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Patricia Fournier and M. James Blackman

Production, exchange and consumption of glazed wares in New Spain: formation of a database of elemental composition through INAA

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Submitted 09/06/2007 by:
Patricia Fournier (Instituto Nacional de Antropología e Historia)
pat_fournier@yahoo.com

M. James Blackman (NMNH-Smithsonian Institution, Washington DC)
blackmanj@si.edu

Abstract

This report presents the results of an investigation that contributes to the understanding of raw material sources utilized in the production of lead glazed ceramics (majolica and glazed earthenwares) in New Spain. Complementary aspects of documentary research and ceramic paste compositional analysis by means of instrumental neutron activation analyses provide the basis for the establishment of different compositional groups of historically relevant ceramics. Through the study of the technologies responsible for the manufacture of ceramics and the contexts in which manufacturing, use, and dispersal occurred, we gain information about both regional and local social processes, thereby leading to a more comprehensive knowledge of the directions along which objects and ideas moved. The results provide a basis from which to document how the Europeans and their descendants who colonized Mesoamerica and the borderlands changed aspects of Native American societies, and in the process were themselves transformed.

Introduction

This report deals with the results of a study of ceramic materials glazed with lead oxide (either as the only surface finish or combined with tin for majolica manufacture) through instrumental neutron activation analysis. This research is

important for identifying the production centers of this type of wares in both central and marginal Mesoamerica, from the Spanish conquest to the start of the independent period. The information presented here serves as a basis for future research focused on the definition of the routes through which the objects circulated, the direction of the transmission of technological information, as well as the social, political, and economic contexts for the use and adaptation of these materials in several provinces of New Spain.

With the aim of defining which were the main producing centers of glazed ceramics, as well as its commercialization and consumption in New Spain --in territories that today are part of Mexico and the United States-- we developed a program of chemical and technical studies, particularly based on instrumental neutron activation analysis of clay samples and potsherds found in many archaeological sites, which were occupied from the 16th to the beginning of the 19th centuries. The study of technological and stylistic variability is especially important to understand the changes generated after the Spanish conquest in the lifeways and work patterns of the natives, the transformations that took place among the European colonizers, and above all, how a differential distribution of power and knowledge was developed in New Spain.

In theoretical terms, we have to consider that in colonial contexts individuals fought for power, for domination and for economic transformation, although they engaged in negotiations for the constitution of identities in the new stage generated through the interaction between natives and colonizers, with the reconfiguration of traditions, the introduction of new guidelines and even the survival of elements, which is the subject of study of an "historical archaeology of indigenous groups" (Silliman 2005) in the context of research about social complexity. The fact that the natives of New Spain adopted or adapted the material culture of European origin does not mean that they wholly embraced Iberian meanings and values, or that indigenous societies totally abandoned their traditions, we are rather facing a process of construction of new identities and sets of values, which led to the integration of indigenous elements with the customs and objects that were introduced from the Old World (van Dommelen 2005).

The material manifestations of social interaction within historical archaeology are of special importance to understand the colonial processes and the formation of identities in the context of New Spain (Rothschild 2003), as in the case of ceramics and likewise of the evidences of the modes of work developed by its producers, who in order to fulfill their goals had to exploit several raw materials and to apply specific production technologies.

Therefore, we consider that the potters are members of communities, and that the process of vessel manufacture depends on the available material and technological means of production, as well as on the technical organization of an specific work. The pieces they manufacture reflect or codify the social structures in their shape and esthetic contents. They are products consumed by social agents for whom these goods have values according to their context of use. As a

consequence, these objects are a reflection of class relations from which they are derived in terms of their techno-function, socio-function and ideo-function in everyday life. As elements inserted in the communication systems, they symbolize socialization between groups, as well as inter-group differentiation, identity and status. Ceramic objects, like many other elements of material culture, have a weight derived from agency or causal action given to them by their producers and consumers, materializations from which the members of certain social groups infer specific processes of origin (Harrington 2004).

Archaeometry and historical archaeology as research strategies can be combined to perform studies about particular productive technologies introduced by the conquistadors to Mesoamerica, based on Iberian systems of labor organization which meant that modes of work were implemented which were foreign to the autochthonous societies. In this type of studies it is required to understand what sort of raw matter, either local or imported, was indispensable for achieving the production of consumer goods according to the needs of the Europeans and their descendants, as well as those of the Amerindian populations.

The study of productive technology, which forms part of the economic system, can help particularly to place pottery manufacture in its social context, as well as to know certain characteristics of the means of production employed, with the objective of inferring aspects linked to the economic processes of production, distribution, change, and consumption of vessels.

Instrumental Neutron Activation Analysis (INAA)

The pottery of New Spain shows the merging of two potting traditions, indigenous and Spanish. The former mainly contributed a deep knowledge of the behavior of local clays and non-plastic components, the latter contributed the introduction of the potter's wheel, as well as lead varnish as cover for glazed ceramics, and tin and lead for majolica, as well as the closed vault kiln.

In order to determine the origin of multiple wares we have to consider that INAA (instrumental neutron activation analysis) has proved to be highly precise to pinpoint the origin of the raw matter of ceramic bodies, therefore these analyses are best suited for the study of majolica imported from Europe or produced in several centers and communities in New Spain and independent Mexico. INAA is likewise well suited for analyzing glazed wares which only used lead oxide. Besides, INAA can serve as a basis to infer circulation patterns of vessels through exchange networks spanning both restricted regions and wide territories, as part of social interaction mechanisms showing economic trends and cultural changes throughout the Viceregal period and the 19th century. Therefore, it is possible to have a more precise picture of the exploitation and use of local or regional resources, as well as the importation of raw matter, and of vessels as finished products.

During the last 40 years INAA has become the most important technique for studying patterns of pottery production and distribution.[1] The questions that once were posed in the framework of long-distance exchange are now focused on sub-regional and even within-site spatial levels, with the objective of having a better understanding of multiple social practices based on the study of the redistribution of ceramic objects. The technique under discussion here allows for a high level of analytical precision for detecting statistically and archaeologically significant differences between pottery groups produced with resources obtained in close geographical localities, considering that compositional differences result from the intentional behavior of the manufacturers (Bishop 2004).

Not all analytical determinations are considered to be sufficiently accurate to characterize archaeological ceramics, therefore only the concentrations of those elements for which analytical precision is more secure are taken into account. The analytical data and the associated descriptive information are included in a database of the Archaeometry Program of the Anthropology Department of the Smithsonian Institution. Residual samples, thin sections, photographs, etc., whether part of the permanent archive or on loan to the project, can be found through the specimen or analytical number (idem).

According to Bishop (2004), although the details of the analytical procedure have been well understood, the use of its results for the explanation of several archaeological patterns still is a complex issue. More attention is constantly being given to analyzing the natural and cultural factors involved in elemental variability determined through INAA, and to the way in which this information can be used to interpret the past (Bishop *et al.* 1982a; Beaudry 1991). Because in archaeological research it is not possible to directly observe the processes responsible for behavioral actions in the past, it is through the detailed study of specific ceramic distributions and of compositional variation in paste, combining databases for particular sites or regions, that we can approach an understanding of socioeconomic and political processes, including patterns of social interaction such as commerce and exchange, as well as productive behaviors of the manufacturers of pottery and the consumption trends of its users through several epochs (cf. idem).

Majolica

Majolica is a pottery with a white layer made of lead oxide and tin oxide, which is applied to vessels that have been previously subjected to firing. Once covered with this layer the vessels can be painted with several decorative elements likewise made with metallic oxides, after which a second firing is performed (Fournier

[1] Information about general aspects related to INAA can be found in the following sources: Bishop and Blackman (2002), Bishop *et al.* (1982a, 1982b), Blackman (1986), Glascock *et al.* (2004), Harbottle (1976), Neff (2000), Perlman and Asaro (1969), Spoto (2003), and Tykot (2004).

2003). This technique arrived in Spain with the Arabs, and its influence was felt from the 13th century. Later it spread to the rest of Europe, primarily Italy (Haslam 1975), where a pseudo-majolica or *mezzamaiolica* had developed from the Renaissance, derived from Byzantine influences. During the 16th century majolica production in several continental areas and even in England acquired important proportions. Apparently the name given to this kind of pottery was derived from the island of Mallorca, an important point of trade between Spain and Italy. In the case of the Iberian peninsula, once the re-conquest was over, the workshops concentrated in Seville (Triana), Talavera de la Reina, and Puente de Arzobispo (Pleguezuelo 1999; Sánchez Pacheco 1999), just to mention some of the most renowned names, while in Italy regions such as Tuscany and Veneto were the main producers of this ware.

It should be pointed out that at the beginning of the 16th century Francisco Niculoso, also known as "El Pisano", migrated to Seville, the most important center for trade with the New World. He was a master potter from southern Italy, who settled in Triana, where there already was experience and skill in the art of making pottery (Pleguezuelo 1999). His arrival brought about technical, stylistic, and decorative changes of great impact, since he introduced the Renaissance palette and Italianate design elements for making pottery covered with tin and lead oxides, which would eventually be incorporated into New Spain's industry.

According to the study of documents kept in the Archivo de Indias, everything seems to indicate that the first *loceros de lo blanco*, or "potters of white", (that is to say majolica specialists) arrived from Talavera de la Reina to Mexico City around 1550. They were old Christians who would later be joined by artisans from Seville, including Moors --in spite of the restrictions imposed by the Crown for the migration to the Spanish empire in the Indies by descendents of the Arabs (Gómez *et al*. 2001). Later the Spanish artisans would set up workshops in Puebla de los Angeles around 1580 (Cervantes 1939; Deagan 1987), as well as in Oaxaca, where apparently thanks to the impulse given by the Dominicans majolica production was started around 1579 (Gómez and Fernández 1998a, 1998b). Around the end of the 18th century, but most importantly during the 19th century, this industry would emerge in Guanajuato (Coehn-Williams 1992; Fournier 2003), Aguascalientes (Giffords and Olvera 2003), and Sayula, Jalisco (Schondube 1989), in addition to San Luis Potosí (Diana Zaragoza and Patricio Dávila, personal communication, 2006).

Elsewhere in the Americas, other manufacturing centers were located in La Antigua, Guatemala (from the early Colonial period; Luján Muñoz 1975; Deagan 1987); Panamá la Vieja (whose industry stopped in 1650; Jamieson 2001; Rovira 2001; Rovira *et al*. 2006); Quito-Cuenca (which carried on until recent times; Buys 1997; Jamieson 2001; Jamieson y Hancock 2004), and the still little-known Lima industry (Jamieson 2001; Jamieson and Hancock 2004).

Glazed ware

Among Amerindian pre-Columbian populations lead oxide was not employed to give ceramic pieces a vitreous cover. This production technology was introduced after the Spanish conquest into Mesoamerican territories and into the regions to the north. The glazed ware is characterized by showing as surface finish a varnish applied to the piece after firing. This varnish is composed of pulverized lead oxide in suspension, which is fixated on the objects after applying a second firing.

According to accounts in several chronicles, in the case of Mexico-Tenochtitlan, the Indians learned from the Europeans to use lead glazing as surface finish for pottery (Mendieta 1973; Torquemda 1977), therefore being able to produce the "yellow ware". Alonzo de Zorita (1963: 87), the *oidor* or judge, recorded that for the mid-16th century many glazed and painted wares were being sold, including large and small jugs, jars, ollas "and other infinite shapes of vessels", which also attracted the attention of fray Bernardino de Sahagún (1989), regarding the market at Tlatelolco.

There are several studies about archaeological evidences for Mexico City (Castillo 2007; Charlton *et al*. in press; González Rul 1988; López Cervantes 1976; Sodi 1994), indicating that at first there was a technological and stylistic fusion between Indian and Spanish traits, preserving pre-Columbian forming techniques, like molding, and shapes like the tripod *molcajetes* (grater bowls), although the potter's wheel was being used since early times and vessels were manufactured in shapes derived from Europe, such as candle holders, *orzas* (gallipots), and *bacines* (chamber pots), which may have been made by European and *mestizo* (i.e. mixed race) hands.

There is limited available information about the location of the workshops where this kind of ware was produced. However, in the *Actas del Cabildo de la Ciudad de México* (Proceedings of Mexico City's Town Council), some potters were recorded in 1537 and 1538 (Lister and Lister 1982), likewise for Xochimilco in the 17th century, according to records by Fray Agustín de Vetancurt (1971). It is very likely that all these potters were involved in the manufacture of "yellow ware", like the Indians from other communities in the Basin of Mexico (Viera 1952).

The analysis of glazed ceramics has received scant attention in the studies of historical archaeology in New Spain, in spite of the fact that in virtually all collections of materials, both recovered from the surface or excavated, they are among the most abundant wares. Besides, the chronological position of different styles or types of this ceramic class in several regions is still problematical, as well as the identification of their place of origin. In fact, since relatively early times their production started in the viceregal capital and in other population centers, and their manufacture has carried on until the present time.

Elemental analysis of glazed wares

The chemical characterization of majolica sherds --and to a lesser extent of glazed pottery-- found in several areas of the former New Spain has been a subject of interest for over three decades (Carlson and James 1995; Jornet *et al*. 1985; Monroy-Guzmán and Fournier 2003; Monroy *et al*. 2000, 2005; Myers *et al*. 1992; Olin and Blackman 1989; Olin *et al*. 1998; Skowronek *et al*. 2003). Likewise, the development of taxonomical systems for majolica, the designation of types, the recording of its stylistic variation (cf. Aguirre *et al*. 1996-1997; Coehn-Williams 1992), its chronological placement and the determination of the origin of vessels of Mexican majolica, has been a slow process that started basically from the proposals made by Goggin (1968) and later by Lister and Lister (1974, 1982).

At present, in light of new findings as well as the study of majolica collections that have been recently subjected to exhaustive analysis (cf. Coehn Williams 1992; Charlton *et al*. in press; Fournier 1996b, 1997a, 1997b, 1999, 2000; Fournier and Fournier 1989, 1992; Marken 1994; Skowronek *et al*. 1988), the chronological placement of many types is becoming more precise. Besides, there have been advances in the precise location of the production centers for these materials, such is the case for types from the 19th century (Seifert 1977): majolica from Guanajuato (Coehn-Williams 1992; Fournier 2003), from Sayula, Jalisco (Schondube 1989), from Aguascalientes (Giffords and Olvera 2003), from Mexico City (Fournier 1996a, 2003; Fournier and Charlton 1998; Gómez *et al*. 2001; López *et al*. 1995; Monroy-Guzmán and Fournier 2003) and from Oaxaca (Gómez and Fernández 1998a, 1998b, 2005).

There is a limited number of studies regarding the social dimension and role played by majolica, for instance its selling price and its association to the consumers' status. This analysis would deal with aspects of the construction of Mexico's identity in viceregal and republican times (Blackman *et al*. 2006; Castillo 2007; Fournier 1997b; Gasco 1992; Gómez *et al*. 2001; Seifert 1977; Snow 1993; Zeitlin and Thomas 1997).

Among the compositional analyses of majolica focused on neutron activation and based on the application of this technique with the same parameters, those performed by Olin *et al*. (1978) stand out. These analyses determined the existence of stark chemical differences between the majolica produced in Spain and the one produced in Mexico. Seville was designated as the place of origin for the former, while the latter was ascribed to the Basin of Mexico. Later, in 1985 Jornet *et al*. (1985) established the chemical compositional differences between the three main producing centers in Spain during the 16th century, namely Seville, Talavera and Manises. In 1989 Olin and Blackman (1989) compared the composition of the ceramic types attributed to Puebla with samples from modern ceramics from Puebla, defining also that the types that have been linked with Mexico City as producing center are characterized by a different elemental composition from those of Angelopolis (i.e. the city of Puebla). In 1922 Myers and his collaborators (Myers *et al*. 1992) performed an analysis of samples from

archaeological excavations conducted in Triana, including the discarded remains of production from *alfares* (pottery workshops), which allowed them to establish the fact that Seville was the main center for providing the majolica that was consumed in the New World. Around the mid-1990s the abundant analytical results established that Spanish majolica from Seville-Triana, Talavera, and Manises, can be chemically differentiated from each other. The manufacture of this ware was documented for Puebla, and the manufacture of majolica in Mexico City was strongly suggested (cf. Blackman 2004).

There are few data about glazed ceramics, and specialists have emphasized primarily regional traditions or the spatial distribution of certain classes or types in specific sites or sub-regions (cf. Barnes 1980; Charlton *et al.* in press; Fournier 1997a; Fournier and Fournier 1992; Gerald 1968; Gómez and Fernández 2005; González Rul 1988; López *et al.* 1995; López Cervantes 1976; Müller 1973, 1981; Skowronek *et al.* 1988; Sodi 1994), although the emphasis has been above all on central Mexico and some settlements within the former internal provinces of northern New Spain. Although it has been possible to determine that in some localities or zones the indigenous populations manufactured glazed wares through the stimulus of the colonizers (Carlson and James 1995; Skowronek *et al*. 2003), for most of the collections under study it has not been possible to establish the origin of many vessels that were consumed and discarded, thus being incorporated into the archaeological record.

In the context of a research project in which the Smithsonian Institution (NMNH, Department of Anthropology, Archaeometry Program) has established academic links with the University of Santa Clara, California, and recently with the Escuela Nacional de Antropología e Historia, up to now more than 1,500 samples of glazed and enameled ceramics from many sites have been analyzed (Figure 1), including the discarded production remains from workshops and ethnoarchaeological samples from contemporary workshops in northwestern Mexico. The studied materials come from Mexico City (Templo Mayor, Palacio Nacional, Tlatelolco, Alameda Central, Coyoacán, Churubusco and San Ángel); Puebla (city of Puebla, Cholula); Tlaxcala; Oaxaca city; Michoacán (Tzintzuntzan, Cuitzeo, Uricho, Pátzcuaro, Santa Fe de la Laguna, Capula, Patamban, Zipiajo, Zinapécuaro); Guanajuato (Hacienda de San Gabriel, Mina La Valenciana, Santa Rosa, San Felipe Torres Mochas); the city of Aguascalientes; San Luis Potosí (city of San Luis Potosí, Villa de Reyes, Real de Catorce); Jalisco (Tlaquepaque, Tonalá, Sayula Basin); Chihuahua (Presidio Carrizal, Misión Santa María de las Cuevas, Casa de Huesos); Durango (Nayar Viejo, Tapias, Ferrería, Navacoyan, Nombre de Dios); Zacatecas (Hacienda de Bernardes, Presa de los Infantes, Pánuco, Veta Grande, Sombrerete, La Noria de San Pantaleón); and Sinaloa (Sinaloa de Leyva, El Fuerte).

Figure 1. Map showing the location of sites of provenance for analyzed collections.

Results of the Instrumental Neutron Activation Analysis

We would like to first highlight the compositional similarities and differences shown by the series of samples studied, which correspond to the groups reflecting majolica production in Mexico City, Puebla, and Oaxaca in different times (to a lesser degree the analyzed sample from Guanajuato, Sayula, and San Luis Potosí needs to be broadened). Above all, we should bear in mind that in archaeological research it is often wrongly assumed that the name given to a ceramic type automatically indicates its origin. That is to say, the fact that materials identified as belonging to the types *Columbia Liso* (presumably of Iberian manufacture), *Ciudad de México Verde sobre Crema* (Mexico City Green on Cream, supposedly made in the viceregal capital, according to Lister and Lister [1982]), or *Puebla Azul sobre Blanco* (Puebla Blue on White, which we would assume belongs to the industry of Angelopolis) are recorded in a site, is hardly unavoidable proof that through trade networks the consumers who settled in a given place had access to Spanish majolica, to majolica from Mexico City, or from Puebla.

The results obtained from the application of instrumental neutron activation analysis allow us to differentiate between different compositional groups with a high degree of confidence, according to the statistical techniques applied. In the case of majolica the following points stand out:

1) The elemental composition of majolica produced in Spain, specifically in Triana[2] is definitive and, as was to be expected, is distinctive and different from the one manufactured in New Spain. Among Iberian compositional groups characteristic of Andalucia we have included the *botijas* or *oliveras* (olive jars) for comparative purposes.

2) The majolica from Oaxaca with diagnostic types from the 16th century to the beginning of the 18th century belongs to three groups whose composition is similar to one another, and apparently represent the production of several workshops which exploited several clay deposits. These groups' elemental composition is unique in comparison with other manufactures from New Spain.

3) The majolica assumed to have been manufactured in Mexico City (according to Lister and Lister's [1982] proposal) includes several samples from several excavations in the Centro Histórico (the old city center), including wasters (production discards) found within the area where the potters' *barrio* was located. These materials consist of types pertaining to the 16th through the 18th centuries. These samples show a particular elemental composition, although they include types commonly attributed to Puebla workshops. It should be pointed out that several types from the early Colonial period, which traditionally have been considered of Iberian origin in the literature (idem), belong to this compositional group. Therefore, according to our analysis, these are without a doubt copies made in New Spain of Spanish archetypes.

4) Majolica from Angelópolis likewise constitutes a group in general consistent in its composition, although we would have to analyze a bigger sample in order to determine whether it is possible to completely isolate it from the one from Mexico City in the case of all representative ceramic types of different times.[3] The analyzed types date from the end of the 17th century through the 19th century, and come from sites located within the city of Puebla and its environs, as well as from Mexico City's old city center, and from different settlements located in the north of the old New Spain, besides the convent of Santo Domingo in Oaxaca.

5) We have yet to separate the compositional groups pertaining to the 19th-century majolica produced in Guanajuato, Sayula, and San Luis Potosí, since we have a limited number of samples. On the other hand, in the case of Aguascalientes, because we analyzed production discards from workshops, we could define a particular compositional group, although up

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[2] A synthesis of these analyses is found in Myers *et al.* (1992).

[3] Due to the effects of volcanism from the Quaternary in the Basin of Mexico and the Puebla Valley, it is likely that it will be impossible to differentiate the elemental composition of the clays used in the manufacture of glazed wares in both regions for all ceramic types.

to now no pieces manufactured in this production center have been identified in archaeological collections from other sites.

In synthesis, nuclear activation analyses have shown that the following types were produced in different ceramic-production centers:

1. *Columbia Liso* and *Santo Domingo Azul sobre Blanco* (Figure 2), which are considered to have been manufactured in Spain,[4] were also produced in Puebla and Mexico City, where the potters copied the traditions of the motherland.[5] In Oaxaca likewise pieces were produced in the *Santo Domingo Azul sobre Blanco* style.

2. The following styles have been thought to be originated in Puebla, but were also originated in Mexico City as well as in Puebla: *Puebla Policromo* (Figure 3); *Puebla Azul sobre Blanco*; and *Puebla Verde sobre Blanco*.

3. While the *Ciudad de México Verde sobre Crema* (Figure 4); *San Luis Policromo* (Figure 5) and *Fig Springs Policromo* (Figure 6), which Lister and Lister (1982) established as characteristic types made in the viceregal capital, were made in Mexico City as well as in Puebla. In the case of Oaxaca the characteristic style of the type *Ciudad de México Verde sobre Crema* was copied, and in the collections of the old city of Antequera these materials are known as *Remedios Verde sobre Crema* (Figure 7) in the typology that was developed here (Gómez and Fernández 2005).

4. *La Traza Policromo* (Figure 8), which had been considered a Mexico City product from the early Colonial period (Lister and Lister 1982), was made in this city and probably in Puebla as well. Besides, the Antequera potters made copies of it with slight differences in style.

5. Finally, *San Luis Azul sobre Blanco* (Figure 9) likewise had been designated as a product of the capital of New Spain (idem), but belongs to the Puebla industry and was copied in Oaxaca.

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[4] Both Goggin (1968) and Lister and Lister (1982) suspected that some sherds of this type belonged to pieces produced in New Spain.

[5] The copies that were produced here are virtually impossible to distinguish from the originals based on macroscopic attributes, above all when the analysis is focused on sherds of small dimensions.

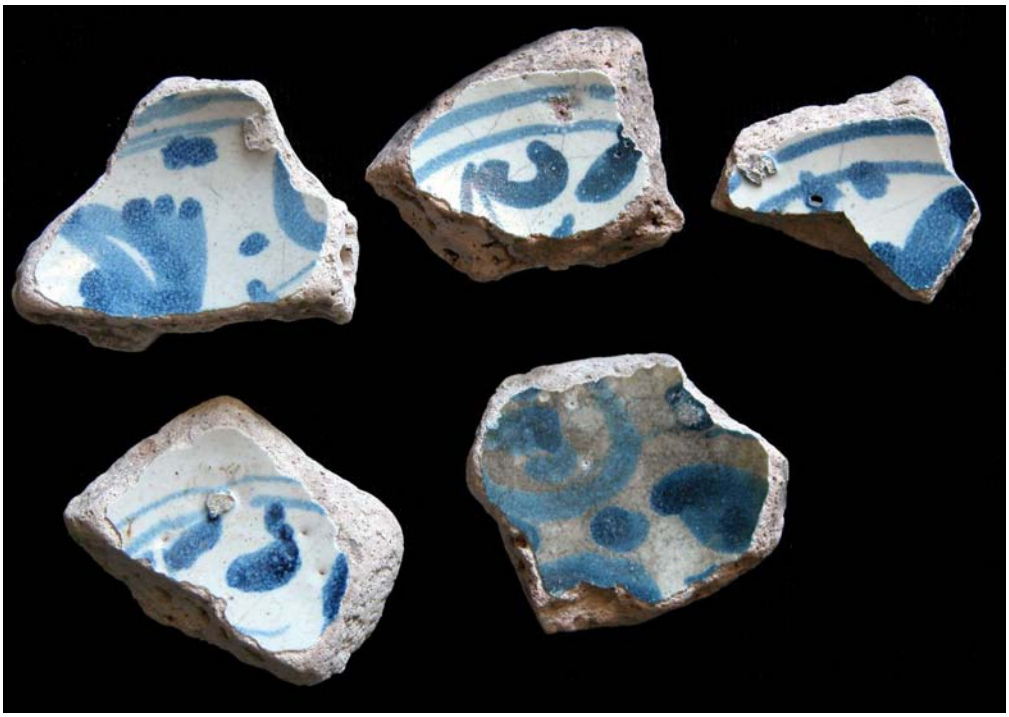

Figure 2. Majolica of Santo Domingo Azul sobre Blanco type.

Figure 3. Majolica of Puebla Policromo type.

Figure 4. Majolica of Ciudad de México Verde sobre Crema (Mexico City Green on Cream) type.

Figure 5. Majolica of San Luis Policromo type.

Figure 6. Majolica of Fig Springs Policromo type.

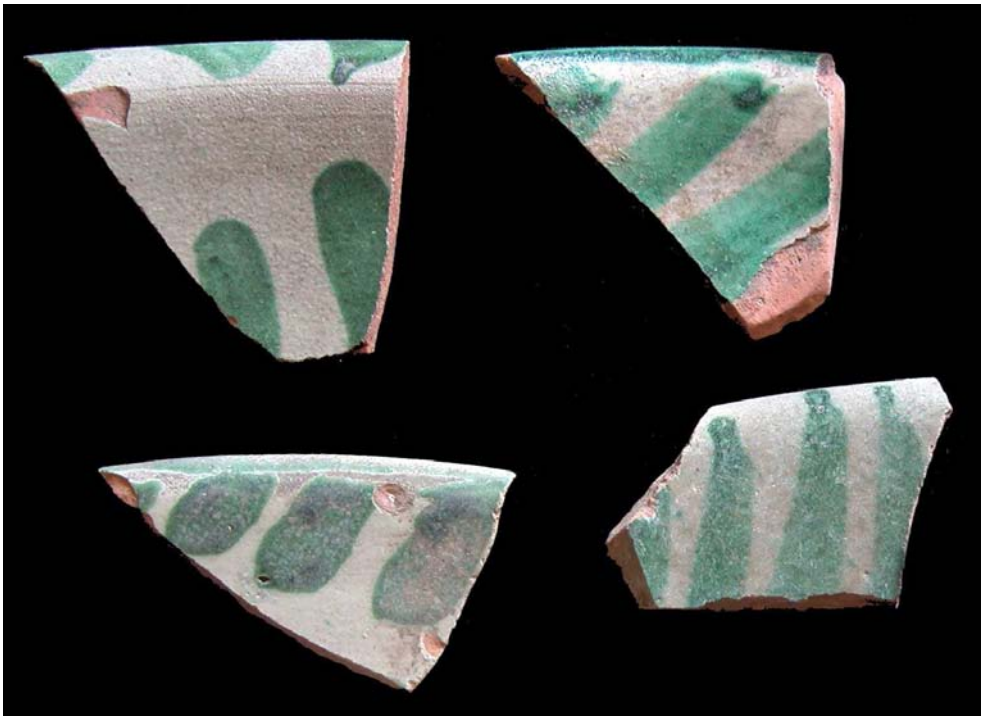

Figure 7. Majolica of Remedios Verde sobre Crema type.

Figure 8. Majolica of La Traza Policromo type.

Figure 9. Majolica del tipo San Luis Azul sobre Blanco type.

Although we need to increase the sample size as well as the typological variability of the specimens under analysis to precisely define patterns, several types are provisionally ascribed to either Puebla or Mexico City. Regarding the Angelopolis, *Tacuba Policromo* (which according to Lister and Lister [1982] was made in the capital of New Spain), would have been made in Puebla, as well as other types that were originally ascribed to that production center, such as *Aucilla Policromo* (with copies likewise made in Oaxaca), *Abo Policromo* (also copied in Oaxaca), and *Huejotzingo Azul sobre Blanco*.

On the other hand, *Ciudad de México Azul sobre Blanco* turns out to be made in the workshops of the capital of New Spain, while undecorated types such as *Ciudad de México Crema* and *Puebla Blanco* are ascribed indistinctly to compositional groups of both colonial cities, which means there may be potential problems derived from the typological designations used by archaeologists on the basis of the classification of these materials.

San Elizario Policromo, as well as several polychrome types with or without formal name whose style is characteristic of the 19th century up to now belong to compositional groups from Puebla, although we are in the process of separating the ones from Guanajuato, San Luis Potosí and Sayula. Examples with the elemental composition characteristic of the producing center in Sayula have been identified in Chihuahua (*Presidio Carrizal*).

Those ceramics resembling majolica but whose surface finish lacks tin can be classified as pseudo-majolica. Important among them are the ones manufactured in Sinaloa, probably since the end of the 18th century (Fournier and Santos 2007). In addition, the so-called *Loza Indígena* (indigenous ware) stands out, with the types of *Romita Liso* and *Romota Sgraffito*, which were thought to be part of the manufacture of the viceregal capital (Lister and Lister 1982). Its elemental composition has been the subject of independent studies through INAA, which concluded that it was highly likely that this ware was not from New Spain (Rodríguez Alegría *et al*. 2003). The following groups have been isolated:

1. The Sinaloense pseudo-majolica (Figure 10), which is abundant in excavated collections from the Antiguo Colegio Jesuita de Sinaloa (Old Jesuit School of Sinaloa) (currently Sinaloa de Leiva), where Santos (2004) did some work, constitutes a distinctive compositional group. Its spatial distribution spans the northern part of the present state of Sinaloa, and some specimens have been identified in Chihuahua (*Presidio Carrizal*) and Arizona (*Presidio Tubac*) as well.

2. The *Romita Liso* and *Romita Sgraffito* types (Figure 11) of the Loza Indígena, as well as sherds of amber and burnished red glazed ware, roof tiles, bricks and ethnographic samples of clay and workshop wasters from Santa Fe de la Laguna and Capula in the Lake Pátzcuaro Basin,

Michoacán, and fragments of Loza Indígena types found in Uricho, Tzintzuntzan, and Pátzcuaro (Michoacán), Guerrero, Chihuahua, Zacatecas, and Sinaloa, belong to two compositional groups with a strong affinity (*Romita 1* and *Romita 2*). This means that the clays used as raw matter for these vessels came from deposits located in the same area, which is highly likely to be precisely the Lake Pátzcuaro Basin.

Figure 10. Pseudo-majolica from Sinaloa.

Figure 11. Romita Sgraffito type.

Results from the INAA studies practiced on samples of glazed ware were conclusive in the following cases:

1) The elemental composition of this ware often cannot be distinguished between Mexico City and Puebla for types spanning from the early Colonial period to the 19th century, notwithstanding the color of glazing and the ornamental styles.

2) Regarding the glazed pottery from Oaxaca (Figure 12), Michoacán (Figure 13), the Tula region (Figure 14), Sinaloa (Figure 15) and the one belonging to the *Presidios Verde* type (Figure 16) (the latter possibly manufactured in New Vizcaya), we were able to define mutually exclusive compositional groups.

3) For the samples of glazed ware found in several sites of Guanajuato, San Luis Potosí, Zacatecas and Durango, there is not enough data yet to allow us to isolate different compositional groups, or to suggest where the production centers for these vessels are located.

Figure 12. Glazed ceramics from Oaxaca.

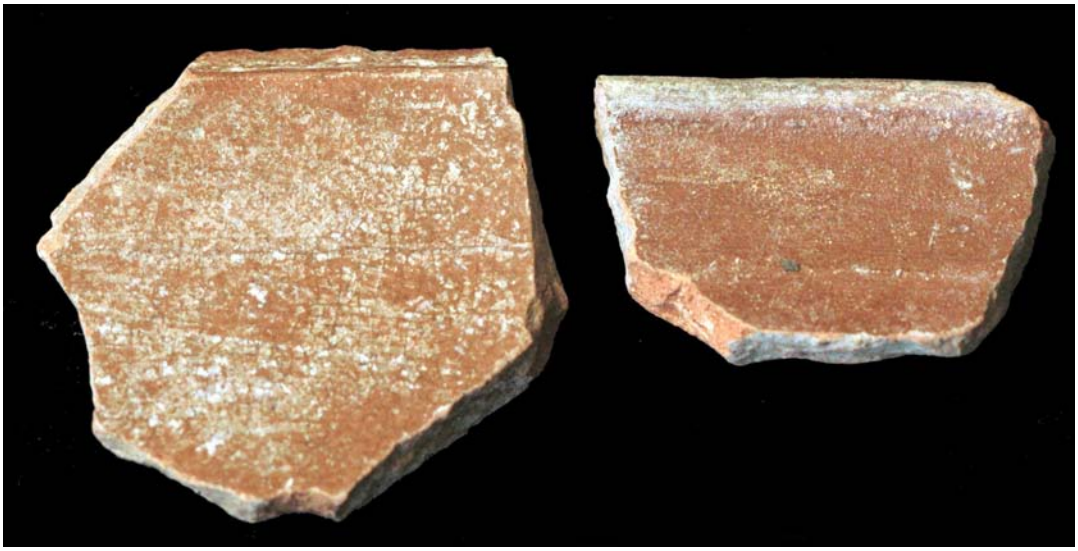

Figure 13. Glazed ceramics from Michoacán.

Figure 14. Glazed ceramics from the Tula region.

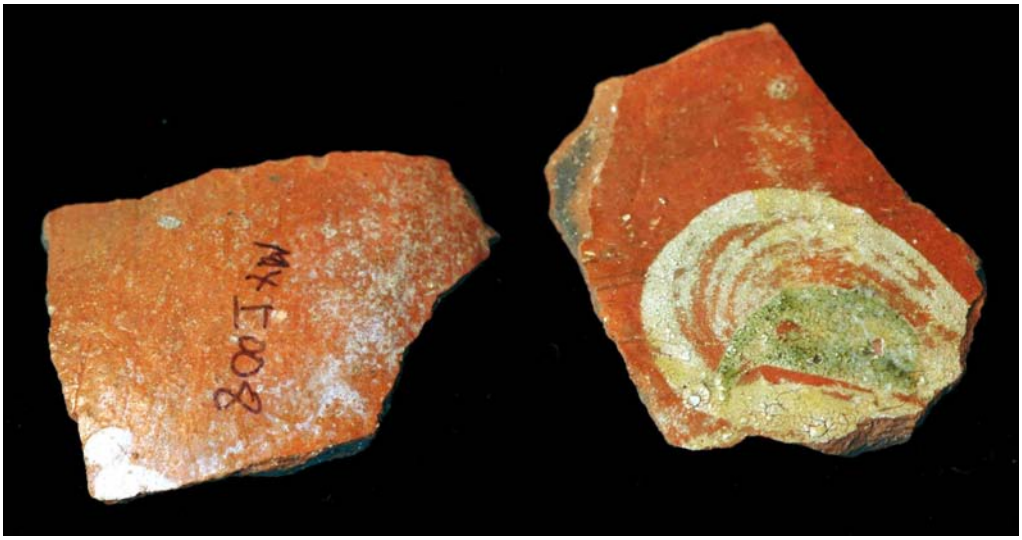

Figure 15. Glazed ceramics from Sinaloa.

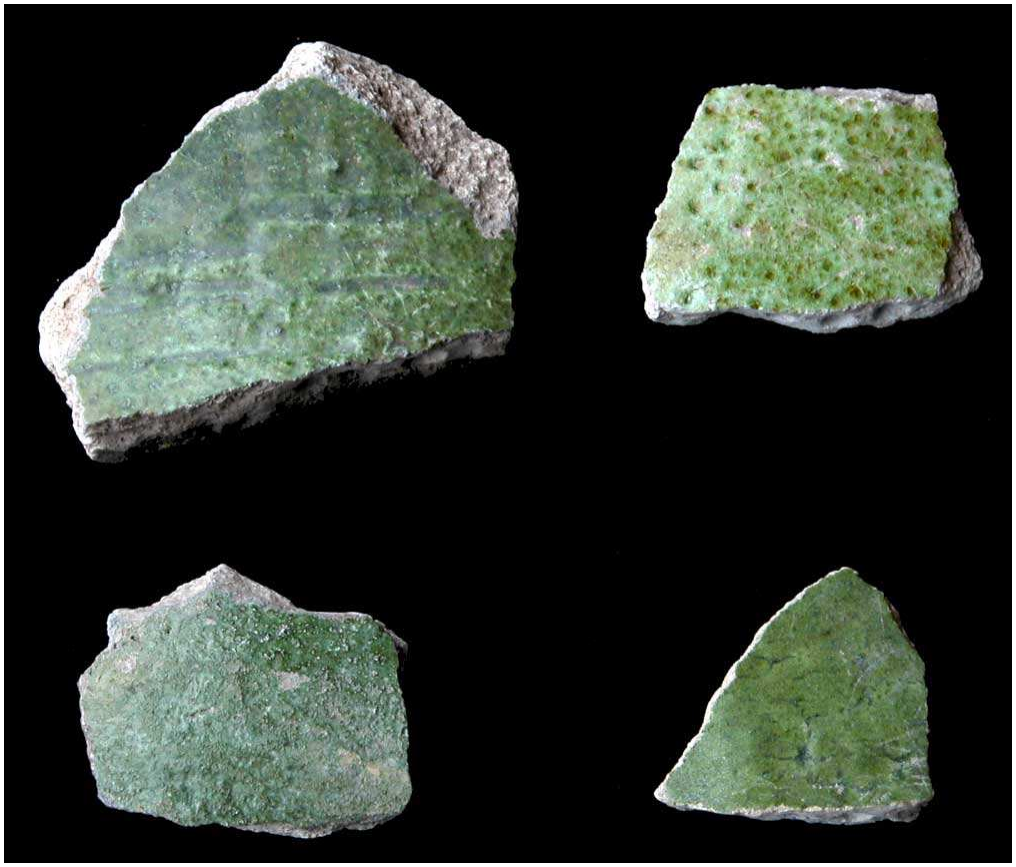

Figure 16. Presidios Verde type.

Figures 17, 18, 19, and 20 show the separation between the compositional groups previously mentioned, with a 90% level of certainty based on the elements appearing on the axes. All groups were segregated within a 90% level of confidence in the space defined by the concentrations of the 16 elements used for data analysis.

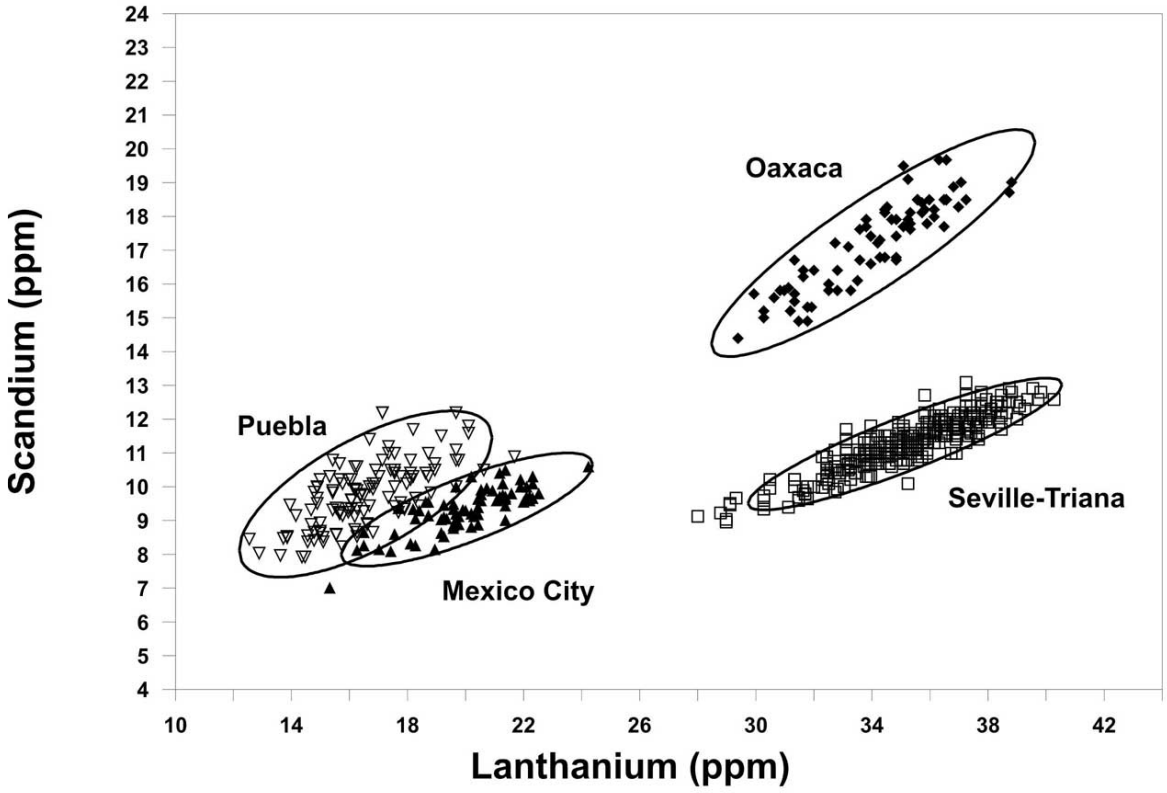

Figure 17. Bidimensional graph comparing parts per million of scandium and lanthanum in majolica from Puebla, Mexico City, Oaxaca, and Seville-Triana (90% confidence intervals).

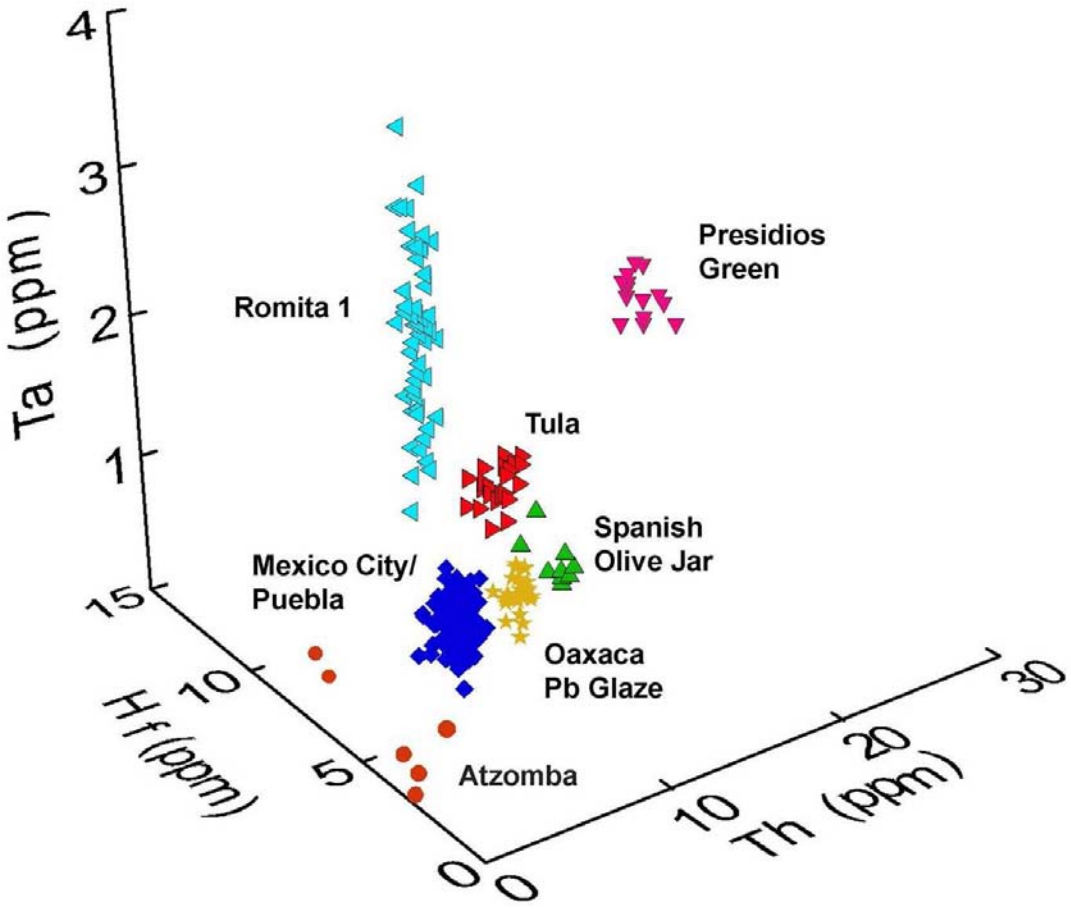

Figure 18. Tridimensional graph comparing parts per million of tantalum, hafnium, and thorium in different glazed wares produced in Mexico and Spain.

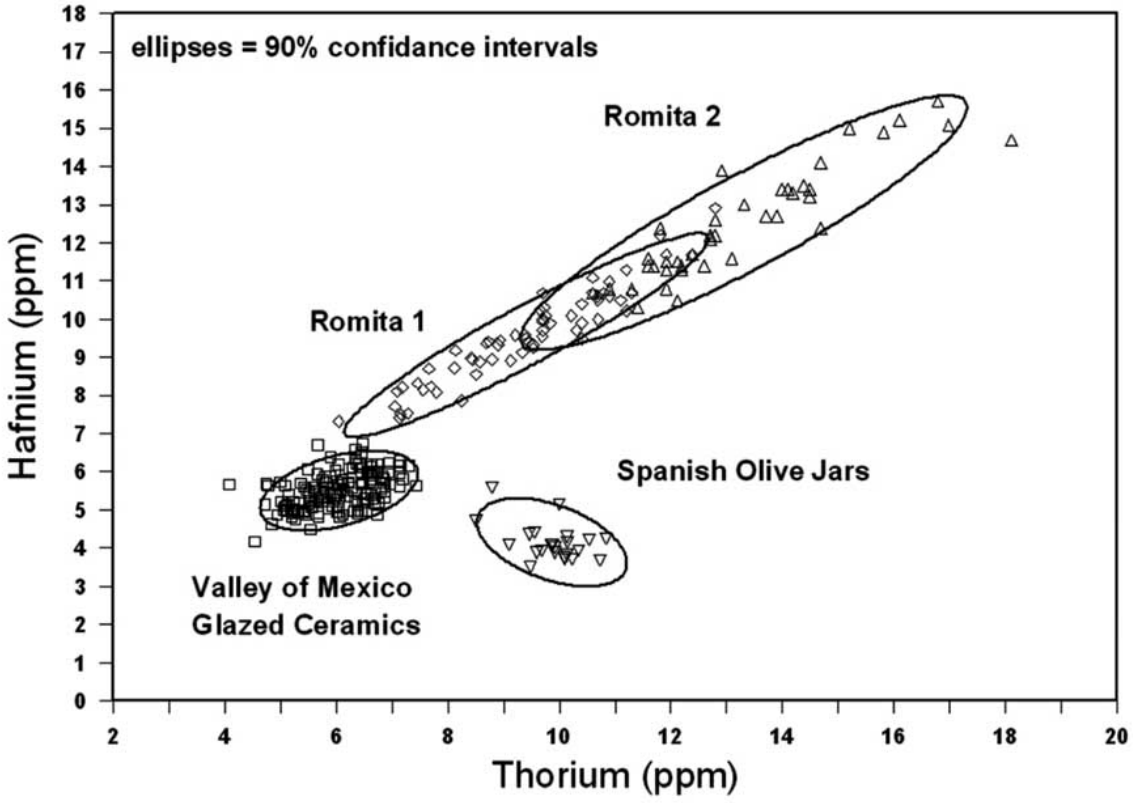

Figure 19. Bidimensional graph comparing parts per million of hafnium and thorium in glazed ceramics from Mexico City, the two groups of pseudo-majolica Romita, and Spanish vessels (*botijas*) (90% confidence intervals).

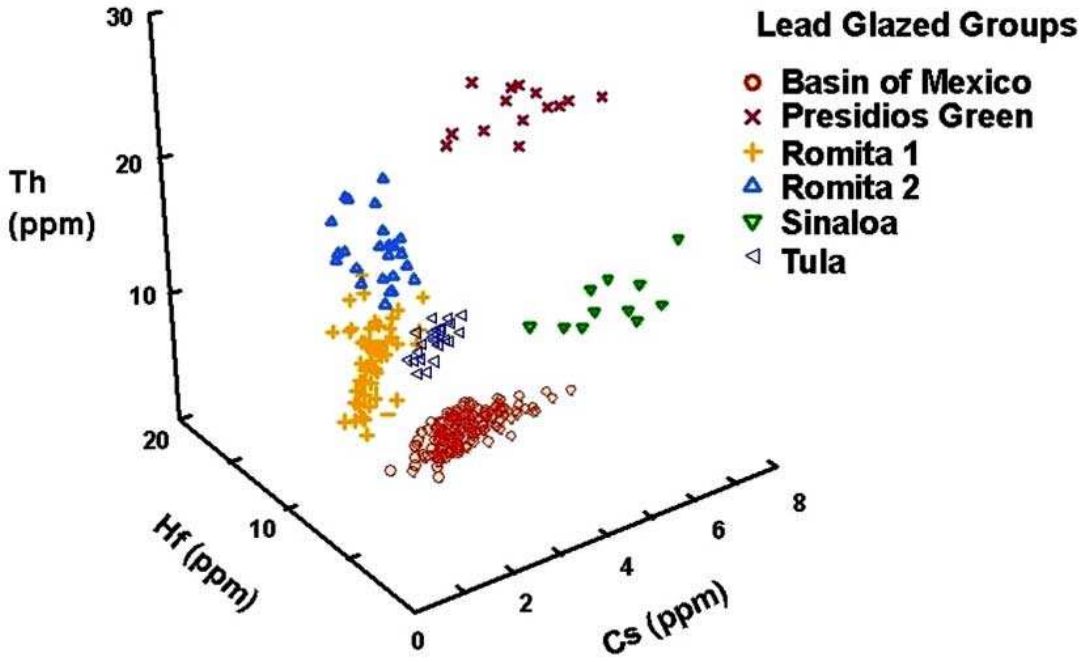

Figure 20. Tridimensional graph comparing parts per million of thorium, hafnium and cesium for different glazed wares produced in Mexico.

Final Remarks

The production and commercialization of glazed wares and of majolica in New Spain were definitely influenced by demand in the markets of the colonizers and their descendants. In urban centers the manufacture of bricks and roof tiles was established, while majolica was manufactured in several cities, such as the viceregal capital, Puebla, and Oaxaca (Blackman *et al*. 2006). Glazed ware became widespread in multiple places, above all where the indigenous population had the pre-Columbian technical and practical skills for making pottery. Although ordinances were put in place to regulate production and to organize the artisans in guilds, they were continuously evaded and broken even by the master potters (Gómez *et al*. 2001; Monroy and Fournier 2003), while Indian and Mestizo (mixed race) potters managed to remain active throughout New Spain.

The results of the compositional analyses allow us to see a trend toward regionalization regarding production and consumption of several classes of glazed ware between the 16th and 19th centuries. During the early Colonial period master potters from Talavera and Seville were able to imitate in their production Iberian majolica from the period to satisfy the demand of consumers, primarily in the capital and in Puebla. On the other hand, the majolica made in Puebla reached consumers settled in several areas of Mexico, including the distant internal

provinces of northern New Spain through the established redistribution channels, primarily the *Camino Real* (Royal Highway) and its branches. The commercialization of majolica from Angelopolis carried on, even during the 19th century, once Mexico's independence had been achieved, in spite of the rise of new production centers whose wares apparently could not really compete with the Puebla products.

The strong formal and stylistic similarities between Iberian and New Spain majolica dating from the mid-16th century to the beginning of the 17th century, as well as the rise of traditions with some originality in the viceregal period (very likely since the 16th century) inspired in *Mudéjar,* Italianate and Chinese-like parameters, apart from the development of diverse 19th-century stylistic patterns, are proof of the fact that in Colonial and Republican society symbolic networks and identity images were constituted through imitation, comparison, and later differentiation.

However, socioeconomic and political conditions in the society of New Spain generated a particular set of cultural guidelines, in part as a result of the long distance that separated it from the motherland. This fact originated responses which, although grounded in metropolitan traditions, were characterized by their originality, setting differences in the construction of the forms of identification and distinction, in comparison with the Spanish (Rubial 2002), with the later flowering of profuse polychromatic patterns in Republican Mexico during the 19th century. The formation of elements of differentiation in majolica, like imitation and comparison in the framework of the economic context of production of glazed wares according to the character of the symbol of identity which majolica had in particular, is reflected in subtle aspects that are not easy to detect macroscopically in archaeological samples. Therefore, this kind of aspect can only be discovered by comparison with similar manifestations in the metropolis and through nuclear activation analysis, like the ones we have been performing.

The hegemonic classes made a great effort to decorate their houses and selves with all those things that identified them as belonging to the privileged group, displaying external symbols of distinction with a profuse preoccupation with appearances and with all that was linked with their own way of life. Thus, according to an individual's rank and functions, there was a corresponding quality, design, and form of objects, depending on the social and economic circumstances of his or her insertion in the world of New Spain. Plebeians who achieved economic prosperity, regardless of their origin, tried to emulate the established aristocracy with lineage, by imitating what the prosperous classes did and what they consumed (cf. Gonzalbo 1996) --including majolica-- according to archaeological evidence and to the compositional analyses we have presented here.

The adaptations performed by master potters on Iberian majolica to make it conform to their own reality in the New World, using available raw matter and skillfully applying the techniques known by them, were part of the mechanisms of comparison in New Spain, so vessels offered a means to communicate aspects of the social identity of consumers, and at the same time the "potters of white"

(*loceros de lo blanco,* that is to say majolica specialists) gave a material expression to ideas about social differentiation and social relationships in the viceregal environment (Costin 1998; Rubial 2002). Although there was a downturn in the manufacture of majolica during the post-independence period due to the introduction on a massive scale of fine European white wares produced in industrial contexts (which were cheaper and to a great extent had more ornamental elaboration; Fournier 1990), tin- and lead-covered wares persisted and remained as relatively important objects of consumption.

On the other hand, by incorporating glazes with lead oxide as surface finish and morphological-stylistic elements of European origin in the production of pottery, thus reconfiguring their cultural knowledge, Indian potters were able to position themselves in a wider field of New Spain society in relation to the complex framework of relationships --not only economic, but symbolic as well.

Obviously, the proliferation of glazed wares in the vast territories of the former New Spain, manufactured in an infinite number of production centers, makes it difficult to identify with precision their place of origin when dealing with archaeological collections. The results discussed in this essay represent substantial advances concerning majolica production, commercialization, and consumption, although regarding pottery glazed with lead oxide there still are additional analyses to be performed in the future, as more samples become available whose chronological placement can be precisely determined, and more compositional groups are isolated to try to determine where the vessels were produced.

The definitive conformation of a compositional database is currently underway, a task that will be accomplished once we finish the analysis of recorded and catalogued samples. This database will be accessible to scholars interested in the historical archaeology of New Spain, dealing with subjects linked with production, exchange, and consumption of glazed ceramics dating from Colonial and Republican periods.

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