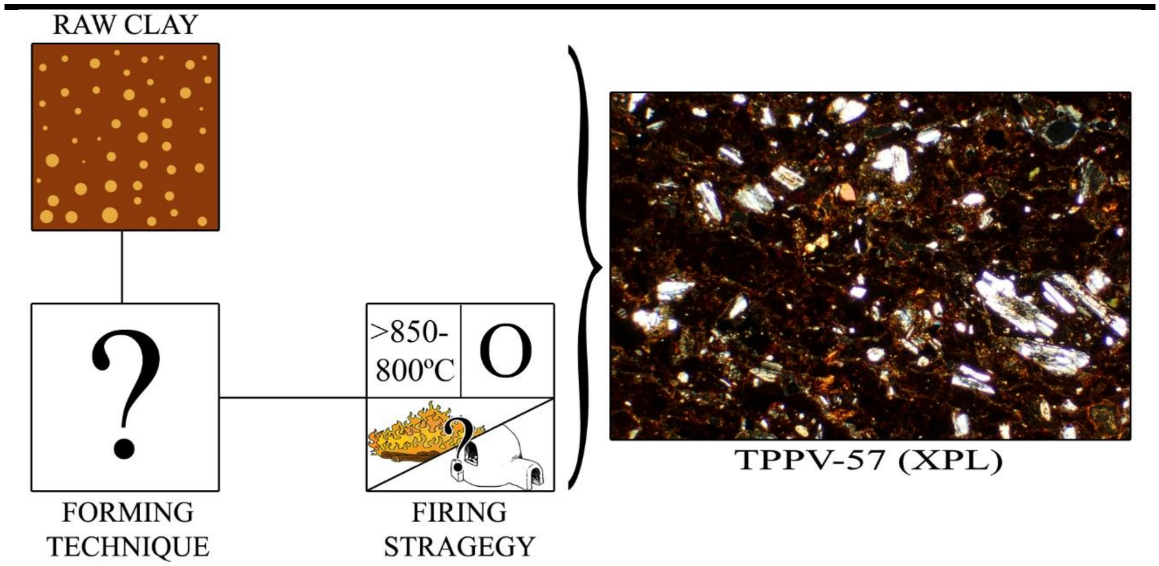
**Table 18** Fabric 19 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Strongly bimodal, single-spaced, and poorly sorted fabric predominantly composed of very fine to fine sand-sized quartz crystals to which crushed medium to coarse sand-sized coarse-grained intermediate rock (possibly tonalite or diorite) inclusions were added as temper. |
| | **GEOLOGICAL PROVENIENCE** |
| **Undetermined** | 1) Excluding grains above the fine sand size range (explained below), the matrix is largely constituted of very fine to fine sand-sized quartz crystals which impedes an accurate determination of the clay's provenience. <br> a) The respective low and moderate degrees of angularity and sphericity exhibited by the quartz grains as well as their very well sorted texture indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **Tempering** | 1) Given the clay's sedimentary nature, the fabric's poorly sorted inclusions as well as their strong bimodal grain size distribution strongly indicate that temper material was added to produce this group's paste. Detailed examination determined the existence of two separate size fractions whose notable compositional and textural differences further support this interpretation: <br> a) The finer fraction is composed of very fine to fine sand-sized quartz crystals while the coarser fraction of medium to coarse sand-sized coarse-grained intermediate igneous rocks (likely from either granodiorite or tonalite) and their individual mineral constituents (quartz, plagioclase feldspar, hornblende, |

| | | |
|---|---|---|
| | | and biotite). Unlike the fine fraction inclusions, the coarse fraction’s exhibit a higher degree of angularity and a slightly lower grade of sphericity. |
| | b) | The coarse fraction’s sharp and poorly sorted inclusions indicate that either granodiorite or tonalite rocks were crushed in order to be added to the clay. Furthermore, the presence of the rock’s constituent minerals with similar size and texture further supports that this process took place because it is common for the separate mineral components of the rock to break off during the crushing procedure. |
| | **PRIMARY FORMING TECHNIQUE** | |
| **Coiling** | 1) | The concentric orientation of inclusions and voids in the matrix reveal the presence of a relic coil indicating that the vessel was formed through coiling. |
| | **FIRING STRATEGY** | |
| **<850-800ºC** | 1) | The matrix’s high degree optical activity indicates that the maximum firing temperature was below 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The paste’s color transition—gradating from red to brownish tones—and the lack of a firing core indicate that while the sherd was fired in an oxidizing atmosphere, this condition was not sustained long enough to allow the oxygen to fully penetrate the paste resulting in an incomplete oxidation of the vessel. |
| **Open firing** | 1) | The relatively low maximum firing temperature estimate as well as the incomplete oxidation of one of the sherds due to a short firing period indicate that an open firing regime was employed. |
| | **WARE TYPES (SAMPLE I.D.)** | |
| **1 sample:** Slipped Criolla (TPPV-35). | | |

**Table 19** Fabric 20 characterization and production sequence




| | |
|---|---|
| **Group's characteristics** | Weakly bimodal, single-spaced, and moderately sorted fabric predominantly composed of coarse sand-sized fine-grained basic rocks and fine-grained igneous rock inclusions, and fine to medium sand-sized plagioclase feldspar crystals and glassy rock inclusions. |
| | **GEOLOGICAL PROVENIENCE** |
| **Basic source** | 1) The dominant presence of fine-grained basic igneous rocks (likely from basalt) and plagioclase feldspar crystals along with detached fragments of the basalt's groundmass to a lesser extent—combined they account for approximately 80% of the coarse fraction— indicate that the clay derived from the breakdown of a basic igneous source.<br>a) The respective low and very high degrees of angularity and sphericity exhibited by most inclusions indicate that the clay derived from a sedimentary deposit. |
| | **BODY PREPARATION** |
| **No process** | 1) While the fabric's moderately sorted inclusions as well as their weak bimodal grain size distribution could suggest that temper material could have been added to produce this group's paste, the textural uniformity between finer-sized and coarser-sized inclusions as well as a comparable degree of chemical weathering weakens this interpretation. Rather, it appears likely these inclusions were natural constituents of the clay. Thus, at this moment there is no evidence to confidently conclude that the clay was processed in any way before being modelled to a ceramic vessel. |

| | | |
|---|---|---|
| | | **PRIMARY FORMING TECHNIQUE** |
| **Undetermined** | 1) | Neither macroscopic nor microscopic evidence was found to determine the vessel’s forming technique. |
| | | **FIRING STRATEGY** |
| **>850-800ºC** | 1) | With the exception of a small area near the vessel’s interior wall where the matrix exhibits a moderate degree of optical activity, the grade in the rest of the sample was low which indicates that the maximum firing temperature was above 850-800ºC. |
| **Oxidizing atmosphere** | 1) | The paste’s uniform color and the lack of a firing core indicate that oxidizing conditions were sustained sufficiently enough to allow the complete oxidation of the sherd. |
| **Undetermined** | 1) | The relatively high maximum firing temperature estimate, complete oxidation of the sherd, and the lack of firing cloud warrants the possibility that a closed firing regime might have been employed. However, while difficult to achieve, it is possible to obtain these results in an open firing (Rye 1988: 98), particularly with coarse-grained pastes. Thus, from the available data it is not possible to determine which regime was used. |
| | | **WARE TYPES (SAMPLE I.D.)** |
| **1 sample:** Plain Criolla (TPPV-57). | | |

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