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Romita pottery revisited: a reassessment of the provenance of ceramics from Colonial Mexico by LA-MC-ICP-MS

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ABSTRACT

The origin of Romita pottery has been a controversial topic during the last three decades of Colonial Mexico archaeological studies. Lead isotopic analyses of glaze coatings of Spanish and Mexican pottery, and Romita ceramics unearthed from the archaeological site of the Metropolitan Cathedral in Mexico City provide evidence that support a Mexican origin.

1. Introduction

Romita pottery[1], also known as Indígena ware (Lister and Lister, 1982) or Loza Indígena (Fournier et al., 2007), is found in greatest abundance in Colonial period contexts in Mexico City (Lister and Lister, 1982). Romita pottery is earthenware covered with a white slip and a transparent Pb glaze, which results in a white and shiny appearance that is visually similar to tin-glazed Spanish majolica. Romita pottery occurs in many typological forms, such as porringers with leaf-shaped handles, compound-silhouette plates, bowls, and other forms similar to the forms of Spanish, Italian, and Mexican majolica serving vessels. The pottery has interested scholars for decades (e.g., Fournier et al., 2007; Lister and Lister, 1982; Rodríguez-Alegría, 2002a, 2002b; Rodríguez-Alegría et al., 2003) because it distinct from, yet similar to, traditional Spanish majolica and other contemporary European glazed ceramics. Although similar in many ways to Spanish majolica, Romita pottery has been considered by some researchers to be an indigenous imitation of Spanish tin-glazed ceramics (e.g., Lister and Lister, 1982; Fournier et al., 2007). Conversely, others consider Romita pottery as a European import or produced by European potters and imported to Mexico from Spain or other Spanish colonies outside of Mexico (e.g., Rodríguez-Alegría, 2002a,b; Rodríguez-Alegría et al., 2003). Because this ceramic is commonly believed to be an indigenous imitation of European tableware, it is considered important in the study of technological change in colonial transculturation processes, the adoption of European aesthetics among indigenous people, and competition between colonizers and indigenous people in the colonial market. The determination of whether Romita pottery is an indigenous version of European wares, or whether it was simply an imported ware that had little or nothing to do with indigenous adoptions of European technologies is a key step in better understanding technological change, transculturation, socio-political, and economic issues in Spanish Colonial Mexico.

The proposed origin of this pottery includes Italy (Lister and Lister, 1976), Mexico (Lister and Lister, 1982; 1987; Magetti et al., 1984) and Spain (Rodríguez-Alegría, 2002a,b; Rodríguez-Alegría et al., 2003). It was initially argued that Romita pottery was an

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[1] The authors disagreed on the name of this ware. Rodríguez-Alegría prefers to call it Indígena Ware, as seen in previous publications (e.g. Deagan, 1987: 72–73; Lister and Lister, 1982, 1987; Rodríguez-Alegría, 2002b; Rodríguez-Alegría et al., 2003). Iñañez prefers to use the term Romita, as seen in previous publications (Fournier et al., 2007; Fournier and Blackman, 2008; although they also refer to *Loza Indigena*, a close translation of Indigena Ware); to avoid confusion between this particular ware and any “generic” indigenous ceramics.

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Italian ceramic, with two main variants named after Rome: Romita Plain for the undecorated variant, and Romita Sgrafitto for the decorated variant (Lister and Lister, 1976). Following their attribution of Romita pottery to Italy, Lister and Lister reconsidered and argued that it was actually an indigenous imitation of European tableware made in Mexico, based on manufacturing techniques, vessel morphology, and decorative attributes of late Aztec period along with possible European influenced motifs (Lister and Lister, 1982). These authors also reasoned that the white slip was added before glazing to achieve the desired white surface color because indigenous potters lacked the technology necessary to render the Pb glaze opaque by the addition of tin. In addition, Romita Sgrafitto has decoration outlined by carving through the white slip to expose the red color of the paste and then filling the areas of the glaze with green and orange pigments, giving the ware its characteristic bright colors. Decorative motifs exhibited on Romita sgraffito vessels include characteristic decorative elements that may derive from prehispanic indigenous traditions, such as corn or eagles. However, the composition and layout of these designs are more similar to the European renaissance style, including wavy valances, spirals, and circular motifs (Fig. 1).

According to Lister and Lister (1982), among the types of Romita ceramics the plain variant was the most represented in the Mexico City archaeological excavations, with the sgraffito variant showing a wider distribution throughout central and northern Mexico and the southern United States. Thus, this latter type is archaeologically documented in multiple sites, not only in Mexico City, but also in the Valle del Mezquital (Hidalgo), in several historic settlements in Michoacán (Pátzcuaro and Cuitzeo basins), in Balsas (Guerrero), in Sinaloa, and in several sites near the Texan and Chihuahan border, as well as in New Mexico (see Fournier et al., 2007, and references therein). Archaeological and historical evidence suggests a lengthy period of production and consumption for Romita pottery that would have begun in the 16th century, and continued until mid or even the end of the 17th century (Fournier et al., 2007).

2. Previous Archaeometric Research

Maggetti et al. (1984) provided the first insight into the chemical and petrographical composition of Romita pottery pastes. Petrographic studies of five Romita sherds unearthed from beneath the Metropolitan Cathedral in Mexico City provided evidence that the source materials for these samples was volcanic in origin, likely from Mexico—in contrast to the more common sedimentary sources for tempers seen in Spanish majolica. Additionally, Maggetti et al. (1984) proposed that Romita sgraffito was made from different clays than those used to manufacture Valle Ware (pottery likely produced in the Valley of Mexico), suggesting that the production area lay outside the Valley of Mexico.

Approximately twenty years after Maggetti argued that Romita Ware was made in Mexico, Rodríguez-Alegría conducted a stylistic analysis and a chemical characterization study of the ceramics from the Metropolitan Cathedral in Mexico City and concluded that it was a European import or produced by European potters and imported to Mexico from Spain or other Spanish colonies outside of Mexico (Rodríguez-Alegría, 2002a, 2002b; Rodríguez-Alegría et al., 2003). Moreover, the chemical composition of the Romita sherds did not match the composition of any samples from Mesoamerica nor any European ceramics. To support the hypothesis that it was a European ceramic, Rodríguez-Alegría relied heavily on decorative attributes and vessel form. The technique of carving decorative motifs through a burnished white slip and then covering with a Pb glaze had been used in Europe since the ninth century, peaking in popularity between the twelfth and the fifteenth century throughout Europe (Kuleff and Djingova, 2001), with no antecedents to this technique in Mesoamerica (Rodríguez-Alegría et al., 2003). Although this specific technology did not exist in Mesoamerica, carved decorative motifs were not uncommon in earlier Mesoamerican ceramics (for example, see Blomster et al., 2005, and references therein).

A more recently challenge to European provenance hypothesis came from the INAA study by Fournier et al. (2007). Based on chemical analysis of numerous Romita ceramics specimens from the Michoacán region, which have ethnographic and contemporary ceramic production contexts, Fournier et al. (2007) conclude that Romita pottery was produced in Mexico, most likely in the Pátzcuaro Basin area. In addition, it was also observed that there are two similar, yet distinctive composition groups of Romita pottery shards based on their relative trace element abundances (Fournier et al., 2007).

Fig. 1. Romita ware plain and sgraffito variants.

Fig. 2. Map of Mexico including sites mentioned in the text and relevant Pb deposits from (Cumming et al., 1979).

In light of the recent and contrasting views of Fournier et al. and Rodríguez-Alegría, we report here the Pb isotopic composition of the glazes from Romita pottery sherds and compare these compositions with those of source materials from the New World and Europe. Importantly, Brill et al. (1987) and Joel et al. (1988) reported on the Pb isotopic compositions of majolica pottery in the Americas. These data along with that for Mexican Pb ores (Cumming et al., 1979) provide a basis to assess the possible provenance of these ceramics (Fig. 2).

3. The samples

In addition to the Romita ceramics, this study also incorporates majolica and non tin-lead glazed ceramics from 16th and 17th centuries Spanish and Mexican production centers in order to put the Romita Pb isotopic data into an interpretable context that allow us to assess the use of Mexican or Spanish Pb for Romita glazes. The provenance and archaeological reliability of the ceramic paste reference groups have been established and published elsewhere (Olin and Myers, 1992; Blackman et al., 2006; Fournier et al., 2007; Iñañez, 2007; Iñañez et al., 2008). In order to obtain better insight on the Pb isotopic fingerprints of the Romita ceramics and its correlation against the Spanish and Mexican ceramics, a sample of 8 Romita ceramics was selected for Pb isotope analysis. Additionally, 5 majolica sherds attributed to Puebla—one of the major production centers in Colonial Mexico—3 glazed ceramics from the Mexico City reference group, 5 majolica sherds from Talavera de la Reina (Spain), and 5 majolica sherds from the production center of Seville (Spain) were selected for analysis.

4. Analytical Methodology

Lead has four isotopes, ^{208}Pb, ^{207}Pb, ^{206}Pb, and ^{204}Pb; ^{204}Pb is invariant in nature, whereas ^{208}Pb, ^{207}Pb, ^{206}Pb are daughter products of the decay of ^{232}Th, ^{235}U, and ^{238}U, respectively. Therefore, variation in the Pb isotopic compositions of materials is a function of its initial U, Th and Pb concentrations, the starting Pb isotopic composition, and the time-integrated growth of radiogenic Pb. Due to dissimilarity in the chemical behavior of U, Th, and Pb, the Pb isotopic compositions of materials can vary widely in nature. These natural variations, therefore, make the Pb isotopic system an ideal candidate to constrain the potential provenance of geologic materials and the archaeological materials derived therefrom (e.g., Brill and Wampler, 1967; Pollard et al., 2007; Pollard, 2009; Stos-Gale and Gale, 2009; Shortland, 2006, and references therein).

Table 1
LA-MC-ICP-MS analytical conditions for Pb isotope analysis at the Plasma Laboratory of the University of Maryland.

Mass spectrometer	
Instrumentation	Nu Plasma MC-ICP-MS
Forward power	1300 W
Reflected power	<10 W
Cones	Ni
Acceleration voltage	4000 V
Gas flows	
Coolant	13 L min^{-1}
Auxilary	0.8 L min^{-1}
Nebulizer	0.77 L min^{-1}
Aridus gas flows	
Sweep gas	2.20 L min^{-1}
N_2	0.15 L min^{-1}
Helium flow	0.4 L min^{-1}
Laser	
Instrumentation	Nu Wave UP 213

	Standard NIST 610	Sample
Line width	150 μm	6–8 μm
Line length	350–400 μm	350–400 μm
Translation rate	7 μm s^{-1}	7 μm s^{-1}
Pulse frequency	7 hz	5–10 hz
Energy density	4–5 J cm^{-1}	4–5 J cm^{-1}
Typical ^{208}Pb V	0.57	1–6

Table 2
Pb isotopic values for NIST 610 acquired by LA-MC-ICP-MS at the Plasma Laboratory of the University of Maryland.

NIST610	$^{208}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{207}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{206}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{207}Pb/^{206}Pb$	$2\sigma_{(mean)}$	$^{208}Pb/^{206}Pb$	$2\sigma_{(mean)}$
Block 1–1	37.827	0.013	15.787	0.006	17.266	0.007	0.91454	0.00005	2.1913	0.0002
Block 1–2	37.840	0.012	15.795	0.005	17.272	0.006	0.91427	0.00006	2.1908	0.0002
Block 1–3	37.703	0.012	15.745	0.005	17.230	0.005	0.91378	0.00008	2.1880	0.0002
Block 1–4	37.688	0.011	15.737	0.004	17.221	0.005	0.91388	0.00004	2.1883	0.0002
Block 2–1	37.703	0.013	15.711	0.004	17.205	0.006	0.91344	0.00008	2.1867	0.0002
Block 2–2	37.688	0.011	15.720	0.004	17.207	0.004	0.91358	0.00006	2.1869	0.0002
Block 2–3	37.624	0.011	15.703	0.005	17.194	0.005	0.91314	0.00012	2.1857	0.0003
Block 2–4	37.628	0.011	15.701	0.004	17.190	0.005	0.91342	0.00004	2.1857	0.0002
Block 3–1	37.624	0.013	15.711	0.004	17.205	0.006	0.91344	0.00008	2.1867	0.0002
Block 3–2	37.628	0.011	15.720	0.004	17.207	0.004	0.91358	0.00006	2.1869	0.0002
Block 3–3	37.581	0.011	15.703	0.005	17.194	0.005	0.91314	0.00012	2.1857	0.0003
Block 3–4	37.574	0.011	15.701	0.004	17.190	0.005	0.91342	0.00004	2.1857	0.0002
Block 4–1	37.581	0.011	15.703	0.005	17.194	0.005	0.91314	0.00012	2.1857	0.0003
Block 4–2	37.574	0.011	15.701	0.004	17.190	0.005	0.91342	0.00004	2.1857	0.0002
Block 4–3	37.619	0.011	15.721	0.004	17.210	0.005	0.91331	0.00006	2.1855	0.0002
Block 4–4	37.580	0.013	15.707	0.004	17.199	0.005	0.91311	0.00006	2.1850	0.0002
Block 5–1	37.632	0.016	15.721	0.005	17.212	0.004	0.91349	0.00010	2.1867	0.0005
Block 5–2	37.534	0.012	15.687	0.005	17.188	0.006	0.91289	0.00006	2.1839	0.0003
Block 5–3	37.535	0.008	15.689	0.004	17.188	0.006	0.91278	0.00008	2.1841	0.0002
Block 5–4	37.534	0.012	15.687	0.005	17.188	0.006	0.91289	0.00006	2.1839	0.0003
Block 6–1	37.535	0.008	15.689	0.004	17.188	0.006	0.91278	0.00008	2.1841	0.0002
Block 6–2	37.534	0.012	15.687	0.005	17.188	0.006	0.91289	0.00006	2.1839	0.0003
Block 6–3	37.602	0.012	15.709	0.004	17.204	0.006	0.91323	0.00006	2.1856	0.0002
Block 6–4	37.594	0.013	15.709	0.006	17.200	0.006	0.91321	0.00006	2.1852	0.0003
Block 7–1	37.602	0.012	15.709	0.004	17.204	0.006	0.91323	0.00006	2.1856	0.0002
Block 7–2	37.594	0.013	15.709	0.006	17.200	0.006	0.91321	0.00006	2.1852	0.0003
Block 7–3	37.586	0.012	15.706	0.003	17.195	0.004	0.91329	0.00008	2.1853	0.0002
Block 7–4	37.768	0.011	15.761	0.004	17.237	0.004	0.91443	0.00004	2.1911	0.0002
Block 8–1	37.586	0.012	15.706	0.003	17.195	0.004	0.91329	0.00008	2.1853	0.0002
Block 8–2	37.768	0.011	15.761	0.004	17.237	0.004	0.91443	0.00004	2.1911	0.0002
Block 8–3	37.618	0.029	15.712	0.009	17.199	0.008	0.91332	0.00020	2.1860	0.0008
Block 8–4	37.500	0.013	15.682	0.006	17.185	0.006	0.91253	0.00007	2.1822	0.0003
Block 9–1	37.618	0.029	15.712	0.009	17.199	0.008	0.91332	0.00020	2.1860	0.0008
Block 9–2	37.618	0.029	15.712	0.009	17.199	0.008	0.91332	0.00020	2.1860	0.0008
Block 9–3	37.498	0.013	15.678	0.006	17.181	0.006	0.91246	0.00004	2.1824	0.0002
Block 9–4	37.466	0.009	15.664	0.004	17.166	0.005	0.91249	0.00006	2.1824	0.0002
Block 10–1	37.498	0.013	15.678	0.006	17.181	0.006	0.91246	0.00004	2.1824	0.0002
Block 10–2	37.466	0.009	15.664	0.004	17.166	0.005	0.91249	0.00006	2.1824	0.0002
Block 10–3	37.581	0.027	15.697	0.008	17.206	0.012	0.91274	0.00029	2.1845	0.0008
Block 10–4	37.772	0.013	15.763	0.006	17.245	0.007	0.91421	0.00006	2.1905	0.0002
Block 11–1	37.581	0.027	15.697	0.008	17.206	0.012	0.91274	0.00029	2.1845	0.0008
Block 11–2	37.772	0.013	15.763	0.006	17.245	0.007	0.91421	0.00006	2.1905	0.0002
Block 11–3	37.768	0.012	15.760	0.005	17.249	0.006	0.91384	0.00010	2.1894	0.0003
Block 11–4	37.772	0.013	15.742	0.005	17.225	0.005	0.91391	0.00006	2.1893	0.0002
Average	37.62		15.71		17.21		0.91		2.19	
2s	0.19		0.06		0.05		0.00		0.01	
%	0.5%		0.4%		0.3%		0.1%		0.2%	

Lead isotopic compositions were determined *in situ* via laser ablation, multi-collector, inductively coupled plasma-mass spectrometry (LA-MC-ICP-MS) employing a New Wave UP-213 laser system and a Cetac Aridus desolvating nebulizer system coupled to a Nu Plasma multiple-collector ICP-MS (Belshaw et al., 1998). The New Wave UP-213 utilizes a frequency quintupled solid-state Nd-YAG laser with a final output wavelength of 213 nm. Helium gas was flushed through the ablation cell and used to entrain the ablated particles. Before the plasma torch, the He gas from the laser ablation cell was combined with an Ar and N_2 gas-flow from the Aridus nebulizer via a T-junction (see Table 1 for typical gas-flow settings). During the analytical session, ultra-pure 18 MΩ (milli-Q) water was flushed through the Aridus ensuring only Ar and N_2 reached the plasma (see Table 1 for typical analytical settings).

Parallel faraday cups outfitted with $10^{11}\Omega$ resistors were used to collect the simultaneous ion currents from masses ^{208}Pb, ^{207}Pb, ^{206}Pb, ^{204}Pb, and ^{202}Hg. Before each sample analysis, an on-peak background was taken for 45 s with the laser on and shuttered. The Nu Plasma time-resolved software was used to establish the average of the background for each analysis and to calculate each ratio using the background-corrected signals from each time-resolved measurement. The integration time of each measurement is 0.2 s. Typical ablation spectra were collected for ∼60 s. The isobaric interference of ^{204}Hg on ^{204}Pb was corrected for by using the background-corrected ^{202}Hg signal and the natural isotopic abundances of each Hg isotope ($^{202}Hg/^{204}Hg = 0.2299$ (de Laeter et al., 2003)). However, the Hg interference was insignificant during our analyses due to the large amount of Pb (≥wt%) and negligible amount of Hg (≤μg/g) in the ceramic glazes.

Isotopic fractionation corrections were performed using the Exponential Law and NIST SRM610 values from (Baker et al., 2007) by means of standard-sample bracketing (e.g., Jochum et al., 2006; Kent, 2008; Paul et al., 2005; Simon et al., 2007). Our block analyses consisted of two standard measurements (NIST SRM610) before and after six sample measurements.

Replicate analyses ($n = 44$) of NIST 610 during the day of analyses yielded an external precision of 0.4% on $^{20x}Pb/^{204}Pb$ ratios and 0.2% on $^{20x}Pb/^{206}Pb$ (with x being 6, 7 or 8, as appropriate) (Table 2). Due to the wt% Pb concentrations in the glaze of the ceramics, we were able to measure their Pb isotopic compositions with a high

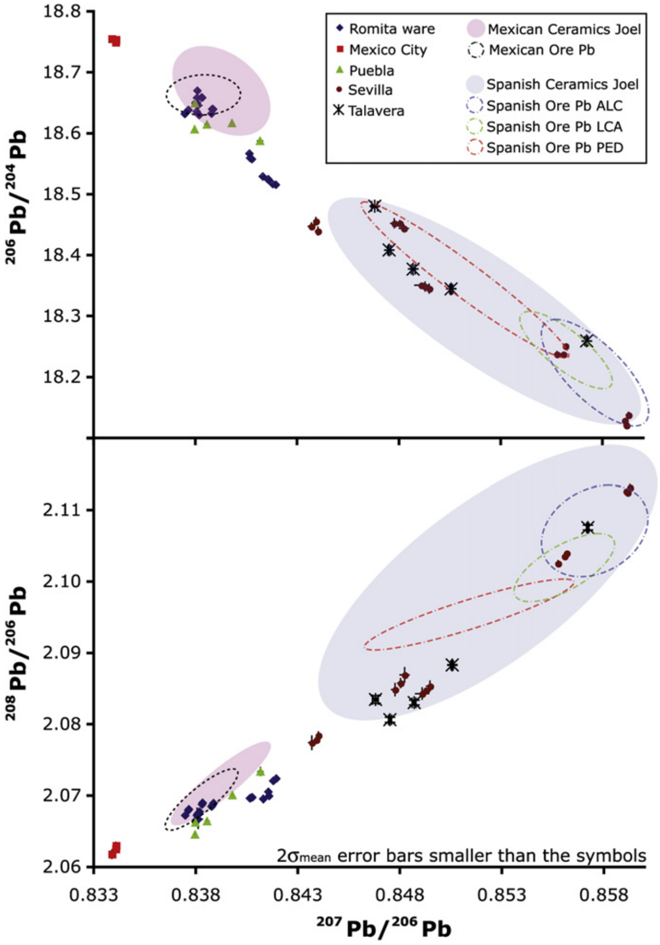

Fig. 3. Pb isotopic ratios of Mexican and Spanish ceramics and lead deposits from the literature.

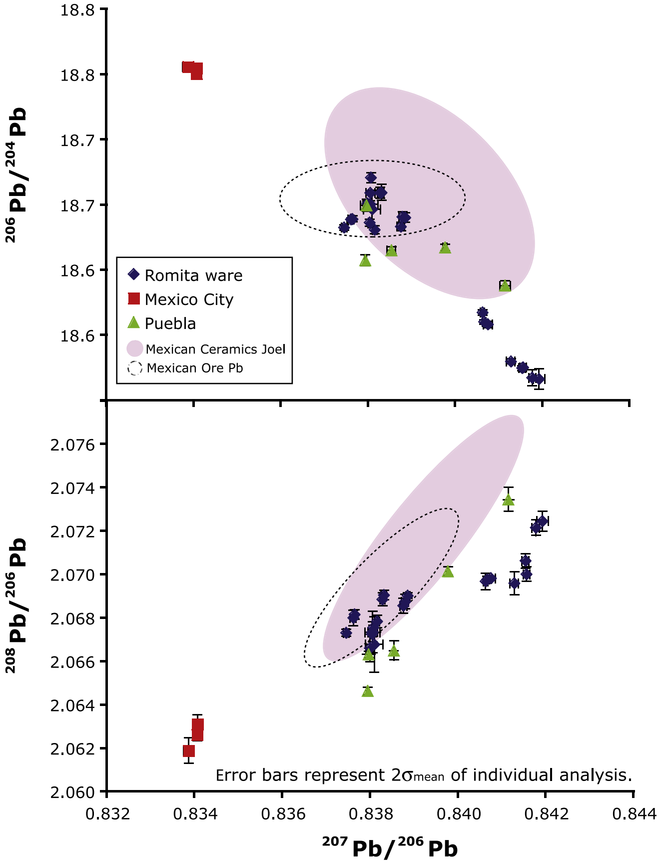

Fig. 4. Pb isotopic ratios of Mexican ceramics and lead deposits from Cumming et al., 1979.

degree of internal and external precision (based on triplicate analyses of individual samples). Typical internal and external precisions for ^{20x}Pb/^{204}Pb of ceramic glazes are on the order of 0.05% and $<$0.1%, respectively. Analyses were conducted on the exterior surface of the glaze of each sample.

5. Results and discussion

The Pb isotopic compositions for the reference groups discussed above and the Romita pottery are illustrated in Fig. 3. Accordingly, Mexican Pb isotopic compositions are distinct from that of European produced Spanish majolica—an obvious consequence of the different geological sources of Spanish and Mexican materials. As expected, Mexican ceramics analyzed by Joel et al. (1988) show close affinity with Mexican ceramics from Puebla studied in this paper. Furthermore, Romita glazes have similar Pb isotopic compositions to the Mexican materials used to produce Puebla ceramics.

Lead used on the non-majolica glazed ceramics attributed to Mexico City shows a different Pb isotopic composition than that for Puebla majolica and Romita pottery. Conversely, majolica recently sampled from the Spanish production centers of Talavera de la Reina and Seville match the Spanish ceramics identified by Joel et al. (1988). Interestingly, Spanish Pb isotopic compositions cluster in two separate groups, both of which include ceramics made in Seville and Talavera. These two groups, previously described by Joel et al. (1988), may suggest that Pb used in Spanish majolica during the 16th and 17th centuries originates from at least two very distinct sources. Lead isotopic compositions measured for the upper group of Spanish majolica are consistent with three possible provenances for Southeastern Spain galenas: Alcudia Valley, Linares – La Carolina, and Pedroches (Santos-Zalduegui et al., 2004), while the rest of the Spanish majolica samples cannot be attributed to any known Pb deposit, although the relatively small sample of artifacts from Spain included in the current study suggests caution regarding the final provenance assessment of these materials.

The provenance of Pb used in Romita ceramics is assessed in Fig. 4 and Table 3 by comparing data for Mexican Pb ores (Cumming et al., 1979) against our Pb isotopic data. Based on the Pb isotopic compositions of each Mexican pottery materials, it appears that the Pb used in Mexico City glazed ceramics was substantially different than from the Pb used in Puebla and Romita pottery. Although the Pb isotopic compositions of the Puebla and Romita glazes cluster closely, it does not mean that pottery from these areas was produced using the same source of Pb, just that these Pb deposits are geologically similar. Additionally, Pb isotopic data for Puebla and Romita ceramics suggest the existence of two different groups. The group of ceramics having higher $^{206/204}$Pb ratios and lower $^{207/206}$Pb and $^{208/206}$Pb ratios (Fig. 4) exhibits similar Pb isotopic compositions to the Pb deposits of El Pavo, Cuale, and Cosala (Cumming et al., 1979). These Pb-sulfide deposits, located in the North and Northwest of Mexico (Fig. 2), were suggested by Joel et al. (1988) as the most probable source of Pb used in Mexican majolica. Additionally, two samples from Puebla (MXF187 and

Table 3
Pb isotopic values of the Romita ware and the lead glazed ceramics analyzed from Spain and Mexico. Value is an average of 3 analyses per sample.

Sample	Type	Provenance	Country	$^{208}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{207}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{206}Pb/^{204}Pb$	$2\sigma_{(mean)}$	$^{207}Pb/^{206}Pb$	$2\sigma_{(mean)}$	$^{208}Pb/^{206}Pb$	$2\sigma_{(mean)}$
MTM103	Romita plain	Romita	Mexico	38.377	0.015	15.591	0.006	18.517	0.008	0.84191	0.00013	2.0725	0.0005
MTM122	Romita plain	Romita	Mexico	38.521	0.002	15.614	0.001	18.631	0.003	0.83815	0.00005	2.0679	0.0003
MTM128	Romita plain	Romita	Mexico	38.612	0.006	15.643	0.005	18.660	0.006	0.83830	0.00006	2.0691	0.0002
MTM130	Romita plain	Romita	Mexico	38.563	0.009	15.637	0.003	18.641	0.004	0.83884	0.00005	2.0690	0.0001
MTM153	Romita sgraffito	Romita	Mexico	38.423	0.006	15.607	0.002	18.568	0.002	0.84062	0.00005	2.0697	0.0004
MTM155	Romita sgraffito	Romita	Mexico	38.344	0.007	15.588	0.002	18.526	0.000	0.84155	0.00007	2.0700	0.0003
MTM159	Romita sgraffito	Romita	Mexico	38.549	0.013	15.630	0.003	18.651	0.002	0.83798	0.00009	2.0666	0.0006
MTM167	Romita sgraffito	Romita	Mexico	38.545	0.007	15.613	0.002	18.639	0.002	0.83760	0.00007	2.0680	0.0004
MXY003	Plain glazed	Mexico City	Mexico	38.677	0.010	15.646	0.002	18.755	0.002	0.83405	0.00008	2.0631	0.0004
MXY005	Plain glazed	Mexico City	Mexico	38.661	0.010	15.644	0.002	18.756	0.001	0.83386	0.00012	2.0619	0.0006
MXY007	Plain glazed	Mexico City	Mexico	38.663	0.006	15.643	0.002	18.751	0.002	0.83405	0.00005	2.0626	0.0003
MXF202	Majolica	Puebla	Mexico	38.418	0.011	15.595	0.004	18.608	0.004	0.83793	0.00003	2.0647	0.0002
MXF206	Majolica	Puebla	Mexico	38.471	0.010	15.613	0.003	18.615	0.003	0.83853	0.00010	2.0665	0.0004
MXF008	Majolica	Puebla	Mexico	38.542	0.022	15.627	0.006	18.650	0.005	0.83795	0.00014	2.0663	0.0002
MXF187	Majolica	Puebla	Mexico	38.532	0.006	15.632	0.003	18.618	0.003	0.83976	0.00005	2.0702	0.0002
MXF198	Majolica	Puebla	Mexico	38.535	0.011	15.635	0.003	18.588	0.004	0.84114	0.00012	2.0735	0.0006
MJ0177	Majolica	Seville	Spain	38.281	0.009	15.570	0.003	18.122	0.004	0.85913	0.00010	2.1125	0.0004
MJ0178	Majolica	Seville	Spain	38.345	0.014	15.610	0.005	18.238	0.005	0.85572	0.00011	2.1026	0.0004
TRI004	Majolica	Seville	Spain	38.347	0.018	15.574	0.006	18.457	0.006	0.84388	0.00009	2.0779	0.0005
TRI007	Majolica	Seville	Spain	38.251	0.019	15.582	0.007	18.350	0.008	0.84925	0.00008	2.0848	0.0003
TRI008	Majolica	Seville	Spain	38.465	0.022	15.642	0.008	18.453	0.007	0.84773	0.00017	2.0850	0.0009
TAL006	Majolica	Talavera	Spain	38.274	0.019	15.595	0.008	18.378	0.009	0.84867	0.00010	2.0831	0.0003
TAL011	Majolica	Talavera	Spain	38.314	0.013	15.601	0.005	18.409	0.005	0.84749	0.00008	2.0807	0.0004
TAL013	Majolica	Talavera	Spain	38.308	0.012	15.603	0.005	18.346	0.005	0.85053	0.00006	2.0884	0.0001
MJ0118	Majolica	Talavera	Spain	38.520	0.014	15.652	0.004	18.481	0.006	0.84677	0.00014	2.0836	0.0005
MJ0119	Majolica	Talavera	Spain	38.472	0.012	15.651	0.005	18.260	0.007	0.85718	0.00007	2.1077	0.0003

MXF198), along with three samples of Romita ceramics (MTM103, MTM153, and MTM155), cluster together closer to the Campo Morado Pb deposit, located southeast of Mexico City (Fig. 2 and Table 3). Therefore, the Campo Morado Pb also was used for glazed ceramics in addition to the Pb from Northern areas of Mexico. Likewise, Romita ceramic glazes were made using Pb that likely came from, at least, two different regions according to their Pb isotopic fingerprints.

It is not clear if the separation of Romita pottery Pb into two different groups corresponds to different production locales or to differential use of (and/or access to) Pb. In addition, the Pb used in both groups that form Romita ceramics appears to have been used indiscriminately for both variants—Sgraffito and Plain. Given that one sample from Puebla, MXF198, is attributed to the 19th century, it may indicate a temporal shift in Pb consumption at this production center, especially given that older materials from Puebla seem to have used Pb from the other sources identified in the literature.

The ceramics from Mexico City that form part of this study have different Pb isotopic compositions than that of Puebla and Romita pottery samples (Fig. 2 and Table 3). Unfortunately, none of the Pb isotopic values found in the literature matches exactly the ceramics from Mexico City, which might be due to many factors. The compositional similarities in Pb isotopes of all of these local materials, nonetheless defines the surrounding geological region as the source deposits that were exploited in ancient times.

6. Conclusions

The present study provides direct chemical data from Pb isotopic analyses of the Pb glazes that demonstrates a New World origin for Romita pottery ceramics. Additionally, these data lend support to the Fournier et al. (2007) hypothesis that the production of Romita ceramics was conducted by Purépecha craftsmen, who inhabited the Pátzcuaro area. The fact that Purépecha artisans successfully combined different ceramic traditions, such as the use of Pb glazing, in an effort to reproduce similar vessels than those of European origin, such as Spanish majolica in this case, is of high importance in acculturation studies of contact societies in New Spain. However, it would be overly simplistic to assume that these ceramics were merely low-cost copies of European majolica. Instead, Romita pottery represents the birth of a new technology created by the combination of different cultural identities, accommodating different technological traditions, and possibly exhibiting decorations adapted from the Spaniards. Therefore, the success of this new ceramic type, reflected in its wide distribution throughout New Spain, is a reflection of the acculturation process in Colonial Mexico.

The findings in this study lay the ground work for mapping out the main production centers of Mexican pottery manufacturing and distribution. The complementary nature of combining chemical and isotopic analysis (including but not limited to Pb, Sr, Nd and other isotopic analysis) provides important constraints for evaluating the possible diachronic changes and strategies in Pb supply.

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