Sevillian transport jars in early colonial America: the case of Santa María La Antigua del Darién (Colombia)

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Abstract

Within the scope of the TECNOLONIAL (HAR2008-02834/HIST) project, an archaeological and archaeometric research is being conducted in order to clarify and systematize transport jars production in the Iberian peninsula and their distribution abroad, especially to the Americas, from the 15th to the 17th century. The production centre of Seville, in the Crown of Castile, produced large glazed and unglazed transport jars, called *botijas*, which were mainly devoted to the Atlantic trade network. The present study accounts for the first results obtained from an initial sample of 34 transport jars dated around the 15th-16th centuries from the production centre of Seville and the reception site of Santa María de la Antigua del Darién (gulf of Urabá, Colombia). This latter site is especially significant since it was the first Spanish foundation (1510) in continental America that obtained the title of *town*, and was the seat for the Governor of the new region called Castilla de Oro, as well as for the first *diocese*. All individuals were analyzed by means of x-ray fluorescence and diffraction analyses and then compared with the majolica production database from Seville. The results enabled us to define the first reference groups for such modern transport jars, and to get a first insight into the jars coming to the Americas in the early 16th century whose provenance can be linked to Seville, but not Triana.

Introduction

The emergence of the new colonial world broke with the traditional coastal trade scheme

established in the Mediterranean sea and added a new practice in the transport of goods. The new long-distance trade requirements gave rise to the creation of a new type of transport and storage jar. Seville developed the production of *botijas*, or *olive jars* (Goggin, 1960), *i.e.* large glazed or unglazed transport jars devoted to the transatlantic trade network (Amores Carredano and Chisvert Jiménez, 1993).

During the 15th and 16th centuries, *i.e.* after the Spanish colonized the Americas, the Spanish town of Seville evolved into a large-scale pottery producing centre for the new colonial world and underwent a large urban development. The increased importance of Seville was mainly due to the fact that this city's inland fluvial port served as both the departure point and the final destination for most Spanish galleons trading with the Americas in the so called *Carrera de Indias*. In order to supervise the traffic of goods, a bureau of trade called *Casa de la Contratación* was established in 1503. Its primary office was in Seville and lasted for more than 200 years (1503-1717). Such organization and control of goods caused an exceptional industrial intensification. As a consequence, pottery workshops moved outside the city, in the Triana area, due to public health issues, as reported by documentary and archaeological evidences. Pottery workshops were relocated in Triana area probably around the late 15th or early 16th century, even if the area flourished after the mid-16th century (Sánchez Cortegana, 1994).

Prior to this change the *Morisco ware* existed (Lister and Lister, 1976; Lister and Lister, 1982), and included the so-called *cuerda seca* technique. This ware featured an outline drawing made by a mixture of manganese oxide with animal fat and glazed pigment. The spaces in between were either totally or partly filled with coloured glazes (Pérez-Arantegui *et al.*, 1999). *Cuerda-seca* technique may date back to the 10th century BC, at the time of the islamic caliphate of Cordoba (South-Iberian peninsula), and was adopted all throughout the Middle Age, with its highest expansion in the 12th and 13th centuries. After the Christian conquered the islamic kingdoms of the Iberian peninsula, the technique was confined to *mudejar* craftsmen (*i.e.* craftsmen of Moorish origin), until it gradually disappeared in the middle of the 16th century (Sánchez Cortegana, 1994). Unfortunately, the archaeological records of the *cuerda seca* production are scarce. Arguably, the few craftsmen who produced *cuerda seca* were of Islamic origin, as testified by the possible concentration of workshops in the area of San Pedro also called *adarvejo de los moros* (*i.e.* Moorish walls) (Sánchez Cortegana, 1994; Lister and Lister, 1982). Though the extent of findings is still limited, the archaeological records of Triana

workshops seemingly report a possible production of *cuerda seca* in this area. As far as the expansion to the Americas is concerned, written documentation suggests that pottery sent to America in the first two decades of the 16th century was characterized by a broad typology, despite the limited number of goods shipped. Europeans brought from Europe all types of pottery that they needed (Sánchez Cortegana, 1996). In this process, a first milestone was the foundation of Santa María la Antigua del Darién (SMAD), one of the first European settlements on continental America (Figure 1). In 1510, Vasco Núñez de Balboa and Martín

Fernández de Enciso founded SMAD after several failed trials, like Santa Cruz (Venezuela) or San Sebastián de Urabá (Colombia). In 1513, the Castilian Crown gave the title of *town* to SMAD, the first town on continental America, and in 1514 the governor Pedrarias Dávila arrived with a contingent of 2000 people formed by soldiers, artisans, doctors, women, and the first bishop, Fray Juan de Quevedo. The expedition of 1514 was a major change in the first years of the American colonization, since it was the first time that the Crown of Castile organized and paid with public funds a whole movement of people in order to start an urban settlement. The ultimate goal of the Crown of Castile was to give birth to other new villages and start a nucleus of Castilian population in continental America. However, after several problems and political tensions, life in SMAD proved to be impossible. Thus, in 1519 the Governor founded the town of Panamá, where most people moved in 1520 (Alzate Gallego, 2006). Most importantly, large documentary evidence exists with regard to 1514's expeditions and informs us about the origin of supply goods. Food and several types of pottery are said to be of Sevillian origin (Mena García, 1998), an origin that seems also plausible for the ceramic transport jars of these food supplies. Since the abandonment of the old city of SMAD, its actual location was unknown until 1957, when the site was eventually identified by archaeologists. However, the only excavation was a limited program conducted in the 1960s and 1970s by Graciliano Arcila Vélez, who made a small plan and several archaeological surveys that revealed the only archaeological remains available nowadays (Alzate Gallego, 2006). Recently, the *Universidad Nacional de Colombia* started a new archaeological project on the site, unearthing an important set of ceramics from the period under consideration (Alzate Gallego, 2000).

Thus, the objective of this paper was to archaeometrically characterize transport jars recovered at SMAD in order to shed light on the characteristics of such vases from Seville, much less studied than other types of pottery produced there (like majolica). Moreover, it is also important that such transport jars are dated back to the 1513-1520 period, an early period in Seville pottery production, before the major role played by Triana, whose products have been largely characterized in contrast to other production areas of this centre.

Materials and Methods

In order to shed light on the first Sevillian transport jars coming to the Americas, 34 transport jars were analyzed in this study. Twenty-three were unearthed from the site of

SMAD (COL001 to COL023), while 11 others were transport jars from Seville (SEV001 to SEV010, recovered at Seville itself; and BCN138, unearthed at Barcelona) (Figure 2). These results were compared with the ARQUB archaeometric data bank for the production centre of Seville (labelled as MJ or TRI, unearthed at Seville, as well as from sites in the Canary islands), currently comprising 105 individuals (87 majolica individuals dated back to the 16th and 17th century; 14 green or honey coarse glazed pottery from the 13th and 14th century; and 4 *cuerda seca* individuals dated back to the end of the 15th and beginning of the 16th century) (Iñañez, 2007).
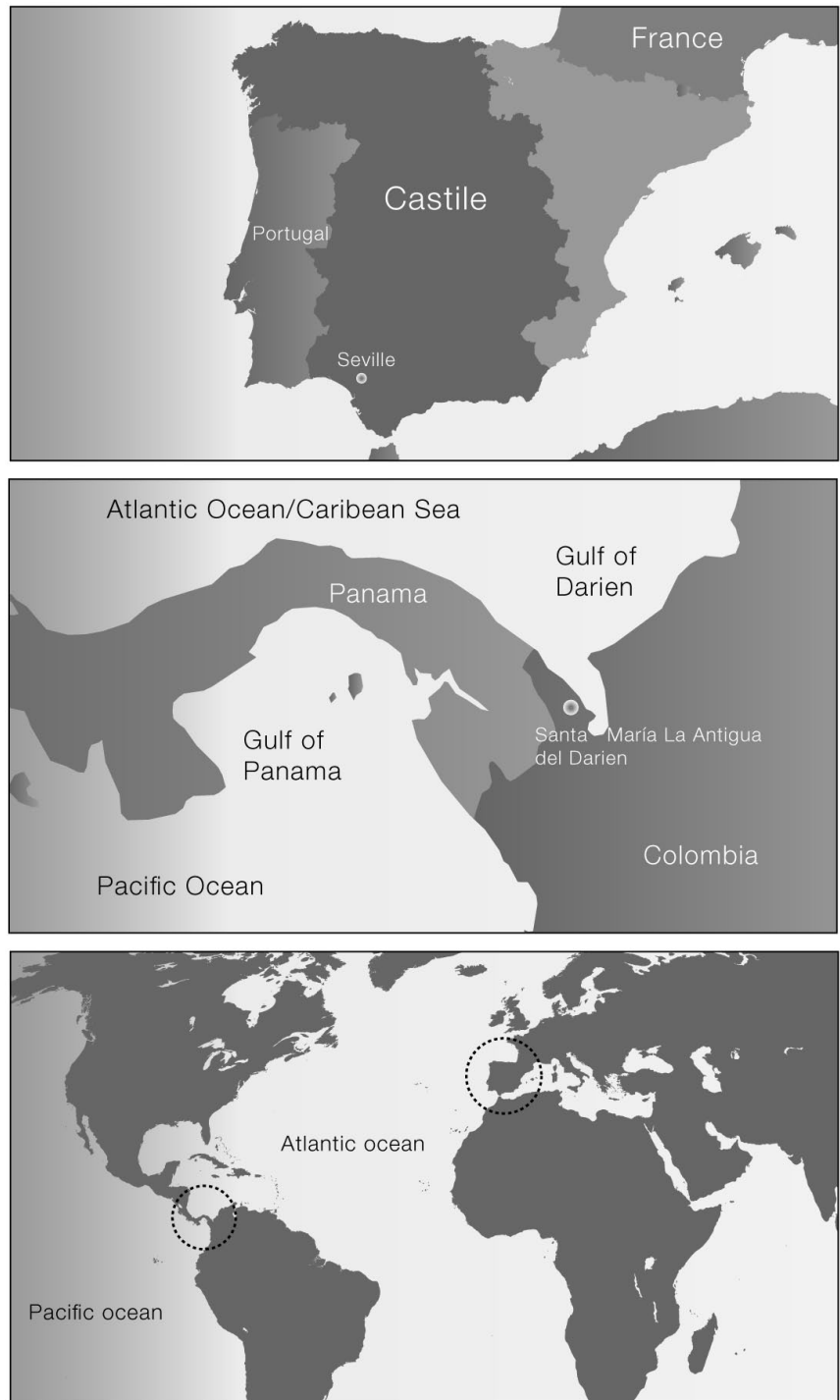
All individuals were chemically analyzed by

Figure 1. Geographical map of the Crown of Castile with Seville (upper panel), Gulf of Urabá with Santa Maria de la Antigua del Darién (central panel), and the Atlantic Ocean (lower panel).

means of x-ray fluorescence (XRF). First, all superficial layers of the potsherds were mechanically removed. Then, the samples were powdered and homogenized in a tungsten carbide mill Spex Mixer model 8000 (SPEX SamplePrep, Metuchen, NJ, USA). The chemical composition was determined from the powder previously dried in oven for 12 h at 105°C. Major and minor elements were determined by preparing duplicates of glass beads and were expressed as oxides (wt%). Each 30-mm glass bead was prepared using 0.3 g of the dried powdered sample mixed up with 5.7 g of lithium tetraborate ($Li_2B_4O_7$). Subsequently, 5 mg of lithium iodide (LiI) was added in order to control the surface tension of the glass bead. This homogenized mixture was deposited on a Pt-Au crucible (95:5) and melted in a fully-automatic bead preparation system PANalytical Perl'X-3 (PANalytical, Almelo, The Netherlands) at a temperature of 1125°C. Trace elements were determined by powdered pills made from 5 g of the powdered specimen mixed with 2 mL of a n-butylmethacrylate synthetic resin solution (Elvacite® 2044, in 20% acetone). This mixture, manually homogenized in an agate mortar to dryness and placed on a base of boric acid (H_3BO_3) in a 40-mm diameter aluminium vessel, was subjected to a pressure of 200 kN for 60 s in a Herzog press (HERZOG Automation Corp., Cleveland, OH, USA). The quantification of the concentrations was performed using an Axios^{mAX}-Advanced PANalytical spectrometer (PANalytical) with an Rh excitation source using a calibration line performed with 56 International Geological Standards. Interferences were taken into consideration and matrix effects were corrected by using the PANanalytical Pro-Trace software for trace elements (PANalytical). The elements determined comprised Fe_2O_3 (as total Fe), Al_2O_3, MnO, P_2O_5, TiO_2, MgO, CaO, Na_2O, K_2O, SiO_2, Ba, Rb, Mo, Th, Nb, Pb, Zr, Y, Sr, Sn, Ce, Co, Ga, V, Zn, W, Cu, Ni, and Cr. Loss of ignition (LOI) was determined by firing 0.3 g of dried specimen at 950°C for 3 h. Calcinations were carried out in a Heraeus muffle model M-110, by using a heating rate of 3.4°C min^{-1} and free cooling. Thus, the sum of major, minor, trace elements concentrations and LOI, is located within a range of 98-102%. A detailed description of the method adopted, as well as its precision and accuracy, has already been published (Hein *et al.,* 2002).

Mineralogical characterization of all individuals was performed by x-ray diffraction (XRD). Measurements were made using a Bragg-Brentano geometry PANalytical X'Pert PRO MPD Alpha-l diffractometer (radium=240 mm) (PANalytical) working with the Cu-Ka radiation (l=1.5406 Å) (45 kV, 40 mA) equipped with an X'celerator detector. Measurements where taken from 4 to 100°2

with a measure step of 0.017°2 and an acquisition time of 50 s per step. Evaluations of the crystalline phases present in each analyzed individual were performed with the software package Siemens DIFFRACT/AT (Siemens, Munich, Germany) including the database of the ICDD-JCPDS 2006 (The International Centre for Diffraction Data, Newtown Square, PA, USA).

Results and Discussion

In statistical terms, the elemental concentrations determined by means of XRF are a special case of the projective d+1-dimensional space, the simplex S^d. Projective points are represented by a d+1-dimensional vector of coordinates adding up to a constant k (k Î R^+):

$$x=[x_1,...,x_{d+1}]|x_i \geq 0 \ (i=1,...,d+1),$$
$$x_1+...+x_{d+1}=k \qquad (1)$$

(in the present case, k=100), a subset in the positive orthant , following a multiplicative model with a logarithmic interval metrics (Barceló-Vidal *et al.*, 2001; Aitchison, 2005; Buxeda i Garrigós, 2008). Therefore, for the statistical data treatment, raw concentrations have been centered log ratio (CLR) transformed, according to this formula:

$$|\mathbf{x} \in \mathbf{S}^d \rightarrow \mathbf{z} = \log\left(\frac{\mathbf{x}}{g(\mathbf{x})}\right) \in \mathbf{R}^D \qquad (2)$$

where S^d is the d-dimensional simplex, and

$g(x)$ the geometric mean of all D (D=d+1) components of x (Buxeda i Garrigós, 1999; Aitchison, 1986).

Some elements were not considered for the chemical study. Among those determined by XRF, Co and W were not used because of the contamination provided by the tungsten carbide cell where samples were powdered. Mo presents a concentration always below the lower detection limit and cannot accurately be determined. Pb and Sn are usually present in high amounts due to the glaze of some samples; for instance, Pb content largely exceeds the upper XRF regression limit (928 ppm). Therefore, these high Pb amounts result in interferences for trace elements such as Ga, Y, Th and Rb, which cannot be corrected. P_2O_5 was not considered due to potential contaminations during burial. Lastly, a double alteration and contamination process has been detected in an important number of samples. This process reports the leaching of K and, sometimes, Rb, from the matrix, with a subsequent enrichment of Na because of analcime crystallization (Buxeda i Garrigós *et al.*, 2002; Schwedt *et al.*, 2006; Zacharias *et al.*, 2007). Therefore, these alteration and contamination processes affect the components in the matrix composition, without any possibility of satisfactory correction. As a result, Na, K, and Rb were also sometimes removed from consideration during statistical analysis.

The statistical treatment of the XRF data is summarized by the cluster analysis in Figure 3. The study of the cluster suggests the existence of several different groups. On the left
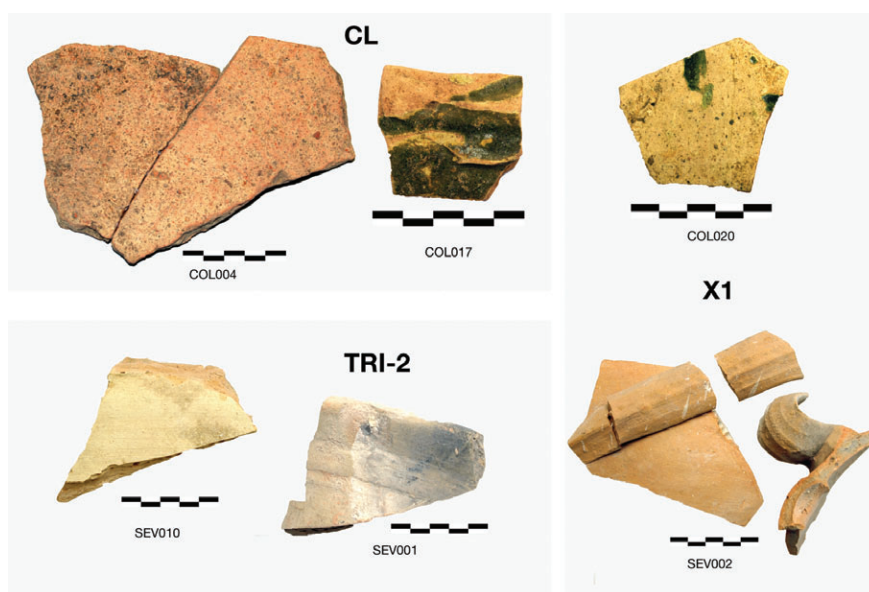

Figure 2. Macrophotographs of some representative individuals according to the defined groups (see the text). CL COL004 and COL017; X1: COL020 and SEV002; TRI-2: SEV001 and SEV010.
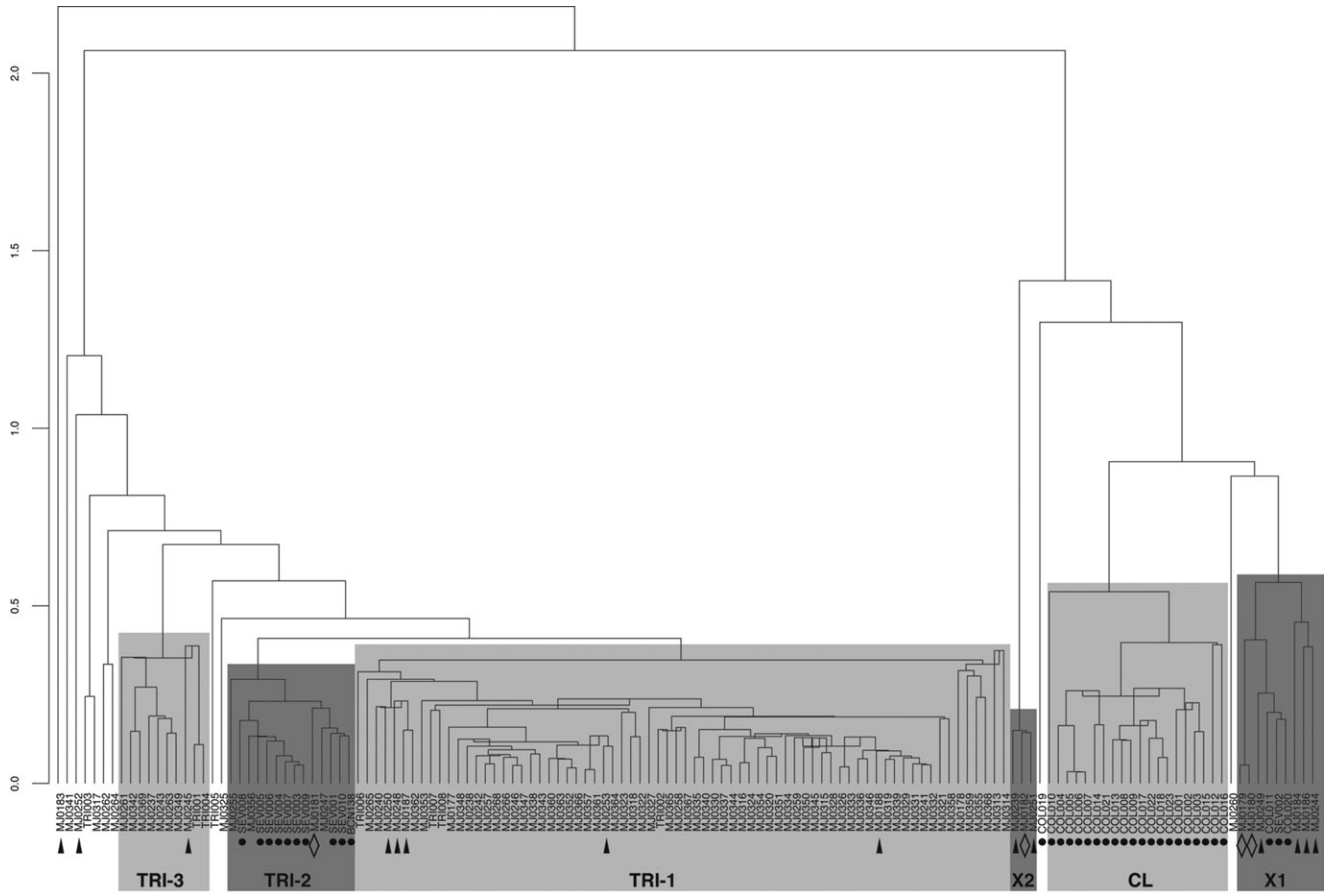
Figure 3. Dendrogram resulting from cluster analysis using squared Euclidean distance and centroid agglomerative method on the subcomposition Fe₂O₃, Al₂O₃, MnO, TiO₂, MgO, CaO, Na₂O, K₂O, SiO₂, Ba, Nb, Zr, Sr, Ce, V, Zn, Ni, and Cr, CLR transformed. Black circles represent transport jars, black triangles indicate coarse glazed pottery, white diamonds stand for *cuerda seca*, and no symbol is majolica.

Table 1. Elements concentration (mean and standard deviation on normalised data) for each chemical group.

Element	Chemical group													COLO19
	TRI1 (n=72)		TRI2 (n=15)		TRI3 (n=10)		X1 (n=9)		X2 (n=3)		CL (n=20)			
	m	sd	m	sd	m	sd	m	sd	m	sd	m	sd		
Fe₂O₃ (%)	4.86	0.31	5.74	0.26	5.09	0.26	6.22	0.78	6.30	0.20	7.35	0.41		6.84
Al₂O₃ (%)	12.68	0.86	14.68	0.63	13.22	0.71	15.52	1.56	15.34	0.49	18.52	0.51		17.05
MnO (%)	0.08	0.01	0.10	0.01	0.09	0.01	0.09	0.01	0.11	0.01	0.11	0.02		0.10
TiO₂ (%)	0.67	0.04	0.68	0.05	0.68	0.03	0.74	0.06	0.92	0.08	0.83	0.04		0.90
MgO (%)	3.18	0.29	3.34	0.31	3.62	0.32	3.39	0.73	2.07	0.20	3.07	0.31		2.98
CaO (%)	22.03	2.47	18.70	1.69	21.56	2.04	12.40	1.40	8.69	0.59	7.70	1.18		5.78
Na₂O (%)	0.96	0.20	0.76	0.09	1.48	0.15	0.71	0.16	1.29	0.13	0.47	0.06		0.29
K2O (%)	2.08	0.46	2.87	0.20	1.23	0.31	2.96	0.26	2.40	0.20	2.84	0.30		2.08
SiO2 (%)	53.33	2.03	53.00	2.25	52.91	1.87	57.85	2.74	62.76	1.55	58.95	1.65		63.84
Ba (ppm)	344	38	399	26	333	45	387	53	356	25	594	122		445
Nb (ppm)	17	1	18	1	17	1	18	1	18	2	20	1		22
Zr (ppm)	196	20	161	24	200	28	169	17	234	35	175	18		267
Sr (ppm)	431	57	408	32	482	31	325	43	251	31	260	52		153
Ce (ppm)	53	8	55	11	49	10	58	16	57	5	76	9		77
V (ppm)	70	8	84	7	83	11	100	12	98	4	112	15		82
Zn (ppm)	86	9	91	6	91	6	94	7	83	7	118	18		131
Ni (ppm)	33	5	40	3	41	3	42	5	36	4	48	3		41
Cr (ppm)	78	9	70	9	82	9	95	7	98	2	101	6		104

n, number of individuals; m, mean; sd, standard deviation; ppm, parts per million (µg·g⁻¹).

side, a broad heterogeneous trend has been highlighted over a grey pattern. This heterogeneous trend can be identified with the most typical Sevillian productions, which are also the most studied ones. Several groups are easily recognized. On the one hand, the TRI-1 group is almost exclusively composed by majolica, even if five coarse glazed individuals are also included. Pottery in this group came mostly from archaeological excavations in Seville city, especially in the workshops of Valladares, Pureza and Plaza de Armas, all three located in Triana. It must be stressed that the three characterized workshops are dated back to 1550 onwards, several decades after the foundation and fall of SMAD. The TRI-3 group is closely related to the TRI-1 group. It is also composed almost exclusively by majolica including some individuals from the three Triana workshops, except for one coarse glaze individual. The main difference between the TRI-1 and TRI-3 groups is related to relative Na_2O and K_2O concentrations. Nevertheless, both groups show the highest relative CaO content in the dataset (Table 1). On the other hand, the TRI-2 group is composed mainly by transport jars, even if it also includes one *cuerda seca* and three majolica individuals, one of them belonging to the Plaza de Armas workshop. Regarding the transport jars in this group, all of them come from the filled vaults of the Seville's Cathedral; specifically, from *Cámara Alta*, built in 1514, and from *San Isidoro*, built in 1520, therefore contemporary to SMAD. In Seville, the use of recycled ceramics as materials for constructions of different buildings was quite frequent because they were relatively light and bulky items (Sánchez Cortegana, 1994; Pleguezuelo Hernández *et*

al., 1999). This TRI-2 group shows lower relative concentrations of CaO and Na_2O, as well as higher relative concentrations of K_2O, Fe_2O_3, Al_2O_3, and Ba. It seems possible that this group is also related to Triana area, with slight compositional differences, possibly due to the type of pottery produced or to small variations in the exploited clay beds, or even to chronological differences. In any case, the presence of one majolica individual from Plaza de Armas points out that the chemical composition in groups TRI-1, TRI-3, and TRI-2 are not necessarily clear-cut. Therefore, this heterogeneous trend must be, at present, related to pottery production in Triana area.

Furthermore, the three different groups can also be clearly identified in the dendrogram (Figure 3), together with two individuals (one majolica and one transport jar unearthed at SMAD) remaining as outliers. In general, these groups and individuals exhibit lower relative CaO values, as well as higher relative Fe_2O_3 and Al_2O_3 (Table 1), and they correspond to non-majolica pottery, except for one. In addition, there is a higher content of SiO_2. The X1 group is formed by 9 individuals from different backgrounds and types including transport jars from the Cathedral and SMAD, coarse glazed pottery from Gran Canaria and Seville, and *cuerda seca* from Seville. Interestingly, there is no majolica in this group, only utilitarian ceramics. The transport jar from Seville is an *olive jar* dated back to early 1500 to 1580, according to Goggin (1960). Amores Carredano and Chisvert Jiménez (1993) indentified these forms as the first jars of transatlantic trade, being an adaptation of traditional *cantimploras*. It is relevant that this

individual is from the same archaeological context as the other transport jars from Seville, from the filled vaults of the *Capilla de San Isidoro*. This scenario may lead to the interpretation that X1 must be from a Sevillian provenance not yet determined. Besides, the coarse glazed pottery from Gran Canaria was recovered in two sites that can be dated back to the end of the 15th century onwards. There are no good chronological indicators for the two coarse glazed pottery individuals recovered at Seville itself. Therefore, it seems that this X1 group can be dated back to the early production of Seville (end of the 15th century-beginning of the 16th century). Three other individuals – two coarse glazed individuals from Gran Canaria and one *cuerda seca* – are grouped together in the X2 group. This group also contains non-majolica pottery and is dated back to the early Sevillian production. From a chemical point of view, it seems to be related to the previous X1 group (Table 1), though differences can be seen in higher relative SiO_2 and Zr concentrations contrasting with lower relative CaO, Ba, and Sr concentrations. Moreover, X2 also exhibits higher Na_2O and lower K_2O relative concentrations. Finally, the CL group includes 20 transport jars from SMAD. This group has the lowest relative CaO and Na_2O concentrations, but the highest relative Fe_2O_3 and Ba concentrations (Table 1). This situation made the paste of CL pottery reddish, while lower Fe_2O_3 and higher CaO amounts of the majolica pottery from Seville provided a light buff colour to their paste due to the incorporation of iron oxides into calcium iron silicates (Molera *et al.*, 1998).

Finally, the study of the transport jars by

Table 2. Estimated equivalent firing temperature according to the defined fabrics from the association of crystalline phases by x-ray diffraction.

Fabric (°C)	Phases	Groups		Total
		X1		
F1 (850-900)	Afs, Cal, Di, Gh, Ilt, Hem, Pl, Qz	SEV002	1	3
F2 (900/950-1000)	Afs, Cal, Di, Gh, Ilt,* Hem, Pl, Qz	COL011	1	
F3 (1000-1050)	Afs, Cal, Di, Gh, Hem, Pl, Qz	COL020	1	
		CL		
F1 (800/850-900)	Afs, Di, Ilt, Hem, Pl, Qz	COL002, 3, 4, 7, 9, 10, 13, 14, 15, 16, 17, 18, 21, 22, 23	15	20
F2 (900/950-1000)	Afs, Di, Ilt,* Hem, Pl, Qz	COL005	1	
F3 (1000-1050)	Afs, Di, Hem, Pl, Qz	COL001, 6, 8, 12	4	
		TRI-2		
F1 (850-950)	Afs, Cal, Di, Gh, Ilt, Hem, Pl, Qz	SEV004, 5	2	10
F2 (950-1000)	Afs, Cal, Di, Gh, Ilt,* Hem, Pl, Qz	BCN138, SEV001, 9, 10	4	
F3 (1000-1050)	Afs, Cal, Di, Gh, Hem, Pl, Qz	SEV007, 8	2	
F4 (1000-1050 analcime)	Afs, Anl, Cal, Di, Gh, Hem, Pl, Qz	SEV003, 6	2	

Afs, alkali feldspar; Anl, analcime; Cal, calcite; Di, diopside (pyroxene); Hem, hematite; Gh, gehlenite; Ilt, illite (illite-muscovite); Pl, plagioclase; Qz, quartz; Ilt,* illite (illite-muscovite) without the 10 Å peak.

XRD enabled us to estimate the equivalent firing temperatures according to the fabrics defined by the association of crystalline phases [Table 2; abbreviations after Whitney and Evans (2010)]. Results show lower equivalent firing temperatures for transport jars belonging to groups X1 and CL, than those belonging to the possible Triana production in group TRI-2. However, the still scarce set of transport jars characterized so far do not enable us to infer necessary technological differences in this respect.

Conclusions

The results of this study show the existence of at least two large ceramic industries in Seville, identified in different reference groups: the disappearing old *mudejar* tradition; and the vibrant majolica industry, which favoured the installation of Italian and Castilian artisans in Triana to produce majolica and other types of pottery, including transport jars. This situation notwithstanding, it is likely that more chemical groups are yet to be identified. In the case of transport jars, the results obtained so far have enabled us to identify a production most probably related with Triana area (group TRI-2). Besides, another group (X1) has also been identified, and its products are also present in SMAD, even if in a small proportion. Finally, another group accounts for more of the transport jars unearthed at SMAD (CL) with no definite analytical proof of Sevillian origin. However, this origin must still be kept as probable according to Pedrarias expedition's written sources and to background knowledge on the Castilian colonization of the Americas. Thus, the evidence studied so far enables us to hypothesize a complex structure of the Sevillian production, including a large number of reference groups which are, at present, unevenly known. Such groups might be related to the different areas of pottery production that were active during the city time history, exploiting different clay beds in different locations. Precisely, groups X1, X2, and CL, seem to be related to the main activity of Seville (end of the 15th century-beginning of the 16th century), before the flourishing of Triana area. In that respect, the transport jars recovered at SMAD are, at present, the largest set of such Sevillian early materials archaeometrically characterized. At the same time, they also are the main advice to be cautious when establishing provenances for a large production centre like Seville, whose complex structure may involve several reference groups not yet known. In this vein, the present results provide some of these new reference groups for such a complex production centre.

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