



Teotihuacan neighborhoods' expansion in Northwestern Mexico. Cultural implications and social processes from ceramic analysis of El Mezquital-Los Azules, Guanajuato

Brigitte Faugère, Daniel Pierce, Héctor Cabadas-Báez

► To cite this version:

Brigitte Faugère, Daniel Pierce, Héctor Cabadas-Báez. Teotihuacan neighborhoods' expansion in Northwestern Mexico. Cultural implications and social processes from ceramic analysis of El Mezquital-Los Azules, Guanajuato. *Journal of Anthropological Archaeology*, 2019, 56, pp.101116. 10.1016/j.jaa.2019.101116 . hal-02502823

HAL Id: hal-02502823

<https://hal.science/hal-02502823>

Submitted on 20 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Teotihuacan neighborhoods' expansion in Northwestern Mexico. Cultural Implications and Social processes from ceramic analysis of El Mezquital-Los Azules, Guanajuato.

Brigitte FAUGERE, Université Paris 1 Panthéon-Sorbonne, Institut d'Archéologie, 3 Rue Michelet, 75006 PARIS

Personal postal address: 17 rue Edgar FAURE 75015 PARIS. brigitte.faugere@univ-paris1.fr

Daniel PIERCE, Archaeometry Laboratory, University of Missouri Research Reactor, 1513 Research Park Drive, Columbia, MO 65211. pierced@missouri.edu

Héctor CABADAS-BÁEZ, Facultad de Geografía, Universidad Autónoma del Estado de México. Cerro de Coatepec s/n Ciudad Universitaria, 50110 Toluca, Estado de México, MEXICO. hvcabadasb@uaemex.mx

Abstract: From the beginning of our era, the multi-ethnic capital of the central plateau, Teotihuacan, served as a great religious center and a hub for artisanal production and consumption. By AD 200, Teotihuacan entered a phase of expansion, which took different forms depending on the quality of resources and the political importance of the particular regions to which its influence spread. This paper examines the specific role of one site located along a key trade route in north central Mexico. Our study utilizes a multi-method approach, combining typological, archaeometric (NAA and petrography) and iconographic data from ceramics from the site of El Mezquital- Los Azules (Guanajuato) to improve our understanding of the mechanisms of the Teotihuacan expansion in Northwestern Mexico. The results of these ceramic analyses allow us to distinguish imports from imitations, and provide a better understanding of the possible messages conveyed by the iconography of the imitations. Based upon our findings, we argue that this commercial staging post was an emanation of the neighborhoods of Teotihuacan, and was integrated in its constantly evolving social fabric.

Keywords : Teotihuacan, Northwestern Mesoamerica, ceramic analysis, Neutron Activation Analysis, petrography, iconography, trade networks, social organization

The prestige and expansion of Teotihuacan in the Mesoamerican provinces of the Classic period is a vast and complex theme known and debated for more than a century (e.g. Bernal 1966; Sanders and Price 1968; Spinden, 1917). This focus has been informed by not only studies carried out at Teotihuacan itself, but in the various outlying regions as well. Teotihuacan witnessed particularly rapid growth during the first centuries of our era through the aggregation of groups of various origins. Together, these groups formed a large cosmopolitan city governed by a political organization probably less hierarchical than others, most likely of a “corporate” type (Blanton et al., 1996; Cowgill, 2003, 2015; Manzanilla, 1996, 2009, 2012, 2015; Pasztory, 1992). Yet, this does not preclude some degree of top-down control by a strong hierarchical authority and the existence of a powerful military cast

as well (Cowgill, 2003, 2015; Headrick, 2007; Manzanilla, 1993a, 2012; Santley, 1989; Smith and Montiel, 2001; Sugiyama, 2012). Soon thereafter, this great city of the high central Mexican Plateau quickly reached its zenith between AD 200 and 550. During this period, the population reached at least 100,000 inhabitants with approximately 2,300 occupied residential units (Cowgill, 2015). As its population grew, so did Teotihuacan's influence to countless regions throughout Mesoamerica. At Teotihuacan, numerous neighborhoods such as Tetitla, Tepantitla, or Oztoyahualco (Gómez Chávez, 2012; Manzanilla 1993b) were scattered around the massive ritual center and were occupied by a variety of local and foreign populations. These groups migrated from near and far, including from places such as Puebla-Tlaxcala, the southern Basin of Mexico (Plunket and Uruñuela, 2012), and from regions even more distant. Specific barrios like the "Enclave of the Merchants" (Rattray, 1987), Teopanazco (Manzanilla, 2015) and Tlailotlacan (Spence, 1992; Spence et al., 2005), are thought to be neighborhoods for migrants from place such as the Gulf coast, the Maya zone or Oaxaca. However, more recently scholars have found that in at least some cases, neighborhoods were more diverse. For example, excavations in Structure 19 (also known as N1W5:19) or Tlajinga 33 indicate mixed cohabitation between local, Western and Oaxacan groups (Gómez Chávez 2002, Gómez Chávez and Abasolo Hernández 2017, White et al.2004).

Incomparable in scale and influence in Mesoamerica, Teotihuacan was not only an enormous religious center, but also served as the most important hub for artisanal production and consumption. As its multi-ethnic neighborhoods developed, Teotihuacan grew to become increasingly dependent on its periphery to meet the growing demand for food supplies and to sustain its ever-expanding markets (Sugiyama and Somerville, 2016). Teotihuacan's economy was largely built upon the production and trade of lime (for plasters and maize paste preparation called nixtamal), cotton, pottery and obsidian (Carballo 2013; Santley 1989; Santley and Alexander, 1996). More specifically, blades from the valuable and highly coveted Pachuca obsidian source were controlled and distributed for domestic and ritual purposes, as was the production of Thin Orange ceramics, censers, and figurines. Most researchers agree that Teotihuacan had strict political and economic control over an expansive area around the capital to facilitate the production and control of these goods and others for local consumption as well as export (Cowgill, 2015; Hirth, 1978; Santley, 1989; Santley et Alexander, 1996; Smith and Montiel, 2001). This economic and strategic dominance ultimately resulted in a wide variety of relationships with provinces throughout Mesoamerica.

The analysis of material culture, iconographic studies, and the description of texts found in some Mayan sites (Stuart, 2000), have led to the formulation of many hypotheses about the modalities of Teotihuacan's expansion throughout Mesoamerica. These diverse hypotheses have subsequently provoked a wealth of lively debates, particularly between Mayanists and specialists of the central high plateau (Braswell, 2003b; Marcus, 2003; Smith, 2011). Nonetheless, efforts to intersect these hypotheses generally highlight the plasticity of Teotihuacan's relationships with different regions as a "mosaic of trade diasporas, diplomatic exchanges, pilgrimages, emulation and strategic direct interventions of limited duration" (D. Nichols, 2015:1). Still some researchers are more interested in the other related topics, such as the objectives and mechanisms of expansion, looking for the manifestations of a hegemonic

empire centered in the capital, understanding commerce dynamics, the diasporas of merchants, a “world system” based on long-distance exchange and/or the existence of international cults (Smith and Montiel 2001; Smith, 2011).

Material culture studies have undoubtedly indicated that some regions of Mesoamerica, such as the Gulf coast (in particular Matacapan), the Maya highlands (with Kaminaljuyu), Oaxaca (Monte Alban), and Western of Mexico, were more connected than others. Isotopic analysis of human remains has also contributed to this discussion of movement, as they have demonstrated that some individuals from all categories of the Teotihuacano population (e.g. soldiers, elites, and commoners) show some degree of relatedness to other regions, such as the Mayan highlands, the eastern coast, Oaxaca and Michoacan. Along with the material culture studies, the widespread nature of this population movement firmly demonstrates the extent of Teotihuacan’s sphere of interest (Price, Manzanilla and Middleton, 2000; Spence, 2006; Spence et al. 2005; White et al. 2002, 2004, 2007).

Relations established with the Gulf coast seem to have been intense and lasting, and would have been facilitated by the existence of the Corredor (commercial route) passing through Tlaxcala to the eastern slopes, and then the coast (Garcia Cook and Merino, 1996; Carballo and Pluckhahn, 2007). But these relationships varied from one place to another. The role played by Matacapan, initially considered an enclave occupied by settlers (Ortiz Ceballos, 1988; Ortiz Ceballos and Santley, 1998; Pool 1992), was more recently re-evaluated and is now considered to be a region where goods are more likely local imitations and where the local population was largely acculturated (Ortiz Ceballos et al., 2010). On the other hand, the Gulf coast would probably have served as a relay for an expansion towards the Pacific coast through the Isthmus as early as AD 200-250. The duration of the long-term economic interaction and the remoteness of the capital would have led to a gradual transformation and “colonization” with the creation of a new site (Montana) around AD 400 (Bove and Medrano Busto, 2003). Thus, it appears that the interests of Teotihuacan seem to have been strongest in the Isthmus region and Pacific coast. Though still apparent, Teotihuacan’s influence and interests may have been secondary elsewhere in the Maya zone and maybe also in other regions of Mesoamerica. There, the strongest influence often did not take place until a slightly later date (ca. AD 400), at which time it manifested itself to varying degrees depending on the location (Cowgill, 2003). The case of Kaminaljuyu in the Guatemala Highlands has been largely reconsidered since the works of Sanders and Michels (1977), thanks to the use of archaeometric methods which have demonstrated that the distribution of Teotihuacan goods was limited to imitations found in the tombs of the elite (Braswell, 2003). For the Maya Lowlands, a debate remains as to whether Teotihuacan exerted military and political domination over Mayan cities such as Tikal or Copan. Finally, there was also notable relationships established with the Zapotec Monte Alban, which seems rather peaceful and of a diplomatic nature (Marcus, 2008).

As can be seen, the modalities of interactions with the Gulf coast, Oaxaca, the Isthmus region, and the Mayan lowlands/ highlands have been much more thoroughly evaluated in recent years. By contrast, studies in Western Mexico remained sparse until recently, in part because they related to a relatively small number of sites. This dearth of data often resulted in assumptions and interpretations being constructed based upon out-of-context and/or incomplete data. Nonetheless, from as early as the 3rd and 4th centuries, Teotihuacan’s interest

in Western Mesoamerica is evident. The recent work at El Mezquital-Los Azules in the Acambaro valley (Guanajuato) has revealed such characteristic remains in a context dated from AD 286-393, corresponding to the Late Tlamimilolpa and Early Xolalpan phase of Teotihuacan. Specifically, several culturally diagnostic ceramics have been found as evidence of Teotihuacan's influence in the material record. To better understand these artifacts and how they relate to the great urban metropolis, we have taken a multi-method approach utilizing typological, archaeometric and iconographic data. The objectives are to measure how prevalent Teotihuacan style objects are at the site, to distinguish imports from exports and to evaluate the content of the messages conveyed by the iconography. These distinct approaches are employed to attempt to answer the following questions: What reasons underlay the Teotihuacan cultural expansion in this particular case? How did it proceed? and Who were its protagonists?

The expansion in northwestern Mesoamerica: the existing hypotheses

Teotihuacan's presence and/or influence in the north-center and West of Mexico during the Classic period (before AD 600) is mainly detected through the presence of ceramic or lithic remains imported from the great city or imitated by local craftsmen and – more rarely – by architectural remains. These materials are dispersed unevenly in the west but more concentrated to the east. Though scattered and often out of context, Agapi Filini (2004) was the first to collect the abundant data for a key region, the lake of Cuitzeo. Other data come from the region of present-day Morelia (Manzanilla López, 1996) or Zacapu (Arnauld et al., 1993) in the north-center of Michoacan. In the northeast, the present-day states of Guanajuato and Queretaro have also provided important data (Saint-Charles, 1996). Today, the hypotheses concerning Teotihuacan expansion are based upon two main propositions. The first prioritizes Teotihuacan's transmission of its influence indirectly, primarily via local elites seeking to use contact with the city to enhance their own prestige. On the other hand, the second proposal envisages the installation of “enclaves” where Teotihuacanos may have lived to promote the circulation of goods.

The indirect influence hypothesis was first defended by A. Filini for the region of Cuitzeo. Located a few kilometers south of the Acambaro valley, this is a region rich with an abundance of local raw materials. Indeed, the Lake Cuitzeo Basin and the Acambaro Valley offer an array rare and valuable products. These include edible salts (halite) from lagoons and found in the numerous hydrothermal deposits in the region, pigments including iron oxides, lime, and clays. Though there is an abundance of fertile agricultural land conducive to intensive farming, the surrounding mountains are also covered with dense pine and oak forests useful for all wood products. Cinnabar has also been an important local resource, although the most significant deposits known today are located further north in the Sierra Gorda (Gazzola 2000; Gómez Chávez and Gazzola, 2007; Mendoza and Lacido 2017). Finally, the key Ucareo/Zinapécuaro obsidian sources are also nearby (Healan, 1997; Hernandez, 2016).

Based on a series of archaeometric analyses showing that a majority of Teotihuacan-style ceramics were local imitations, Filini posited that the Cuitzeo Basin was only part of the Teotihuacan periphery (Filini, 2004). In other words, it may not be demonstrative of direct contact. Her analysis was rooted in world systems theory, which proposes concepts particularly suited to describe situations where independent polities are linked through economic interaction and information exchange. As evidence of the importance of Teotihuacano culture, Filini notes not only the existence of imported prestigious goods, but also the production of numerous local imitations showcasing distinct Teotihuacan iconographic representations related to elite ideology (i.e. birds, feathered serpent, *Xonecuilli*, Goggle-Eyed A, butterflies, and the Triple Mountain). This adoption of Teotihuacan symbolic forms would have been made by local elites who emulated and copied symbols reflecting a prestigious ideology. However, the region appears to have remained culturally homogenous without direct control or intrusion by Teotihuacan (Filini, 2004, 2010).

A variant of this proposition is defended by Hernandez (2016) for the eastern part of the Cuitzeo Basin and the Ucareo/Zinapécuaro area. Hernandez similarly rejects the idea of the implantation of “colonies” but believes that Teotihuacan emissaries and merchants exercised a form of cultural hegemony among the emerging elites of southern Bajío. Although it does not evoke a real diaspora of merchants, the model emphasizes the role of the merchants as crucial to the administration of the long-distance trade critical to the Teotihuacan economy. In the meantime, local societies would have been undergoing socio-political change with a strengthening of the elites (Hernandez, 2016).

In contrast, the investigations in Southern Queretaro and Guanajuato emphasize the role of some specific sites such as La Negreta (Brambila and Velasco, 1988), Santa María del Refugio (Castañeda et al., 1996) or El Rosario (Saint-Charles et al., 2010), all of which have been excavated and offer contextualized materials. There, Teotihuacan style imported materials and local imitations can be found along with architectural structures interpreted as being implantations of groups of *Teotihuacanos* installed on trade routes. In his regional scale study, Saint-Charles remarks that the sites presenting Teotihuacan influence in this region are spaced at regular distances. Though this periodicity likely served to help lubricate commercial activities, Saint-Charles also underlines the metropolis’s political impact through an ideological “conquest” at these sites (Saint-Charles, 1996).

In a recent synthesis, Peter Jiménez Betts (2017) extended these analytical themes into the Early Classic North-Center and Western Mesoamerica, using the nested networks adaptation of the world system theoretical model originally proposed by Hall and Chase-Dunn (2006). He argues that three distinct kinds of networks linked Teotihuacan to West Mexico a “central bulk network” around the city, a “political-military network” in a medium periphery and a “prestige goods network” in the far periphery to the west. In this model, the region of Acambaro was situated on the western margin of the “political military” periphery. Importantly, the Cuitzeo Basin lies precisely at the point of articulation between this network and the more distant “prestige goods network” (Jiménez Betts, 2017:101). In this “political military periphery”, local elites would have had regular political or military relations with Teotihuacan. This proposition suggests that Teotihuacan was imminently important in the Cuitzeo Basin area and would have had an increasing cultural impact. In doing so, elites there

would have been influenced to the point that they adopted the symbolic codes of the great city's official warrior and conqueror ideology. Farther west, the cultural exchange was likely less distinct, as the stakes for Teotihuacan were less important.

A site on a trade route

The site of Cuizillo El Mezquital-Los Azules is situated in the Valle Medio del Rio Lerma (State of Guanajuato). Founded in the middle Preclassic Early Chupicuaro phase (600-400 BC), its population reached its highest point in the Late Chupicuaro phase (400-100 BC) as the site's boundaries grew to an area of approximately 50 hectares. After just a period of abandonment, the region was subsequently reoccupied in the Classic Period. In a phenomenon very rare in this part of the valley, El Mezquital- Los Azules also shows a clear cultural influence by Teotihuacan.

The site is positioned on the right bank of the Rio Tigre, the principal tributary of the Rio Lerma, and on one of the main routes joining the north of Michoacan and the Cuitzeo Basin via the Acambaro Valley to the center of Mexico (Faugère et al., 2016). In a recent study, we have shown that the distance to Teotihuacan via the least cost paths was between 223 and 225 km and would have taken approximately 47 to 50 hours to traverse by foot. This proximity situates the site in the intermediate periphery of Teotihuacan's network (Figure 1). Notably, the least cost path also coincided with the old route that joined the town of Acambaro with the center of Mexico and was a secondary section of a Camino Real in the colonial period. The Caminos Reales were laid by the Spaniards for the passage of horses and convoys of wheeled vehicles, but for the most part adopted the courses of the principal pre-Hispanic roads (see Figure 1). It is striking that the sites we have mentioned above - La Negreta, El Rosario, and Santa María del Refugio - are also located along these key roads. El Mezquital-Los Azules, however, is located on a more direct path between Teotihuacan and the region of Cuitzeo at the gateway into the Basin.

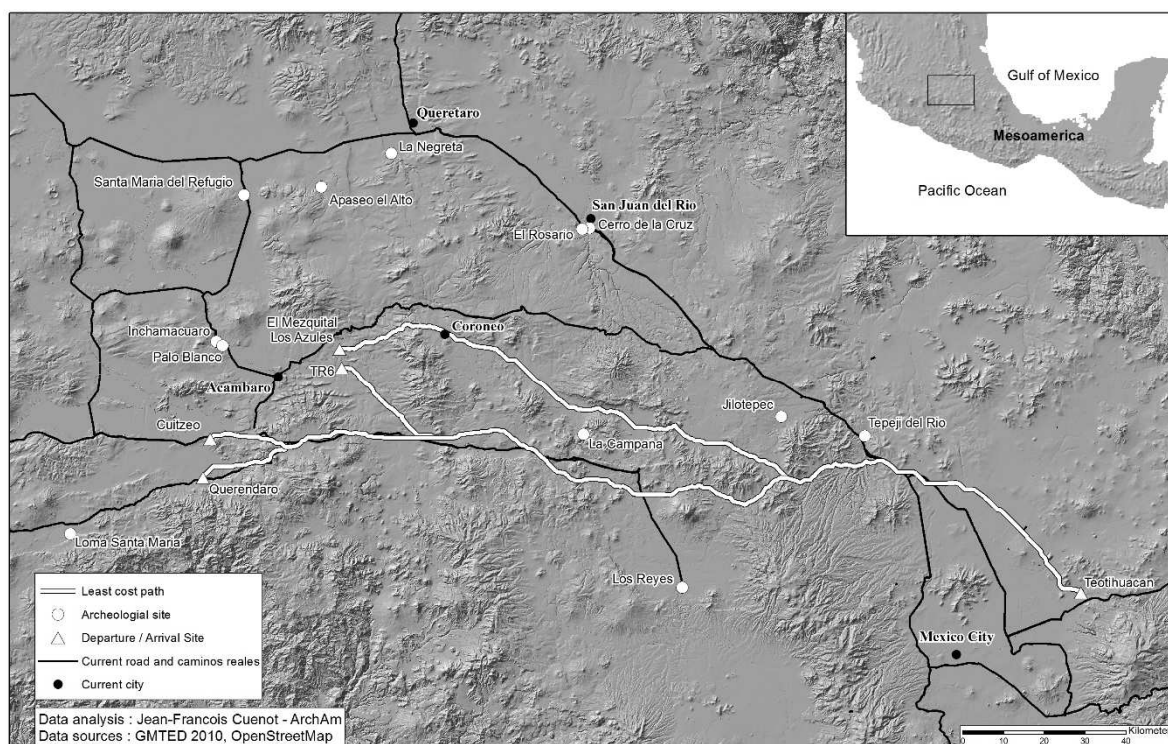


Figure 1. Localization of the area and circulation routes

Excavations in 2012 and 2013 at Cuizillo El Mezquital- Los Azules have made it possible to collect data on the construction techniques that the inhabitants used and key information regarding the production, use, and trade of a variety of material culture items (i.e. ceramics, stone tools, and shells). Unfortunately, after over 50 years of looting and the erosional damage as a result of intensive farming, the site is in a poor state of preservation, like all the sites of the Chupicuaro culture. The remaining vestiges that have been found were located in a sunken patio, built around 350 BC and abandoned by the end of Formative. The Classic period archaeological material was found inside the sunken patio, on an occupation level located on the upper abandonment level. Several fireplaces and offerings were located in this area and correspond to initial dedicatory rites for the structure, which was then built above. At the end of the ritual, the fireplaces and offerings were destroyed. Subsequently, the remaining sunken structure was backfilled and covered by a stucco floor. In the following millennia, this stucco floor has been badly damaged and is found in only fragments today, just beneath the plowed soil. Nonetheless, it represents the last vestiges of the constructions that has been largely erased from the site. The archaeological data indicate that the ritual and the filling were formed as part of a single event dated to an interval AD 286-393 (obtained from the radiocarbon analyses of charcoals and bones). In the backfills, mixed sediments containing materials from both the Formative and Classic periods were found, indicating that the site was already occupied by Teotihuacan-affiliated populations prior to this important event. It is from these localized contexts in layers of backfill that the ceramics in our study originate.

Material culture of the Teotihuacan tradition

The Teotihuacan cultural tradition is indicated at Cuizillo El Mezquital - Los Azules by the introduction of distinct architectural techniques and a wealth of evidence from the material record, as well as features such as the fragmented 13 cm thick stucco floor mentioned above. Though features such as these are found in sites such as El Rosario and La Negreta in Teotihuacan context, this construction technique is unknown in the Acambaro's Valley as well as in Michoacan. Among the presumably imported items are prismatic green obsidian blades from Sierra de Pachuca and a single Teotihuacan styled figurine head. The presence of seashell (particularly *Pinctada sp.*) plaques may also be evidence of commercial activity reaching the shores of the Pacific.

The site is rich in obsidian flakes and artifacts, which come from mixed Formative and Classic Period contexts. Though archaeometric analysis of the obsidians has yet to be carried out here, the provenance of obsidians can be suggested based upon visual cues (i.e. colour and texture) and contextual information (Aoyama 1991; Braswell et. al. 2000; Pierce 2015, 2017). Importantly, the site is located between two key obsidian sources, the Cerro de Los Agostinos, to the north, and the Ucareo-Zinapécuaro, to the south. The Ucareo-Zinapécuaro source, in particular, is one of the most important sources in all of Mesoamerica due to its location and excellent quality grey obsidians (Healan, 1997). Interestingly, Ucareo was heavily exploited during the Formative period. During the Classic Period, its utilization declined significantly. But after AD 600, it became a dominant source once again. Nonetheless, the exploitation in Classic times has yet been confirmed by the presence of its obsidian at Teotihuacan. Prismatic blades appear in the Lerma Valley's sites only at the beginning of our era. Therefore, we suspect that the 36 specimens found in the mixed backfills at Cuizillo El Mezquital – Los Azules date from the Classic occupation. These artifacts are 58% green obsidian most certainly from Sierra de Pachuca, near Teotihuacan. Though, the absence of green obsidian debitage may indicate that it was imported as a finished product. The rest is grey obsidian from which it is not possible to identify the provenance.

Among the ceramic finds, two types of artifacts are especially remarkable due to their clear association with Teotihuacan material culture: the comales and the candeleros. The case of the comales is particularly interesting as they indicate that the inhabitants had adopted some of the eating habits of the high central plateau. Given the size and weight of such objects, they were probably manufactured locally. Although not abundant, these items appear in the residential contexts from the Late Tlamimilolpa phase (Rattray, 2001). At Teotihuacan's residential complex N1W5 :19, which was occupied by groups from Oaxaca and Michoacan, these do appear to be slightly more common during both the Tlamimilolpa and Xolalpan phases (Martel Begun, 2013: 152). Candeleros, on the other hand, were multi-functional ritual objects used to burn copal or as offering holders (Rattray, 2001; Séjourné, 1966). Significantly, none of these artifacts have been found in the Lake Cuitzeo region, but candeleros are mentioned for the site of La Negreta. Although not abundant (1% and 0.5% respectively) of the sherds found in post-abandonment levels, these artifacts indicate that Teotihuacan did permeate the local culture (Table 1).

Ceramic types	Frequency	%
Chupicuaro	1780	71.0
Ramon ceramic complex	412	16.0
Possible imported products (Thin Orange + candeleros)	25+12	1.5
Comales	29	1.1
Decorated local Early Classic	176	7.0
Monochrome brown local Classic/Epiclassic ¹	86	3.4
Total	2520	

Table 1. Distribution of ceramics from post-abandonment levels

Pottery can also be a significant cultural indicator and key category of ceramic manufacture. Originally defined by C. Hernandez (2016) as a marker of Teotihuacan influence in the region, the Ramon ceramic complex is comprised of at least six different types, including four with painted and/or engraved decoration (Ramon Specular Red on buff, Ramon Specular Red on buff engraved, Red on buff engraved, Specular Red on buff, Monochrome brown and Monochrome Specular Red). In total, the sherds from this complex make up 16% of the assemblage found in post-abandonment levels, and at least 56% of the Classic assemblage (Table 1). Additionally, the Thin Orange type (3.4% of the Classic assemblage) is often considered to be a one of the most telling markers of Teotihuacano presence and/or influence in Mesoamerica. Though actually produced in Puebla rather than Teotihuacan, this type's distribution was still controlled by the powerful metropolis (Rattray, 1981, 1990). Nonetheless, it is also known to have had local imitations (Sugiura Yamamoto et al., 2013). In total, the Teotihuacan tradition types comprise at least 65% of the Classic assemblage.

A cursory visual comparison of these types with sherds collected directly from Teotihuacan in the laboratories of the INAH has not revealed any real differences. It was therefore imperative to at first conduct a study of the iconography of the decorated types to compare them to Teotihuacan visual codified language. Afterwards, due to the visual similarities between local and Teotihuacano ceramics, a small number of samples were selected to carry out petrographic and geochemical analyses to better determine provenance and assess the level of interaction between the regions.

Iconography of the Teotihuacan tradition types

Teotihuacan style decorations in our assemblage include types that are painted and those that are painted and engraved. Resist wares from Classic period, decorated in red on buff and negative motifs, were not included in our study due to their presumed local production. While the painted and engraved decorations cover the entirety of the vessels' outer surface (Figure

¹ The Monochrome brown type is found abundantly in local sites from Early Classic to Epiclassic periods. Shapes and pastes change little over time and only a technological study would allow for the distinguishing of its evolutions.

2), the care taken in elaborating the motifs varies noticeably from one type to another. Within the sample, the artistry appears relatively meticulous for the painting, but can be very slapdash for the engraving. On the technological level, the engraving was probably carried out on pastes that had already been fired with a fine stone tool but with a slightly rounded end (blunted blade?). These often imprecise engravings demarcate the painted zones, but at the same time maintain a level of fluidity without corrections. Because all of the sherds in our sample were collected from domestic backfill contexts, no complete vessels were found. Any Classic Period burials which might have yielded intact vessels have yet to be brought to light.

In our corpus, we have listed eleven different motifs that are distributed in groups of straight lines and scrolls, points, undulations, reticulations, phytomorphic motifs, shells and birds (see Table 2). Due to the absence of complete pieces, we are unable to reconstitute complete iconographic units but can only list isolated motifs that would have been associated with one another in various combinations. A single example of these associations of motifs appears on a cylindrical tripod vessel, which will be explored below in greater detail.

Painting alone was used to form the simplest motifs (Motifs in V-shape or chevrons in frieze and X-shapes, scrolls and volutes). On the other hand, the more complicated and combinatory motifs were both painted and engraved.












Lines and scrolls		Dots		Ondulations		Hatching		Plants		Shells		Birds	
motive	tech.	motive	tech.	motive	tech.	motive	tech.	motive	tech.	motive	tech.	motive	tech.
	P		P/E		P		P		P/E		P/E		P/E
	P P/E								P/E				
	P P/E R												
	P P/E												

Table 2. Motif classification. P: Painted, P/E Painted and Engraving

Motifs based on straight lines and Scrolls

These class of painted geometric decorations are the most common in the assemblage, and were at times highlighted with engraving.

Within this class, the painted X-shaped motifs motives are quite common, whether isolated or in series. These may represent Langley's saltire (Langley, 1986:282), which is associated with the four cardinal directions and could have a celestial as well as a terrestrial connotation.

The frieze in chevrons is also considered to be a notational sign by Langley, who notes its recurrence in the iconography of Teotihuacan. This particular motif may have had a martial connotation (Langley, 1986:65) and might also be associated with fire by Von Winning (1987).

Scrolls are the most common motif in our corpus (Figure 2a). Von Winning (1987) and Langley (1986:283) both associate this notational motif with water and clouds. The *Xicalcolihqui*, a very common motif in Mesoamerica, can also be found in a variety of forms whether as volutes or rungs and sometimes is associated with the fire serpent (Braniff 1970, 1975). Langley (1986:286) relates it to the sky or the hereafter. This idea has also been adopted by Filini, who emphasized its possible connection with the world of the dead (Filini, 2010).

Dots

When present, large painted and engraved dots are distributed over the entirety of the vessel surface. Langley affirms that they may have a multiplicity of meanings when they are grouped together, and that they may sometimes be part of notation systems. Alternatively, according to Seler's studies and by analogy with the codices, the simple dots may be considered to represent balls of cotton (Langley, 1986:247). Nonetheless, Von Winning is more inclined to associate them with rain.

Waves and reticulations

Motifs consisting of fine parallel waves and reticulations are found painted primarily on the bodies of the jars. However, given that we only have fragments for which observations can be made, we cannot know whether these decorated surfaces were part of larger patterns or if they merely symbolized the element of water, especially for the wave forms.

Phytomorphs

Phytomorphic motifs are also quite abundant in Teotihuacan's iconography and occasionally have notational values, such as the four-petaled flower. Called "Flower frontal Q" by Langley, this is an astral symbol, according to Filini (2010). This motif, undoubtedly emblematic of the capital of the high central plateau, occurs locally on domestic wares that are incised or engraved and painted. A testament to its significance and wide distribution, it is also documented in the north of Michoacan and in the States of Guanajuato and Queretaro, especially at El Rosario (Saint Charles et al., 2010). Other floral motifs may alternatively simply represent leaves.

Shells

One sherd bears a probable shell motif, but unfortunately it is incomplete. However, this motif is found in abundance at Teotihuacan, where it is associated with the aquatic sphere (Von Winning, 1987).

Birds

Birds are one of the major themes of the iconography of Teotihuacan (Muzzio Cepeda, 2017). They are found painted on frescoes and carved in bas-relief in public or elite contexts in particular. Alternatively, they are also engraved more generally in the form of graffiti in domestic contexts at Teotihuacan and likely existed at El Rosario as well (Saint Charles et al., 2010). Within the public complexes, the birds are shown conventionally and may be associated with militarism (Headrick 2007). Though primarily birds of prey such as eagles and vultures are found in public contexts, the variety of birds is notoriously wider in the domestic sphere, including some with long beaks, such as those in our assemblage (Figure 2b). In this example, the bird is shown in profile, with a short (or hunched) neck, long beak and a crest outlined on its head, signifying a possible aquatic species. Fairly similar examples are frequently found in the local tradition of resist ceramics, especially at Querendaro (Carot, 2013) and Cuitzeo (Filini 2010). The fact that these birds are absent from the frescoes and “official” art could indicate that these depictions were valued above all in a domestic context, which also squares with the ware’s utilitarian character.

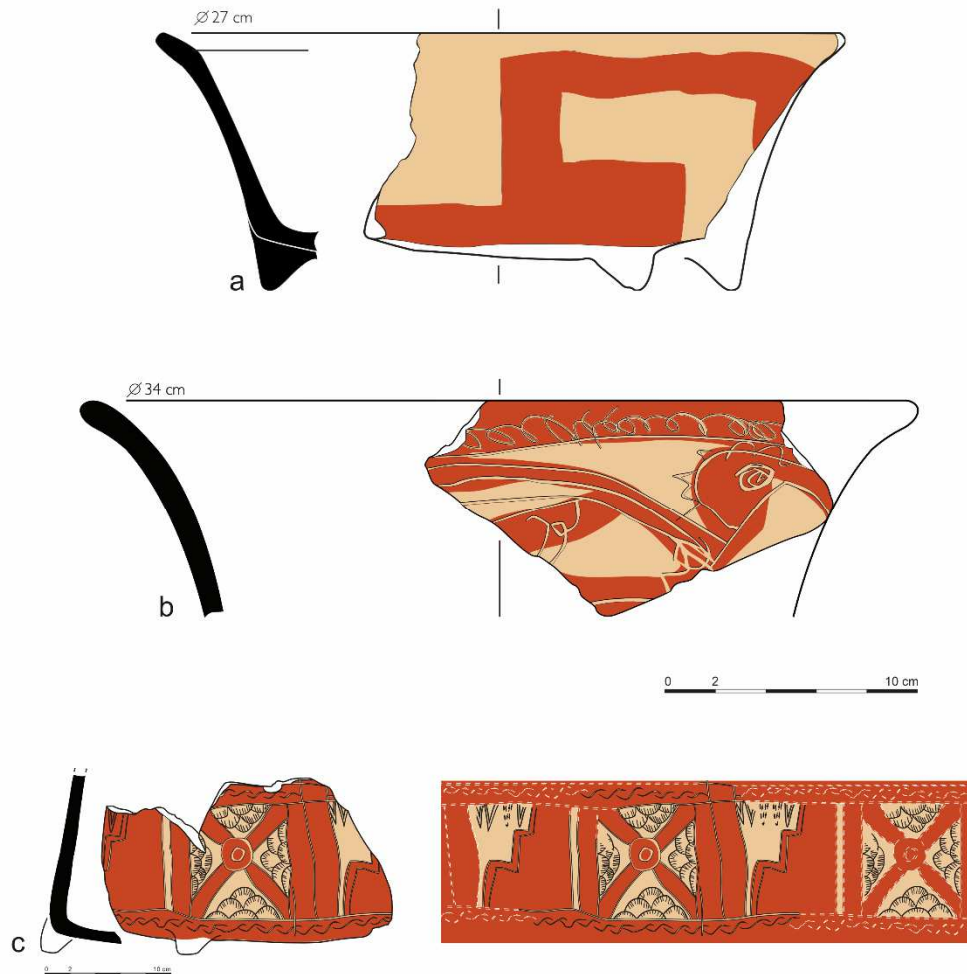


Figure 2. Ramon Red on buff (a) and Ramon Red on buff engraved (b,c) tripods.

Compound Motif

A rare fairly complete vessel belonging to the *Ramon Red on brown engraved* type is decorated with two iconographic schemas alternatively winding around the vessel's outer surface (Figure 2c). Each of these schemas is repeated four times around the exterior and is associated with various motifs emblematic of the iconography of Teotihuacan. These were further combined in special iconographic configurations elsewhere.



Figure 3. Combined motifs

The first motif consists of nesting “Quatrefoil C” signs (Figure 3a), which define a square frame divided in four, and a “Triple cerro” (Figure 3b) which is inscribed in each of the four spaces. Langley (1986) considers both of these motifs to be notational signs with terrestrial and aquatic connotations and argues that they are concurrently associated with mountains, rain, storms, and clouds. Taube describes the motif of “Triple cerro” combined with flowers and volutes as “Paradise mountain”, in reference to the Maya iconography (Taube, 2006). In the present case, the motif contains six superimposed mountains of which their peaks have fine transversal hatchings that may represent rain.

The second motif alternates with the one described above and features a triangular form with the point downwards (Figure 3c). At Teotihuacan, the most similar motif seems to be Langley’s “Thorn maguey”, which is a well-known Mesoamerican iconographic motif used to represent an instrument of auto-sacrifice (Baudez, 2012). However, in our example, the stepped side does not show the spines that appear on the symbol at Teotihuacan (Langley, 1986:293). Graphically, the figure’s point is also not distinguished. A frieze of four to five triangles pointing downwards decorates the top side.

This compound decoration is framed by two S friezes following the vessel’s top and bottom edges respectively (Figure 3d). The S symbol may, according to Filini (2010:79), be related to the representation of the *Xonecuilli*, and by extension to the feathered serpent. It may also have associations with water, rivers and streams. This motif is commonly represented in the local ceramics, especially in the region of Lake Cuitzeo, and is also common all over Mesoamerica.

The motifs painted and engraved on this tripod vessel thus demonstrate a precise visual code that refers to religious beliefs and perhaps practices, the aquatic and terrestrial sphere, and plant fertility as the dominant themes. Not only do these themes belong to the cognitive sphere of Teotihuacan, but most of them are considered to be notational signs by Langley. In this notational system, the repeated association of signs corresponds to an intentional codification that aims to translate a message, even if certain signs may also have a purely decorative function (Langley, 1986). The nesting of the signs seen here is particularly significant for the message conveyed. Among the other motifs in our corpus, the importance of the four-petaled flower must again be emphasized. As mentioned above, this symbol is closely connected to the capital of the high central plateau and demonstrates clear influence. On the other hand, the rest of the iconographic symbols (the long-beaked bird, the plants, the dots, the volutes, and scrolls) most often relate to water and fertility in simpler and perhaps less strictly codified compositions.

The act of symbolizing amounts to a metalanguage, a codified language that in any case is a vehicle of the power of some persons over others (Filini, 2010). The choices the craftsmen made to decorate their pottery reflected metaphysical concerns relating to agricultural fertility while also borrowing considerable elements from the local tradition. Though these motifs were fundamental to Teotihuacan’s communication system, they only formed one aspect of it. For example, the warrior imagery that is so frequently displayed in the official art of

Teotihuacan in the form of frescoes, sculpture, and the most prestigious ceramics, is generally absent at our site. Conversely, it is common, or even dominant, in the north of Michoacan (Filini, 2010). Among the other common motifs absent from our corpus, birds of prey and felines may represent the warrior orders, while the complexes of Tlaloc or butterflies are also related to militarism. Finally, it is further notable that this iconography more specifically connected to the status of the elite is typically associated with prestigious objects, such as the dorsal mirrors or circles (anteojeras) used by warriors in the region of Cuitzeo.

Petrography and NAA analysis

The combination of Petrography and Neutron Activation Analysis (NAA) in the characterization of archaeological pottery can greatly improve our understanding of ceramic production and its subsequent distribution (e.g. Shepard, 1954; Rands and Bishop, 1980; Bishop et al., 1982; Rice and Saffer, 1982; Zedeno, 1994; Triadon, 1997; Strazicich, 1998; Day et al., 1999; Cau et al., 2004; Fowles et al., 2007; Wallis, 2011; Eckert and Schleher, 2012; Larson, 2013; Ownby et al., 2014; Ownby, 2017). In the context of the Mesoamerican geoarchaeology (Dunning, 2015), the coupled analysis continues to be a useful tool for identifying ceramic provenance (e.g. Cecil, 2007; Stoner et al., 2008; Minc and Sherman, 2011) in concordance with soil micromorphology techniques (e.g. Howie, 2012; Minc et al., 2016; Stoner, 2016; Cohen et al., 2018). Nonetheless, in some cases, interpretations of these data can still be controversial, as is the case with studies at some sites within the Olmec influence area (e.g. Blomster et al., 2005; Stoltman et al., 2005; Neff et al., 2006a, 2006b; Sharer et al., 2006). Generally, these controversies have been based upon the results of methodological differences among techniques, the geological homogeneity/heterogeneity of the study area, and/or the production technology of the ceramics analyzed (Ownby et al., 2014).

In our work, petrographic and geochemical analyses of the pastes were conducted on twelve ceramic samples (Table 3) with the aim of distinguishing the types produced in or near the Acambaro Valley from the imported types. Within this sample, the Preclassic and Resist types have been considered to provide local references due to their prominence within the Acambaro Valley.

Sample number	Ceramic Type	Period	Stylistic affinity
1	Ramon Specular Red on buff engraved	Classic	Teotihuacan
2	Ramon Specular Red on buff	Classic	Teotihuacan
3	Monochrome brown	Classic	Teotihuacan
4	Specular Red on buff	Classic	Teotihuacan
5	Monochrome brown Chupicuaro	Preclassic	Local
6	Monochrome brown/buff Chupicuaro	Preclassic	Local
7	Dichrome Red on buff Chupicuaro	Preclassic	Local
8	Garita brown	Epiclassic (post AD 600)	Local

9	Monochrome Specular red	Classic	Teotihuacan
10	Ramon Resist Specular red on buff	Classic	Local
11	Red on buff engraved	Classic	Teotihuacan
12	Thin orange	Classic	Teotihuacan

Table 3. Description of specimens analysed

The mineralogical description of these specimens was made using a Carl Zeiss model Lab.A1 petrographic microscope and recorded using ZEN 2011 software. The objective was to define preliminary groups or classes of similar ceramic fabric; mainly concentrated in non-plastic coarse particles and the b-fabric activity (Stoops, 2003) of the clay matrix. Included in the qualitative descriptions were compositional grain percentage estimates based upon published petrographic charts (Castro-Dorado, 1989). In general, all descriptions follow the terminology used for soil micromorphology (Bullock et al., 1985; Stoops, 2003) and its adaptations to ceramic petrography (Whitbread, 1989, 1995).

Commonly, these pastes' fabrics display a general "sandwich color structure", with colors that range from brownish, reddish-brown and darkish-brown in the core (with diffuse to sharp limits) to orange and reddish-brown at the ceramic edge. The single Thin Orange type sherd is the only sample that features a ceramic matrix that is more homogeneous and orange-reddish in color, and has the most compacted microstructure, with less presence of voids.

After considering numerous mineralogical aspects, two petrographic groups can be identified in our ceramic sample. Apart from these two groups, only the solitary Thin Orange sherd appears distinct. Surprisingly, these two groups mix known all temporal and stylistic affiliations. This is just one reason why we believe the importation of this assemblage is unlikely.

Group I: Four specimens (Ramon Specular Red on Buff, Monochrome Red Chupicuaro, Ramon Resist Specular Red on Buff, and Specular Red on Buff) feature lower proportions of coarse non-plastic components. In this group, b-fabric varies between monostriated (Figure 4a), porostriated to granostriated patterns, including reticular patterns more evident at the ceramic edge. An equilibrated presence of quartz /feldspar over mafic minerals and volcanic glass with different textures and a notable presence of fragmented (reworked) clay coatings are also present (Figure 4d). Overall, the microstructures are compact; notwithstanding some coarse vesicular pores associated with the core of organic remains. Throughout the paste, these pores are also interconnected with fine linear microvoids that bypass around coarse mineral components such as clay temper and rock fragments. Fine organic components are also sometimes related to natural soil humification. The results of this are often observable in ceramic pastes in the form of microgranular structures and phytoliths. Within Group I, Monochrome brown/buff Chupicuaro and Dichrome Red on Buff Chupicuaro sherds could also be considered a related subgroup, as the high proportion of volcanic glass shards (Figure 4b) is one of the most important attributes.

Group II: The Garita Brown, Red on buff engraved, Monochrome brown, Ramon Specular Red on Buff engraved, and Monochrome Specular Red sherds present a less active b-fabric (weak clay minerals orientation/organic matter impregnation) with a dominance of sub-

rounded to rounded coarse components of quartz particles and the presence of pumice fragments. Parallel elongated microvoids are also more abundant. The alignment of these voids is likely to be related to the application of pressure during forming, which promotes cracking upon drying (Quinn, 2013).

Mineralogically, Specimen 1 (Ramon Specular Red on Buff engraved tripod vessel, Petrography Group II), is particularly interesting due to the presence of perlitic textures (Figure 4c) in the volcanic glass. Notably, perlite has been reported by the Servicio Geológico Mexicano (2002) near Cerro El Chivo in a rhyolitic flow. In the INEGI (1979) geological chart, rhyolitic rocks are associated to Sierra Patlachique range in the south of the Teotihuacan Valley; however, several petrographic analyses also suggest less silicic compositions along its mountains, including andesite, dacite, rhyodacite and latite (Mooser, 1968; Sotomayor-Castañeda, 1968; Díaz-Lozano, 1979; Vázquez-Sánchez and Jaimes-Palomera, 1989; Murakami et al., 2018). In general, these mineral compositions have been described in ceramic assemblages as temper from the Teotihuacan Valley (Bennyhoff and Heizer, 1965). But, we suggest to proceed with caution when interpreting these mineralogical coarse fractions. In fact, they may reflect a number of different processes. Truly, they may reflect the original composition of the parent rock. But we must also consider mineral stability (i.e. hydrothermal alteration and weathering) and firing. Nevertheless, we propose that the evidence of perlitic textures in the volcanic glass - a compositional feature described by Williams (1956) as spherulitic rhyolite - and the high quartz proportion in combination with scarce mafic minerals (1-3% of the bulk), supports a origin within the Acambaro Valley for the ceramic.

At times, common geological formations in disparate regions can create similar mineralogical signatures. For this reason, among others, scholars have promoted the use of a dual method approach in which both mineralogy and geochemistry is taken into account to determine provenance (Ownby, 2017; Quinn, 2013). To these ends, we have also conducted NAA at the University of Missouri Research Reactor (MURR) to complement the aforementioned petrographic analyses. This analysis was based on standard protocol utilized at MURR and other laboratories (Glascock 1992; Neff 1992, 2000). All specimens were subjected to both short and long irradiations after which 33 short and long lived elements were recorded based upon variable decay rates. Statistical analyses were then carried out on base-10 logarithms and/or linear concentrations to normalize trace elements. Using GAUSS statistical software elemental concentrations were then examined for each specimen, comparing each to MURR's NAA database.

Despite the apparent mineralogical homogeneity of pastes, there is a high amount of compositional variability between the specimens (Table 3). While the relative mineralogical homogeneity likely represents common production within the Acambaro Valley, the higher degree of chemical variability demonstrates a level of heterogeneity in the sample indicative of multiple paste recipes, even if from the same local vicinity. Though petrographic analyses suggest two groups, there is little chemical relationship between specimens and the two petrographic groups do not materialize in the chemical analysis. Traditionally, a baseline of presumed local paste recipes can be concluded based upon the criterion of abundance (Bishop

et al. 1982) when attempting to determine provenance. But for small samples, determining the compositional range of variation of individual paste recipes can be difficult. In our study, we focused our attention on a small sample such as this. Further, our sample selection emphasized ceramics which were stylistically similar to pottery produced elsewhere at Teotihuacan, in hopes of identifying direct trade. This targeted sampling method precludes our understanding of the range of variability of any singular paste recipes local to the Acambaro Valley. Yet, we have compared each specimen to a subset of MURR's NAA database focused on Central Mexican ceramics ($n > 9,000$) due to the stylistic similarities to address production locale by other means. A k -nearest-neighbor search routine was performed to identify the ten specimens in the MURR database which are chemically most-similar to each sherd in our study. Squared mean (average) Euclidean distance was used as the distance metric in the searching algorithm. While this technique does not provide definitive proof of provenance, one can deduce if a specimen is comprised of a paste recipe commonly found elsewhere to suggest possible production locales.

	Group Mean	St. Dev	Coefficient of Variation
As	4.2319	2.0227	47.80
La	24.9775	6.5925	26.39
Lu	0.3845	0.0828	21.52
Nd	23.4802	6.7140	28.59
Sm	5.3858	1.4460	26.85
U	1.8203	0.8726	47.94
Yb	2.5880	0.6303	24.35
Ce	51.8865	11.1381	21.47
Co	9.9517	1.8262	18.35
Cr	41.8256	8.6065	20.58
Cs	5.9079	2.7250	46.12
Eu	1.1259	0.2854	25.35
Fe	34565.1097	7627.0424	22.07
Hf	8.1361	0.9653	11.86
Rb	83.3383	17.6806	21.22
Sb	0.7110	0.6288	88.43
Sc	11.8324	2.6792	22.64
Sr	449.4348	67.2587	14.97
Ta	1.2183	0.1892	15.53
Tb	0.8254	0.2338	28.33
Th	8.5649	1.6448	19.20
Zn	69.5509	5.2303	7.52
Zr	210.8832	35.1635	16.67
Al	91877.4631	12661.2174	13.78
Ba	1865.5180	437.8817	23.47
Ca	16941.2257	2605.4141	15.38
Dy	4.4794	1.1705	26.13
K	20484.3057	2825.4033	13.79
Mn	453.1494	185.9866	41.04
Na	13286.9170	4404.2972	33.15
Ti	5514.5105	1462.3993	26.52

V	76.2168	23.1813	30.41
---	---------	---------	-------

Table 4. Elemental concentrations and variation including Samples 1-11 (excluding the non-local Thin Orange sherd).

Petrographic Group I

Sample 2 (Ramon Specular Red on Buff), in the Petrographic Group I, is similar to some other specimens in our sample in many ways. However, it is yet distinct based upon specific compositional elements, indicating a slightly different paste recipe. For example, as compared to the generally similar Sample 1 specimen (in the Petrographic Group II), this sherd features far lower levels of sodium. With the usage clay as temper as identified in the petrographic analysis above, this difference in Sodium may be a result of the use of different clays which can have drastically variable absorption rates (Ferrell Jr. and Brooks 1971; He et al. 2014). Nonetheless, compared to the MURR database, multivariate Euclidean distance is also greater with this specimen indicating even less commonality with specimens from Teotihuacan despite any stylistic similarities. As suggested by the petrographic analysis, due to this lack of similarity, this specimen is more likely a locally produced imitation of a Teotihuacano style.

Both samples 5 and 6 are Formative Period Monochrome brown Chupicuaro type sherds known to be common in the Acambaro Valley region (Porter, 1956). As initially suspected based upon type alone, these two specimens are most likely local products. Compositionally, they are more similar to each other than they are to any other specimens in the MURR NAA database, indicating common paste recipe and production locale. Secondly, in consideration of the criterion of abundance (Bishop et al. 1982), the fact that these two specimens are so similar and are part of such a small assemblage, makes local production a near certainty.

The Formative Dichrome Red on Buff Chupicuaro ware (Sample 7) is also a local type. While there is some overall compositional similarity with specimens from elsewhere, individual elements (e.g. Co, Hf, Rb, Ta, Zr, and K) are notably different. Yet, this paste is also compositionally different than others from the Acambaro Valley as well, particularly Samples 5 and 6, perhaps due to a difference in volcanic glass temper. Nonetheless, this specimen does not represent a Teotihuacano recipe and is also most likely a local product as suspected based upon style.

Collected at the site of Chamacuaro, in the Acambaro Valley, Sample 11 is also an engraved Red on Buff sherd dating to the Classic period. While it is compositionally similar to some Teotihuacan specimens, and it is part of a different mineralogical group, it also has some compositional similarities with Sample 10. As sample 10 is most certainly not from Teotihuacan, this suggests that both are produced in the same general region. This was confirmed based upon Mahalanobis distance, clinal patterns of individual elements (Stoner, 2016), and visual inspection of bivariate plots. Though we do not have a local compositional fingerprint of clays and/or pastes in and/or near the Acambaro Valley, we can deduce where a specimen is not from, including other population centers where large reference collections

exist such as Teotihuacan, Xaltocan, Tula, and the Toluca valley. As such, while ruling out these other locales, we are left only with the inability to disprove local production.

Petrographic Group II

Despite the Monochrome brown type being common at Teotihuacan, Specimen 3 (Petrographic Group II) shows no affinity to the area either based upon direct comparison to Teotihuacan sherds or in consideration of elements that appear geographically diagnostic for the Basin of Mexico (Mooser et al., 1974; Neff and Glascock, 2000; Nichols et al., 2002; Stoner, 2016). This type is also known to be common in the Acambaro Valley and the Querendaro Basin, however (Padilla, 2018). Thus, production within the Acambaro Valley as suggested by petrographic analyses appears to be upheld through geochemical analysis.

Though Sample 4's Specular Red on Buff type is also common at Teotihuacan, there is little compositional similarity between this specimen and any sherds from the Teotihuacan Valley. In fact, not only is this sherd compositionally dissimilar to those of a similar type from there, it is most compositionally similar to numerous sherds from elsewhere that have been decorated in a completely different manner. Even these multivariate similarities fall apart, however, when considering individual elements. Instead, more detailed analyses reveal distinctiveness based upon individually diagnostic and geographically clinal patterns of elements such as Chromium. Thus, the composition of this specimen is inconsistent with expectations if imported from Teotihuacan or elsewhere in the region.

Specimen 8 (Garita brown) is a local type and is characteristic of the Late Classic Acambaro Valley (Snarskis, 1985). Despite stylistic and temporal differences between this sherd and Specimen 9 (Monochrome specular red), they are indeed similar compositionally. Further, neither of these two sherds are particularly similar to any sherds from Teotihuacan or elsewhere in Central Mexico. Thus, though one of the two is stylistically related to Teotihuacan, compositionally, they both appear to have been produced within the Acambaro Valley using similar recipes.

Sample 10 is a Ramon Red on Buff Specular Resist ware collected from Las Angosturas, Tarandacuao, on the south bank of Lerma river. Not only is this decorative type stylistically different than Teotihuacano ceramics, it is compositionally distinct as well. This sample may be locally produced or perhaps produced in Querendaro, as this particular decorative type is commonly found there. However, with no samples available for comparison from this region, we cannot conclusively determine if this sample was imported from Querendaro. Nonetheless, this particular sherd shows no compositional or stylistic relationship with Teotihuacan.

Outlier

Finally, one Thin Orange ceramic sherd (Sample 12) has been included for which the style in and of itself is not specific to a particular production locale. While this type has been known to be imitated in the Toluca Valley and elsewhere, it was also known to have been produced at Tepexi de Rodriguez (Puebla) and controlled by Teotihuacan (Rattray, 1981, 1990). Because this type is a common style found in many locales, it is important to compare this

specimen to other Thin Orange sherds directly to assess potential production locale. In doing so, we have identified one specimen in particular from the MURR database that was collected at Teotihuacan and is quite similar compositionally. It is unclear where this incised Thin Orange hemispheric bowl was produced, but it is in fact dissimilar to compositional signatures from Puebla where a great number of Thin Orange ceramics were made. Nonetheless, the similarity between these two specimens in both style and chemistry is notable and deems importation of Sample 12 a distinct possibility. This sherd is also the only specimen that features a more homogeneous orange-reddish color in the ceramic matrix. Observed under Reflected Light (RL), the orange-reddish colors produced by firing oxidation are brighter (Figure 4f) and show differences in comparison with other iron components (associated to clay lumps/clay temper, Fe-Mn nodules, primary oxides of volcanic rocks or finishing pigments). As mentioned by Rattray (1990), petrographic descriptions of Thin Orange ceramics have also shown that the temper is distinctive from those in the majority of the Teotihuacan ceramics (Shepard, 1946; Sotomayor and Castillo-Tejero, 1963; Lambert, 1978; Galguera-Rosas, 1989). Lambert (1978) suggests that the presence of metamorphic rock material and the presence of carbonates are distinctive characteristics in this type. Thus, mineralogically, Sample 12 (Figure 4e and 4f) is clearly distinct from the other samples collected from the Acambaro Valley as well as those from Teotihuacan and Puebla. The distinctiveness of this sample is also clear compositionally. Despite any stylistic similarity with the individual sherds from elsewhere, Sample 12 generally falls outside of the range of variation for the Teotihuacan collection (Figure 5) with many elements. Further, we can also be certain that this specimen is distinct from all others in our assemblage. Given this distinctiveness and ubiquitous style, this specimen above all others may represent non-local production, though the precise production locale remains unclear.

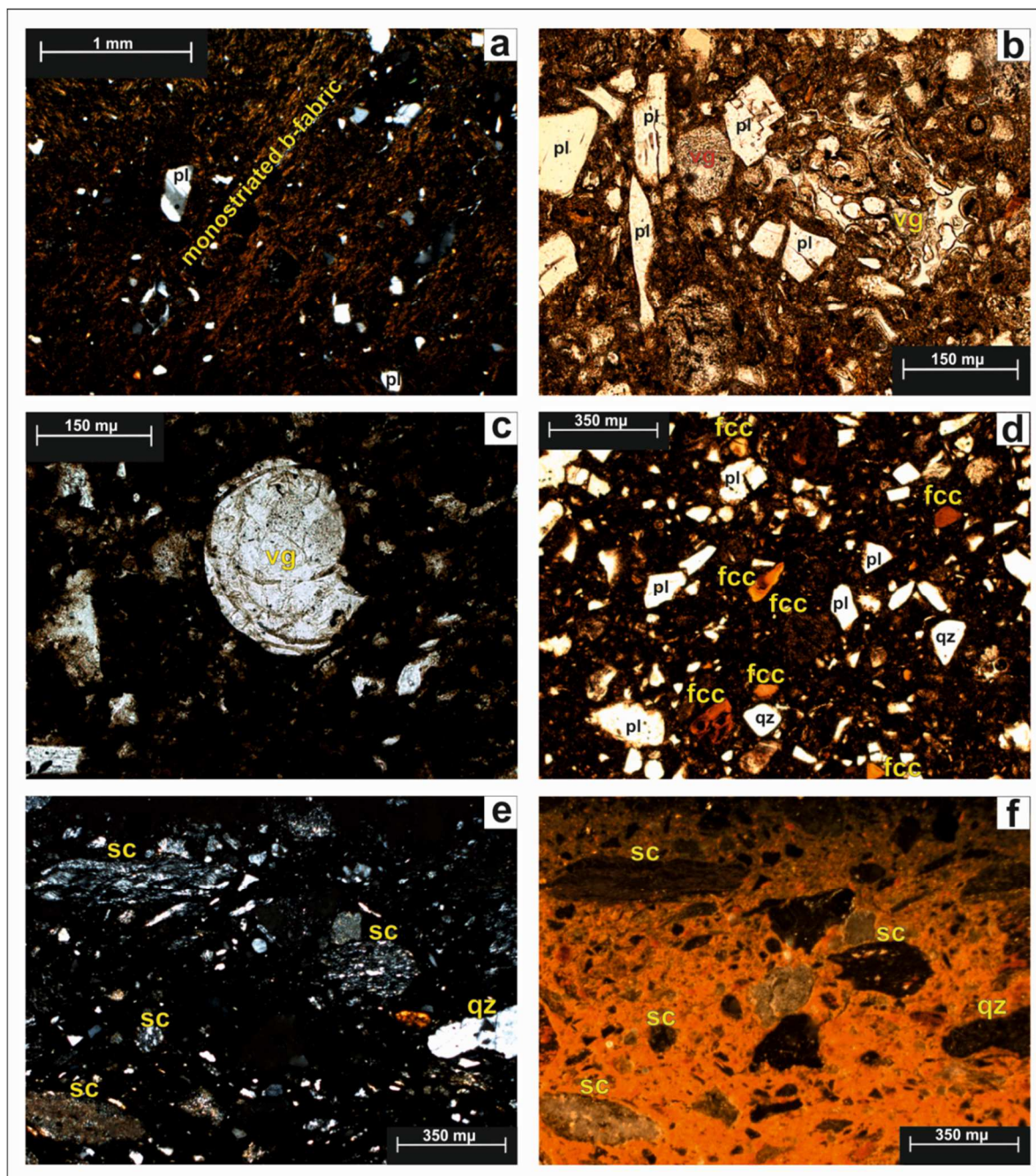


Figure 4. Photomicrographs of ceramic thin sections.

- a. Ramon Specular Red on Buff type (Sample 2). Monostriated b-fabric (Stoops, 2003) in the ceramic matrix and fine coarse isolated plagioclase (pl) particles. Crossed Polarized Light (XPL) observation.*

- b. Monochrome brown/buff Chupicuaro type (sample 6). Vesicular volcanic glass shard (vg) surrounded by plagioclase (pl) with its typical tabular habit. Plane Polarized Light (PPL) observation.*
- c. Ramon Specular Red on buff/engraved type (sample 1). Center of the image, fragment of volcanic glass (vg) with perlitic texture (natural concentric curved fractures by contraction during rapid cooling lava flow). PPL observation.*
- d. Monochrome brown/buff Chupicuaro type (Sample 6). Details of rounded fragmented clay coatings (fcc) inherited by the soil used as raw material. Note the presence of plagioclase (pl) and quartz (qz) fine sand angular-sub-angular particles. PPL observation.*
- e. Thin orange type (sample 12). General composition of coarse mineral particles associated to metamorphic rock fragments. Schists (sc) with foliated structure and microcrystalline quartz (qz) are typical. XPL Observation.*
- f. Thin orange type (sample 12). Same image as e, with Plane Polarized Light and Reflected Light (RL) combined observations. Note the orange-reddish brighter color in the ceramic matrix, produced by firing oxidation.*

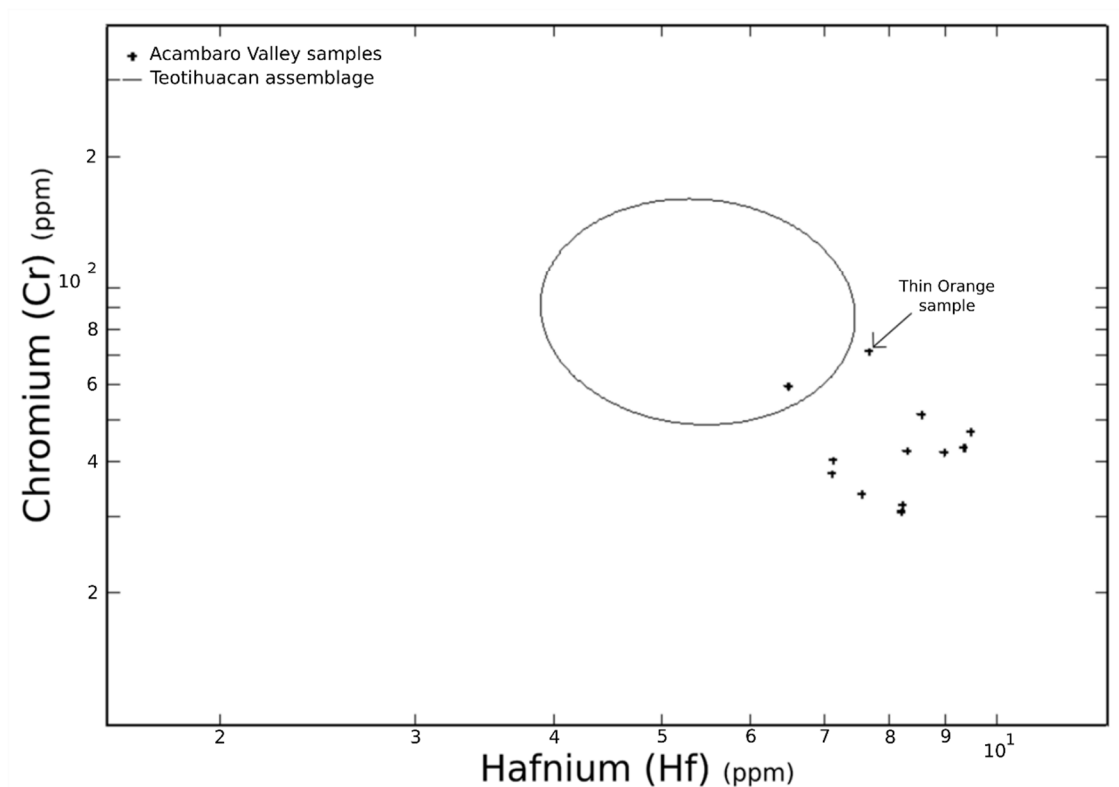


Figure 5. Comparison to complete Teotihuacan collection based upon Hf and Cr axes.

Euclidean Distance nearest neighbor analyses demonstrate a particular uniqueness with our sample, ruling out production elsewhere in nearly every case. Rather, while many of the

Acambaro Valley ceramics are stylistically related to Teotihuacan, the petrographic and geochemical analyses suggest production within or near the Acambaro Valley for the majority of the assemblage. Furthermore, an origin at Teotihuacan is particularly unlikely for these specimens based upon previously established clinal patterns of key elements such as K, Na, and Cr for Central Mexico (Mooser et al., 1974; Neff and Glascock, 2000; Nichols et al., 2002; Stoner 2016). If these specimens were in fact imported from Teotihuacan, we should expect to find the composition of the Acambaro Valley specimens to fall well within MURR's tightly clustered and well defined Teotihuacan assemblage compositionally. Yet, the sample generally falls outside of the range of variation for not only the large Teotihuacan collection, but also the large reference collections from other locales, such as Xaltocan, the Toluca Valley, and Tula (Figure 6).

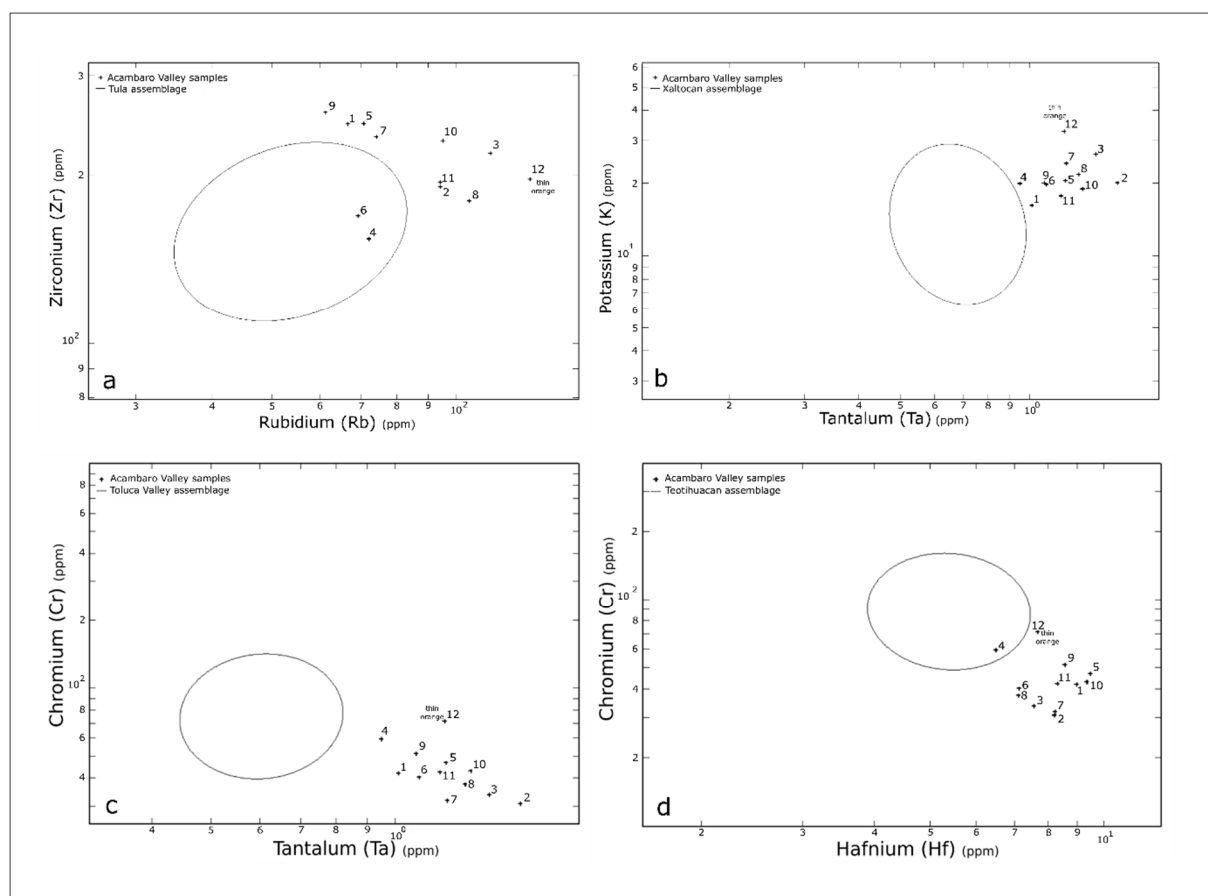


Figure 6. Compositional comparison of Acámbaro samples with collections from other population centers (a. Tula, b. Xaltocan, c. Toluca Valley, d. Teotihuacan)

In sum, when considering all analyses above, the Acambaro Valley assemblage does not appear to reflect Teotihuacano production, for the most part. Rather, Teotihuacan styled ceramics may more likely be local imitations. Because we do not have a representative sample from the Acambaro Valley, we are left with only the twelve specimens discussed here to speculate what a local signature may look like. With such a limited scope, we cannot be certain of the true range of variation of local recipes. Nonetheless, in consideration of all of the above analyses, we have not located any foreign compositional groups or petrographic signatures to which our sample is similar, and must therefore conclude the likely local origin

of most of the assemblage based upon chemistry despite a variety of paste recipes employed. The one exception may be the Thin Orange sherd (Sample 12) which does appear to be an import and does share some compositional and mineralogical similarities with ceramics collected elsewhere.

Discussion

The cultural remains found at the site contrast sharply with local Preclassic and Classic patterns and relate to populations sharing some eating habits of the high central plateau. Unlike local traditions, these individuals built according to the Teotihuacan tradition by laying thick stucco floors and practiced Teotihuacan rites. Moreover, it appears that potters manufactured their heaviest and most fragile pieces locally to replicate those used in the neighborhoods of Teotihuacan for the purposes of conveying concepts emblematic of the city in a very fundamental way. Yet, these pieces do not necessarily express the values of the elite, but rather perceived affiliation and esoteric knowledge. On the other hand, they imported small quantities of prestigious productions (i.e. Thin Orange ceramics) which were less heavy and fragile with open shapes that allowed them be stacked for shipment. Just like the ubiquitous prismatic obsidian blades, figurines, or shells, these products were also intended to circulate and be exchanged for other resources. Distinctly local styled sherds are also present in the Classic period (at best 35% of the Classic assemblage, Table 1), but it is difficult to distinguish whether they were used at the same time as the Ramon complex or previously, because the sample comes from backfills levels. In any case, the pottery illustrates the influence of Teotihuacan especially on this site located at an important commercial axis joining the city to the north of Michoacan at a time when the neighborhoods in Teotihuacan were in full expansion and required raw materials to develop their craft industries. These characteristics are also found at El Rosario considered as an “enclave” (Saint Charles et al 2010). Other staging-post sites on these roads of commerce may include La Negreta (Brambila and Velasco, 1988) and Santa María del Refugio (Castañeda et al., 1996; Saint-Charles, 1996), both of which feature striking parallels with El Mezquital-Los Azules in their construction systems and ceramic complexes. In the case of El Rosario, relatively well dated to AD 400, this may correspond to a reinforcement or extension of the network farther to the north. Its abandonment is considered to coincide to the decline of Teotihuacan supremacy, around AD 550-600 (Saint-Charles et al. 2010). The destruction suffered by El Mezquital-Los Azules does not allow to know if the site was occupied until the end of the Classic period, but Epiclassic ceramics here are very rare. At the same time, large architectural centers were created in the nearby valleys. It is therefore plausible, if not likely, that the decline of Teotihuacan explains the disaffection of trade routes and the transfer of population to other locations

The staging post of El Mezquital-Los Azules must be distinguished from others due to being a key location on a trade route where goods were primarily traded, unlike sites in the north of Michoacan where goods were maybe produced and stored and may have served as an end of the line of sorts. Even if one may deplore the fact that too few Teotihuacan tradition remains come from verified contexts, the region encompassing the lagoons of Cuitzeo and Querendaro may well have played a major role within the trade system. Here, the Teotihuacan

iconographic elements listed by Filini are more varied and widely disseminated, but they refer to elite ideology above all (Filini, 2010). The excavations at the site of Tres Cerritos have identified graves which contain various elite status objects, including artifacts made of shell, jade, and turquoise and a mask made of green stone in the Teotihuacan style. It is likely that the organization of commercial activities here demanded more integration in the local networks and stronger involvement (or submission) by the local elites. Corresponding to models proposed by Filini and Hernandez, this integration would have necessarily included the managing of collection and storage of the resources of commerce.

Another important question concerns the identities and statuses of the groups living in these commercial staging posts. On this point, it is very interesting to refer to the situation at Teotihuacan whose economic and social organization was founded on the coexistence of multi-ethnic neighborhoods (Gómez Chávez and Gazzola, 2007; Gómez-Chávez, 2012; Manzanilla, 2015, 2012; Rattray, 1987; Spence, 1992; Spence et al., 2005). The city's requirements in raw material were also considerable. As such, it became critical to establish methods for providing provisions for its large population (Sugiyama and Somerville, 2016). These needs included not only the need to supply materials to craftsmen, but to also support the construction of the city itself which demanded large amounts of stone, wood for the roofs, and stucco and pigments for the walls. Thus, the inhabitants of the neighborhoods needed all at once subsistence goods, finished products imported from their various regions of origin, and a whole range of raw materials, whether locally procured or luxuries from distant regions.

Inside the city, at least two residential complexes show the presence of groups or individuals from the north-center, more particularly from the north of Michoacan (Gómez Chávez and Abasolo Hernández, 2017; Gómez Chávez and Gazzola, 2007; Martel Begun, 2013; White et al., 2004). For complex N1W5:19, the arrival of Michoacanos in Teotihuacan is dated to AD 250 (Gómez Chávez and Abasolo Hernández, 2017). Groups from Oaxaca also occupied it as an example of multi-ethnic residential structure. Isotope composition analyses have revealed that at least some of these individuals seem to have been born and died in Teotihuacan but lived much of their lives in the provinces (Gómez Chávez and Abasolo Hernández, 2017). At Tlajinga 33, on the contrary, they were immigrants who had arrived when young and remained living in Teotihuacan with a good social status (White et al., 2004). These data - which are still incomplete for the contacts with the west but are more plentiful for Oaxaca and the Gulf coast - clearly show that the neighborhoods' social fabric was formed of intertwining relationships between groups and individuals of different origins who cooperated in their work and joined together in common lifestyles and families. Yet, for these individuals, keeping ties with their native region was vital for preserving stable commercial relations (Gómez Chávez and Abasolo Hernández, 2017).

Our hypothesis is that the Cuizillo El Mezquital- Los Azules site was occupied during Teotihuacan's phase of commercial expansion by groups related to the neighborhoods who had every interest in shipping goods to the Gran Urbe efficiently. In addition, they knew the region well, either directly or indirectly. And when it came to supplying the goods, they quite possibly utilized family contacts. The system depended on the neighborhoods' inhabitants, merchants, and craftsmen who circulated a great deal, especially over medium distances. But

as they were a part of the general social fabric of Teotihuacan, their goal must have been to keep the goods moving towards the capital. The construction of staging posts on trade routes was intended to make these routes secure, and to optimize and perpetuate them. In these particular contexts, the foci were only economic and strategic as evidenced by the differences in usage and distribution of Teotihuacano motifs. This is in contrast with other locales such as north of Michoacan in regards to production and storage. Unlike the largely economic role at El Mezquital-Los Azules, these sites served a greater function of military and political importance through local elites in the Teotihuacan network.

Conclusion

The archaeometric and typological analyses of the ceramics from the site of El Mezquital-Los Azules show that the quality small-sized to medium-sized objects (i.e. Thin Orange ceramics) were controlled by the Teotihuacan trade system. As for the iconography found on the types manufactured locally, we find some motifs which are very emblematic of the city's cognitive sphere but are not a part of any politico-military message controlled by the elites. Rather, these symbols convey an ideology promoted by the high central plateau centered on a cosmogonic vision and plant fertility from which the politico-military dimension is absent. We suggest that El Mezquital-Los Azules – just like El Rosario, La Negreta, or Santa María del Refugio – was yet another settlement occupied during the Late Tlamimilolpa and Early Xolalpan phases by groups connected to the multi-ethnic neighborhoods precisely along trade routes forming part of a kind of “corridor” to western Mesoamerica. There, they built their architectural structures and created goods in the style of Teotihuacan. The ties that joined these groups to the city were probably quite variable, but they nonetheless seem to have participated in the constantly evolving multi-ethnic social fabric, characteristic of the Gran Urbe. All this was owing itself to a quite specific situation, which has resulted from the region's position in the intermediate periphery between a central bulk zone and the sectors rich in resources.

Acknowledgements: This work was supported by the Institut Universitaire de France (IUF), the Centre National de la Recherche Scientifique (CNRS) and by a grant from the National Science Foundation (BCS-1621158) to the Archaeometry Laboratory of MURR. It was conducted with permission from the INAH Consejo de Arqueología. We kindly thank Julie Gazzola and Jorge Méndez Cuautitla from INAH at Teotihuacan, Jaime Díaz Ortega from the Laboratorio de Laminación de Suelos y Sedimentos (Instituto de Geología, UNAM) for thin section preparation, as well as Brandi MacDonald and Emma Gloe for their assistance in the preparation and irradiation of the specimens presented in this paper. Finally, we wish to thank the anonymous reviewers whose comments have greatly improved this article.

References

1. Aoyama, K., 1991. Lítica. In: Investigaciones arqueológicas en la región de La Entrada, Vol. 2. S. Nakamura, K. Aoyama, and E. Uratsuji (Eds). Servicio de Voluntarios Japoneses para la Cooperación con el Extranjero y el Instituto Hondureño de Antropología e Historia, San Pedro Sula, pp.39-203.

2. Arnauld, M.-C., Carot, P., Fauvet-Berthelot, M.-F., 1993. Arqueología de las Lomas en la cuenca lacustre de Zacapu, Michoacán, México, Cuadernos de Estudios Michoacanos. Centro de Estudios Mexicanos y Centroamericanos, México.
3. Baudez, C.-F., 2012. La douleur rédemptrice: l'autosacrifice précolombien. Riveneuve éditions, Paris.
4. Bennyhoff, J., Heizer, R., 1965. Neutron Activation Analyses of Some Cuicuilco and Teotihuacan Pottery: Archaeological Interpretations. *American Antiquity* 30, 348-349.
5. Bernal, I., 1966. Teotihuacan, capital de imperio? *Revista Mexicana de Estudios Antropológicos* 20, 95-110.
6. Bishop, R.L., Rands, R.L., and Holley, G.R., 1982. Ceramic compositional analysis in archaeological perspective. In: *Advances in Archaeological Method and Theory*, vol. 5. Academic Press, New York, pp. 275-330.
7. Blanton, R.E., Feinman, G.M., Kowalewski, S.A., Peregrine, P.N., 1996. A Dual-Processual Theory for the Evolution of Mesoamerican Civilization. *Current Anthropology* 37, 1-14. <https://doi.org/10.1086/204471>.
8. Blomster, J.P., Neff, H., Glascock, M.D., 2005. Olmec pottery production and export in ancient Mexico determined through elemental analysis. *Science*, 307, 1068-1072.
9. Bove, F.J. and Medrano Busto, S., 2003. Teotihuacan, Militarism, and pacific Guatemala. In: Braswell, G.E. (Ed.), *The Maya and Teotihuacan*. University of Texas Press, Austin, pp.45-79.
10. Brambila, R., Velasco, M., 1988. Materiales de La Negreta y la expansión de Teotihuacan al norte. In: *Primera Reunión Sobre Las Sociedades Prehispánicas En El Centro Occidente de México, Memoria*. INAH, México, pp. 287-298.
11. Braniff, B., 1975. Algunas representaciones de la greca escalonada en el norte de Mesoamérica (Segunda parte). *Anales del INAH (1972-1973)* 23-30.
12. Braniff, B., 1970. Greca escalonada en el norte de Mesoamérica. *Boletín del INAH* 38-40.
13. Braswell, G.E., 2003 (Ed.). *The Maya and Teotihuacan*. University of Texas Press, Austin.
14. Braswell, G.E., 2003. Introduction: Reinterpreting Early Classic Interaction. In: Braswell, G.E. (Ed.), *The Maya and Teotihuacan*. University of Texas Press, Austin, pp.1-43.
15. Braswell, G.E., Clark, J.E., Aoyama, K., McKillop, H.I. and Glascock, M.D. 2000. Determining the Geological Provenance of Obsidian Artifacts from the Maya Region: A Test of the Efficacy of Visual Sorting. *Latin American Antiquity* 11:269-282.
16. Bullock, P., Fedoroff, N., Jongerius, A., Stoops, G., Tursina, T., Babel, U., 1985. *Handbook for soil thin section description*. Waine Research Publications, Wolverhampton.

17. Carballo, D.M., 2013. The Social organization of Craft Production and Interregional Exchange at Teotihuacan. In: Hirth, K.G., Pillsbury, J. (Eds.), *Merchants, Markets, and Exchange in the Pre-Columbian World*. Dumbarton Oaks, Washington D.C., pp. 113-140.
18. Carballo, D.M., Pluckhahn, T., 2007. Transportation Corridors and Political Evolution in Highland Mesoamerica: Settlement Analyses Incorporating GIS for Northern Tlaxcala, Mexico. *Journal of Anthropological Archaeology* 26(4):607-629.
19. Carot, P., 2013. La larga historia purépecha. In: *Miradas Renovadas En El Occidente Indígena de México*. UNAM/INAH/CEMCA, México, pp. 133–214.
20. Castañeda, C., Crespo, A.M., Flores, L.M., 1996. Santa María del Refugio: una ocupación de fase Tlamimilolpa en el Bajío. In: Crespo A.M. y Viramontes C. Coord. *Tiempo y Territorio En Arqueología. El Centro-Norte de México*. Colección Científica - Serie Arqueología., México, pp. 161–178.
21. Castro-Dorado, 1989. *Petrografía básica: Texturas, clasificación y nomenclatura de rocas*. Paraninfo (Ed), Madrid.
22. Cau, M.A., Day, P.M., Baxter, M.J., Papageorgiou, I., Iliopoulos, I., Montana, G., 2004. Exploring automatic grouping procedures in ceramic petrology. *Journal of Archaeological Science* 31, 1325-1338.
23. Cecil, L.G., 2007. Postclassic Maya ceramic advances: Conjoining stylistic, technological, and chemical compositional data. In: Rosslere, D. (Ed.), *Developments in ceramic materials research*. Hauppauge, NY, Nova Science Publishers, pp. 1-34.
24. Cohen, A.S., Galaty, M.L., Fisher, C.T., 2018. Petrographic analysis of ceramics and clay from Angamuco, Michoacán. *Journal of Archaeological Science: Reports* 19, 155-165.
25. Cowgill, G.L., 2015. *Ancient Teotihuacan. Early Urbanism in Central Mexico*. Cambridge University Press, Case Studies in Early Societies. New York.
26. Cowgill, G.L., 2003. Teotihuacan and Early Classic Interaction: A Perspective from Outside the Maya Region. In: Braswell, G.E. (Ed.), *The Maya and Teotihuacan: Reinterpreting Early Classic Interaction*. University of Texas Press, Austin, pp. 315–336.
27. Day, P.M., Kiriati, E., Tsolakidou, A., Kilikoglou, V., 1999. Group therapy in Crete: a comparison between analyses by NAA and thin section petrography of Early Minoan pottery. *Journal of Archaeological Science* 26, 1025-1036.
28. Díaz-Lozano, E., 1979. Rocas y minerales del valle. In: Gamio, M. (Ed.), *La población del valle de Teotihuacán*, Tomo II. Instituto Nacional Indigenista, Mexico City, pp. 27-66.

29. Dunning, N.P., McCane, C., Swinney, T., Purtill, M., Sparks, J., Mann, A., McCool, J.P., Ivenso, C., 2015. Geoarchaeological Investigations in Mesoamerica Move into the 21st Century: A Review. *Geoarchaeology: An International Journal* 30, 167-199.
30. Eckert, S.L., Schleher, K.L., 2012. Integrating petrographic and chemical composition analyses: Sante Fe black-on-white ceramic production and distribution in the Española Basin. Paper Presented at the Society of American Archaeology Annual Meeting, Memphis.
31. Faugère, B., Lefebvre, K., Cuenot, J.-F., 2016. Circulation of Goods and Communication Routes between the Acambaro Valley and Central Mexico : from Chupicuaro to Teotihuacan. In: Williams, E., Maldonado, B. (Eds.), *Cultural Dynamics and Production Activities in Ancient Western Mexico*. BAR International series, Archaeopress, Oxford, pp. 187–200.
32. Ferrel Jr., R.E., and R.A. Brooks 1971. The selective adsorption of Sodium by clay minerals in Lakes Pontchartrain and Maurepas, Louisiana. *Clays and Clay Minerals*. 19:75-81.
33. Filini, A., 2004. The presence of Teotihuacan in the Cuitzeo Basin, Michoacan, Mexico: a World-System Perspective. BAR International Series. Archaeopress, Oxford.
34. Filini, A., 2010. El sistema-Mundo Teotihuacano y la Cuenca de Cuitzeo, Michoacán. El Colegio de Michoacán, Zamora.
35. Fowles, S.M., Minc, L., Duwe, S., Hill, D.V., 2007. Clay, conflict, and village aggregation: compositional analyses of Pre-classic pottery from Taos, New Mexico. *American Antiquity* 72, 125-152.
36. Galguera-Rosas, G., 1989. Fuentes de material para la elaboración de cerámica en la región de Tepexi de Rodríguez, Puebla. Instituto de Geología, UNAM. Unpublished manuscript.
37. García Cook, A., Merino, B.L., 1996. Situación cultural en Tlaxcala durante el apogeo de Teotihuacán. In: Mastache A.G., Santley, J.R., Serra Puche, M.C. (Eds.), *Arqueología mexicana. Homenaje a William Sanders*, Vol.1, INAH, Mexico, pp.11-26
38. Glascock, Michael D.1992. Characterization of archaeological ceramics at MURR by neutron activation analysis and multivariate statistics. In: Neff H. (Ed), *Chemical Characterization of Ceramic Pastes in Archaeology*. Prehistory Press, Madison, WI, pp. 11–26.
39. Gazzola, J., 2000. Les utilisations du cinabre à Teotihuacan. PhD tesis, Paris 1 Université.
40. Gómez Chávez, S., Abasolo Hernández, R., 2017. Aspectos de la vida de los migrantes michoacanos en le antigua ciudad de Teotihuacán. In: *Migraciones e Interacciones En El Septentrión Mesoamericano*. El Colegio de Michoacán, Zamora, Michoacán, pp. 87–103.

41. Gómez Chávez, S., Gazzola, J., 2007. Análisis de las relaciones entre Teotihuacán y el Occidente de México. In: Faugère B. (Ed.), *Dinámicas Culturales Entre El Occidente, El Centro-Norte y La Cuenca de México, Del Preclásico Al Epiclásico*. El Colegio de Michoacán -CEMCA, México, pp.113-136.
42. Gómez-Chávez, S., 2002. Presencia del occidente de México en Teotihuacán. *Aproximaciones a la política exterior del Estado Teotihuacano*. In: M.E. Ruiz (Ed.) *Ideología y Política a través de materiales, imágenes y símbolos*. Memoria de la Primera Mesa redonda de Teotihuacán. UNAM/IIA/IIIE/INAH, pp. 563-625.
43. Gómez-Chávez, S., 2012. Structure and Organization of Neighborhoods in the Ancient City of Teotihuacan. In: M.C. Arnauld, L. Manzanilla and M.E. Smith (Eds), *The Neighbourhood as a Social and Spatial Unit in Mesoamerican Cities*, University of Arizona Press, Tucson.
44. Hall, T. and Chase-Dunn, C., 1996. Comparing World-Systems: Concepts and Hypotheses. In: *Pre-Columbian World-Systems*, P.N. Peregrine and G. Feinman (Eds). *Monographs in World Archaeology*, n°26, Prehistory Press, Madison, pp.13-28.
45. Haelan, D., 1997. Pre-Hispanic Quarrying in the Ucareo-Zinapécuaro Obsidian Source Area. *Ancient Mesoamerica* 8(1): 77-100.
46. He, Y., DeSutter, T.M., and Clay, D.E., 2013. Dispersion of Pure Clay Minerals as Influences by Calcium/Magnesium Ratios, Sodium Adsorption Ratio, and Electrical Conductivity. *Soil Science of American Journal* 77(6): 2014.
47. Headrick, A., 2007. The Teotihuacan trinity. The sociopolitical structure of an ancient Mesoamerican city, The William & Bettye Nowlin series in art, history, and culture of the Western Hemisphere. University of Texas Press, Austin.
48. Hernandez, C.L., 2016. Ceramic Evidence of Teotihuacan Contact Linking the Basin of Mexico, The Bajío, and Southern Hidalgo. In: Williams, E., Maldonado, B. (Eds.), *Cultural Dynamics and Production Activities in Ancient Western Mexico*. BAR International Series, Archaeopress, pp. 221–238.
49. Hirth, K.G., 1978. Teotihuacan Regional Population Administration in Eastern Morelos. *World Archaeology* 9 (3): 320-33.
50. Howie, L., 2012. Ceramic Change and the Maya Collapse: A study of pottery technology, manufacture and consumption at Lamanai, Belize, BAR International Series 2373. Archaeopress. Oxford.
51. INEGI, 1979. Carta geológica Texcoco E14B21, México y Tlaxcala. Escala 1:50,000. Instituto Nacional de Estadística. Geografía e Informática, Mexico City.

52. Jiménez Betts, P., 2017. Orienting West Mexico. The Mesoamerican World System AD 200-1200. PhD Thesis, University of Gothenburg.
53. Lambert, W., 1978. Petrographic study of selected Thin Orange sherds from the States of Mexico, Puebla and Tlaxcala, Mexico. Unpublished manuscript, Albuquerque, New Mexico.
54. Langley, J.C., 1986. Symbolic Notation of Teotihuacan. Elements of writing in a Mesoamerican culture of the Classic period., BAR International Series. Archaeopress, Oxford.
55. Larson, D.L., 2013. Albuquerque the Frontier? Exploring Migration and Social identity in the Albuquerque Area during the Late Development to Coalition Period Transition. Ph.D. dissertation. University of New Mexico.
56. Manzanilla, L., 2015. Cooperation and tensions in multiethnic corporate societies using Teotihuacan, Central Mexico, as a case study. *Proceedings of the National Academy of Sciences of the United States of America* 112, 9210–9215.
57. Manzanilla, L., 2012. Neighborhoods and Elite “Houses” at Teotihuacan, Central Mexico. In: M.C. Arnauld, L. Manzanilla and M.E. Smith (Eds), *The Neighbourhood as a Social and Spatial Unit in the Mesoamerican Cities*. The University of Arizona Press, Tucson, pp. 55–73.
58. Manzanilla, L., 2009. Corporate Life in Apartments and Barrio Compounds at Teotihuacan, Central Mexico. In: *Domestic Life in Prehispanic Capitals: A Study of Specialization, Hierarchy, and Ethnicity*, Memoirs of the Museum of Anthropology, University of Michigan, Ann Arbor.
59. Manzanilla, L.R., 1996. Corporate Groups and domestic Activities at Teotihuacan. *American Antiquity* 7, 228–246.
60. Manzanilla, L., 1993a. The economic Organization of the Teotihuacan Priesthood: Hypotheses and Considerations. In: *Art, Ideology, and the City of Teotihuacan: A Symposium at Dumbarton Oaks*. Dumbarton Oaks, Washington D.C., pp. 321–338.
61. Manzanilla, L. (Ed.) 1993b. *Anatomía de un Conjunto Residencial Teotihuacano en Oztotyahualco*. Instituto de Investigaciones Antropológicas, UNAM, Mexico.
62. Manzanilla López, R., 1996. La cerámica arqueología de Loma Santa María I, Morelia. In: Crespo A.M. and Viramontes C. Coords, *Tiempo y Territorio En Arqueología. El Centro-Norte de México*. Colección Científica - Serie Arqueología., Mexico, pp. 179–190.
63. Marcus, J., 2008. Monte Alban. Fondo de Cultura Económica, Mexico.

64. Marcus, J., 2003. The Maya and Teotihuacan. In: Braswell, G.E. (Ed.), *The Maya and Teotihuacan: Reinterpreting Early Classic Interactions*. University of Texas Press, Austin, pp. 337–356.
65. Martel Begun, E., 2013. *Detecting Ethnicity at Teotihuacan through Archaeology: the West Mexican Presence at Structure N1W5:19*. PhD Thesis, Iowa University.
66. Mendoza, R.C., Lacido, J.A., 2017. Tollan Teotihuacan. Multiethnic mosaics, Corporate Interaction, and Social Complexity in Mesoamerica. In: Chacon, R.J., Mendoza, R.C., *Feast, Famine or Fighting: Multiple Pathways to Social Complexity*. Springer, New York.
67. Minc, L.D., Sherman, R.J., 2011. Assessing natural clay composition in the Valley of Oaxaca as a basis for ceramic provenance studies. *Archaeometry* 53, 285-328.
68. Minc, L.D., Sherman, R.J., Elson, C., Winter, M., Redmond, E.M., Spencer, C.S., 2016. Ceramic provenance and the regional organization of pottery production during the later Formative periods in the Valley of Oaxaca, Mexico: Results of trace-element and mineralogical analyses. *Journal of Archaeological Science: Reports* 8, 28-46.
69. Mooser, F., 1968. Geología, naturaleza y desarrollo del Valle de Teotihuacan. In: Lorenzo, J.L. (Ed.), *Materiales para la arqueología de Teotihuacan, Serie Investigaciones XVII*. Instituto Nacional de Antropología e Historia, Mexico City, pp. 29-37.
70. Mooser, F., Naim, A.E., and Negerdank, J.F.W., 1974. Paleomagnetic investigations of the tertiary and quaternary igneous rock: VIII, a paleomagnetic and petrologica study of volcanics in the valley of Mexico. *Geologische Rundschau* 63(2): 451-483.
71. Murakami, T., Boulanger, M.T., Glascock, M.D., 2018. Petrographic and XRF analyses of andesitic cut stone blocks at Teotihuacan, Mexico: implications for the organization of urban construction. *Archaeological and Anthropological Sciences* 11, 1491-1518.
72. Muzzio Cepeda, G., 2017. *La iconografía de las representaciones de aves en el Arte de Teotihuacán*. Tesis de Licenciatura, Universidad de Chile, Santiago de Chile.
73. Neff, H., 1992. Introduction. In: Neff H., (Ed), *Chemical Characterization of Ceramic Pastes in Archaeology*. Prehistory Press, Madison, pp. 1–10.
74. Neff, H., 2000. Neutron activation analysis for provenance determination in archaeology. In: Ciliberto E., Spoto G. (Eds), *Modern Analytical Methods in Art and Archaeology*. John Wiley and Sons, Inc., New York, pp. 81–134.
75. Neff, H., and Glascock, M.D., 2000. *Provenance Analysis of Aztec Period Ceramics From the Basin of Mexico: Final Technical Report*. University of Missouri Research Reactor.
76. Neff, H., Blomster, J.P., Glascock, M.D., Bishop, R.L., Blackman, M.J., Coe, M.D., Cowgill, G.L., Cyphers, A., Diehl, R.A., Houston, S., Joyce, A.A., Lipo, C.P., Winter,

- M.C., 2006a. Smokescreens in the provenance investigations of Early Formative Mesoamerican ceramics. *Latin American Antiquity* 17, 104-118.
77. Neff, H., Blomster, J.P., Glascock, M.D., Bishop, R.L., Blackman, M.J., Coe, M.D., Cowgill, G.L., Diehl, R.A., Houston, S., Joyce, A.A., Lipo, C.P., Stark, B.L., Winter, M.C., 2006b. Methodological issues in the provenance investigations of Early Formative Mesoamerican ceramics. *Latin American Antiquity* 17, 54-76.
78. Nichols, L., 2015. Teotihuacan. *Journal of Archaeological Research* 24: 1-74.
79. Nichols, D. L., Brumfiel, E.M., Neff, H., Hodge, M., Charlton, T.H., and Glascock, M.D., 2002. Neutrons, markets, cities, and empires: A 1000-year perspective on ceramic production and distribution in the Postclassic Basin of Mexico. *Journal of Anthropological Archaeology* 21(1):25-82.
80. Ortiz Ceballos, P., 1988. Los Teotihuacanos en Matcapán. In: *La Época Clásica: Nuevos Hallazgos, Nuevas Ideas*. INAH, Mexico, pp. 307–328.
81. Ortiz Ceballos, P., Santley, R.S., 1998. Matcapán: un ejemplo de enclave Teotihuacano. In: *Los Ritmos de Cambio en Teotihuacán: Reflexiones y Discusiones de Su Cronología*, Colección Científica. INAH, Mexico, pp. 377–460.
82. Ortiz Ceballos, P., Rodríguez, C., Morales, D., 2010. Teotihuacan et la côte du Golfe. In: *Teotihuacan cité des Dieux*. Musée du Quai Branly/Somogy, Paris.
83. Ownby, M.F., Huntley, D.L., Peeples, M.A., 2014. A combined approach: using NAA and petrography to examine ceramic production and exchange in the American southwest. *Journal of Archaeological Science* 52, 152-162.
84. Ownby, Mary F., 2017. The Importance of Petrography for Interpreting Compositional Data: A Case Study of Tanque Verde Red-on-Brown. In: *Integrative Approached in Ceramic Petrography*, Mary Ownby, Isabelle Druc, and Maria Masucci (Eds). University of Utah Press, Salt Lake City, pp. 24-28.
85. Padilla, E., 2018. Territorio y movilidad en Queréndaro, Michoacán desde la perspectiva de las colecciones cerámicas del Museo Nacional de Antropología. Unpublished presentation, Museo Nacional de Antropología e Historia, Mexico.
86. Pasztory, E., 1992. Abstraction and the Rise of a Utopian State at Teotihuacan. In: *Art, Ideology, and the City of Teotihuacan*. *Dumbarton Oaks*, Washington D.C., pp. 281–320.
87. Pierce, D.E., 2015. Visual and geochemical analyses of obsidian use at San Felipe Aztatlán. *Journal of Anthropological Archaeology* 40: 266-279.
88. Pierce, D.E., 2017. Finding Class in the Glass: Obsidian source as a costly signal. *Journal of Anthropological Archaeology* 48: 217-232.
89. Plunket, P., Uruñuela, G., 2012. Where East Meets West: The Formative in Mexico's Central Highlands. *Journal of Archaeological Research* 20(1): 1-51.

90. Pool, C.A., 1992. Strangers in a Strange Land: Ethnicity and Ideology at an Enclave Community in Middle Classic Mesoamerica. In: *Ancient Images, Ancient Thought. The Art of Ideology*. University of Calgary, Calgary, pp. 43–55.
91. Porter, M.N., 1956. Excavations at Chupicuaro, Guanajuato, Mexico. *Transactions of the American Philosophical Society* 46, 515–637. <https://doi.org/10.2307/1005749>
92. Price, D.T., Manzanilla L., Middleton, W.D., 2000. Immigration and the Ancient City of Teotihuacan in Mexico: a Study Using Strontium Isotope Ratios in Human Bone and Teeth. *Journal of Archaeological Science* 27, 903–913 doi:10.1006/jasc.1999.0504
93. Quinn, Patrick S., 2013. *Ceramic Petrography: The Interpretation of Archaeological Pottery & Related Artefacts in Thin Section*. Oxford: Archaeopress.
94. Rands, R.L., and Bishop, R.L., 1980. Resource Procurement Zones and Patterns of Ceramic Exchange in the Palenque Region, Mexico. In: Fry, R.E. (Ed), *Models and Methods in Regional Exchange*. SAA Papers No. 1. Society for American Archaeology, Washington, D.C, pp. 19-46.
95. Rattray, E.C., 2001. *Teotihuacan: Ceramics, Chronology and Cultural Trends*. INAH, Mexico.
96. Rattray, E.C., 1990. New findings on the origins of Thin Orange ceramics. *Ancient Mesoamerica* 1: 181-195.
97. Rattray, E.C., 1987. Los barrios foráneos de Teotihuacán. In: Rattray E.C., Litvak K.J., Diaz, C. (Eds), *Teotihuacán: Nuevos Datos, Nuevas Síntesis, Nuevos Problemas*, Anthropological Series. UNAM, Mexico, pp. 243–274.
98. Rattray, E.C., 1981. Anaranjado delgado: cerámica del comercio de Teotihuacán. In: *Interacción Cultural En México Central*. UNAM, México, pp. 55–80.
99. Rice, P.M., Saffer, M.E., 1982. Cluster analysis of mixed-level data: pottery provenience as an example. *Journal of Archaeological Science* 9, 395-409.
100. Saint-Charles, J.C., Viramontes, C., Fenoglio Limon, F., 2010. El Rosario, Querétaro: un enclave Teotihuacano en el Centro Norte. *Tiempo y Región. Estudios Históricos y Sociales*. Querétaro.
101. Saint-Charles, J.C., 1996. El reflejo del poder Teotihuacano en el sur de Guanajuato y Querétaro. In: Crespo, A.M., Viramontes C. Coords, *Tiempo y Territorio En Arqueología : El Centro Norte de México*, Colección Científica. Instituto Nacional de Antropología e Historia - INAH, México, pp. 143–161.
102. Sanders W.T., Michels, J.W., 1977 (Eds.). *Teotihuacan and Kaminaljuyu: A Study of Prehistoric Culture Contact*. Pennsylvania State University Press, College Park.

103. Sanders W.T., Price, B., 1968. *Mesoamerica: The Evolution of a Civilization*. Random House, New York.
104. Santley, R.S., 1989. Economic Imperialism, Obsidian Exchange, and Teotihuacan Influence in Mesoamerica. In: *La Obsidiana En Mesoamérica*, Colección Científica. INAH, Mexico, pp.321-329.
105. Santley, R.S., Alexander, 1996. Teotihuacan and Middle Classic Mesoamerica: A Precolumbian World-System?. In: *Arqueología Mesoamericana: Homenaje a William T. Sanders*. INAH, Mexico D.F, pp. 173–194.
106. Séjourné, L., 1966. *Arqueología de Teotihuacán. La cerámica*. Fondo de Cultura Económica, México.
107. Servicio Geológico Mexicano, 2002. Carta geológico-minera Acámbaro F14-C84. Servicio Geológico Mexicano, Secretaría de Economía, Gobierno del Estado de Guanajuato. Pachuca, México.
108. Sharer, R.J., Balkansky, A.K., Burton, J., Feinman, G.M., Flannery, K.V., Grove, D.C., Marcus, J., Moyle, R.G., Price, T.D., Redmond, E.M., Reynolds, R.G., Rice, P.M., Spencer, C.S., Stoltman, J.B., Yeager, J., 2006. On the logic of archaeological inference: Early Formative pottery and the evolution of Mesoamerican societies. *Latin American Antiquity* 17, 90-103.
109. Shepard, A.O., 1946. Technological features of Thin Orange Ware. In: Kiddler, A., Jennings, J., Shook, E. (Eds.), *Excavations at Kaminaljuyu, Guatemala*. Carnegie Institution of Washington, pub. 561, pp. 198-201.
110. Shepard, A.O., 1954. *Ceramics for the Archaeologist*. Carnegie Institute of Washington, Washington, D.C.
111. Smith, M.E., Montiel, L., 2001. The Archaeological Study of Empires and Imperialism in Pre-Hispanic Central Mexico. *Journal of Anthropological Archaeology* 20: 245–284.
112. Smith, M.E., 2011. Tula and Chichen Itza: Are we Asking the Right Questions? In: Kowalski, J.K., Kristan-Graham, C. (Eds), *Twin Tollans: Chichen Itza, Tula and the Epiclassic to Early Postclassic Mesoamerican World*. Dumbarton Oaks, Washington D.C., pp.579-619.
113. Snarskis, M.D., 1985. Ceramics. In: Gorenstein, S., *Acambaro: Frontier Settlement on the Tarascan-Aztec Border*. Publications in Anthropology 32. Vanderbilt University, Nashville, Tennessee.
114. Sotomayor, A., Castillo-Tejero, N., 1963. Estudio petrográfico de la cerámica "anaranjado delgado". Departamento de Prehistoria 12, Instituto Nacional de Antropología e Historia, México.

115. Sotomayor-Castañeda, A., 1968. Estudio petrográfico del área de San Juan Teotihuacan, Edo. de México, In: Lorenzo, J.L. (Ed.), *Materiales para la Arqueología de Teotihuacan*, Serie Investigaciones XVII. Instituto Nacional de Antropología e Historia, Mexico City, pp. 39-49.
116. Spence, M., 1992. Tlailotlacan, a Zapotec Enclave in Teotihuacan. In: *Art, Ideology and the City of Teotihuacan*. Washington D.C., pp. 59–88.
117. Spence, M., White, C.D., Rattray, E.D., Longstaffe, F.D., 2005. Past Lives in Different Places: The Origins and Relationships of Teotihuacan's Foreign Residents. In: Richard E. Blanton (Ed.) *Early Civilizations, Settlement, and Subsistence: Essays in Honour of Jeffrey R. Parsons*. Cotsen Institute, University of California, Los Angeles, pp. 155–197.
118. Spinden, H.J., 1917. The Origin and Distribution of Agriculture in America. *Acts and Proceedings of the nineteenth International Congress of Americanists*, Washington D.C., pp. 269-276.
119. Strazicich, N.M., 1998. Clay Sources, Pottery Production, and Regional Economy in Chalchihuites, Mexico, A.D. 200-900. *Latin American Antiquity* 9:259-274.
120. Stoltman, J.B., Marcus, J., Flannery, K.V., Burton, J.H., Moyle, R., 2005. Petrographic evidences shows that pottery exchange between the Olmecs and their neighbors was two way. *Proceedings of the National Academy of Sciences* 102, 11213-11218.
121. Stoner, W., Pool, C.A., Neff, H., Glascock, M.D., 2008. Exchange of coarse Orange pottery in the middle classic Tuxtla mountains, southern Veracruz, Mexico. *Journal of Archaeological Science* 35, 1412-1426.
122. Stoner, W.D., 2016. The analytical nexus of ceramic paste composition studies: A comparison of NAA, LA-ICP-MS, and petrography in the prehispanic Basin of Mexico. *Journal of Archaeological Science* 76:31-47.
123. Stoops, G., 2003. Guidelines for analysis and description of soil and regolith thin sections. Soil Science Society of America, Inc. Madison, Wisconsin.
124. Stuart, D., 2000. "The Arrival of Strangers": Teotihuacan and Tollan in Classic Maya History. In: Carrasco, D., Jones, L., Sessions, S., (Eds.), *Mesoamerica's Classic Heritage: from Teotihuacan to the Aztecs*. Colorado University Press, Niwot, pp.465-513.
125. Sugiura Yamamoto, Y., Villalobos Acosta, C., Zepeda Valverde, E., 2013. Biografía cultural de la cerámica arqueológica desde la perspectiva de la materialidad: el caso del valle de Toluca. *Anales de Antropología* 47, 63–90.
126. Sugiyama, N., Somerville, A.D., 2016. Feeding Teotihuacan: integrating approaches to studying food and foodways of the ancient metropolis. *Archaeological and Anthropological Sciences* 9, 1–10.

127. Sugiyama, S., 2012. Ideology, Polity, and Social History of the Teotihuacan State. In: *The Oxford Handbook of Mesoamerican Archaeology*. Oxford University Press, New York, pp. 215–229.
128. Sugiyama, S., 1993. Worldview Materialized in Teotihuacan, Mexico. *Latin American Antiquity* 25, 111–126.
129. Taube, K., 2006. Climbing Flower Mountain: Concepts of Resurrection and the Afterlife at Teotihuacan. In: *Arqueología e Historia Del Centro de México. Homenaje a Eduardo Matos Moctezuma*. INAH, México, pp. 153–170.
130. Triadan, D. 1997. Ceramic Commodities and Common Containers. *Anthropological Papers* No. 61. University of Arizona, Tuscon.
131. Vázquez-Sánchez, E., Jaimes-Palomera, R., 1989. Geología de la Cuenca de México. *Geofísica Internacional* 28, 133–190.
132. Von Winning, H., 1987. *La Iconografía de Teotihuacan*. UNAM, México.
133. Wallis, N.J., 2011. *The Swift Creek Gift: Vessel Exchange on the Atlantic Coast*. University of Alabama Press, Tuscaloosa.
134. White, C.D., Spence, M.W., and Longstaffe, F.J., 2004. Demography and Ethnic Continuity in the Tlailotlacan Enclave of Teotihuacan: The Evidence from Stable Oxygen Isotopes. *Journal of Anthropological Archaeology* 23, 385–403.
135. White, C.D., Spence, M.W., Longstaffe, F.J., Stuart-Williams, H., and Law, K.R., 2002. Geographic Identities of the Sacrificial Victims at the Feathered Serpent Pyramid: Implications for the Nature of State Power. *Latin American Antiquity* 13, 217–236.
136. White, C., Longstaffe, F.J., Storey, R., Spence, M., 2004. Immigration, Assimilation, and Status in the Ancient City of Teotihuacan: Stable Isotopic Evidence from Tlajinga 33. *Latin American Antiquity* 5, 176–198.
137. White, C., Price, T.D.; Longstaffe, F.J., 2007. Residential Histories of the Human Sacrifices at the Moon Pyramid, Teotihuacan. Evidence from Oxygen and Strontium Isotopes. *Ancient Mesoamerica* 18, 159–172.
138. Whitbread, I.K., 1989. A proposal for the systematic description of thin sections towards the study of ancient ceramic technology, in Maniatis, Y. (ed.), *Archaeometry: Proceedings of the 25th International Symposium*. Amsterdam, Elsevier, 127–138.
139. Whitbread, I.K., 1995. *Greek transport amphorae: A petrological and archaeological study*. British School at Athens, Athens.
140. Williams, H., 1956. Petrographic Notes on Tempers of Pottery from Chupícuaro, Cerro del Tepalcate and Ticomán, Mexico. In: *Excavations at Chupícuaro, Guanajuato, Mexico*, Transactions of the Philosophical Society. The American Philosophical Society, Philadelphia, pp. 576–582.

141. Zedeno, M.N. 1994. Sourcing Prehistoric Ceramics at Chodistas Pueblo, Arizona. Anthropological Papers No. 58. University of Arizona, Tuscon.