

The Effects of Aztec Conquest on Provincial Commoner Households
at Calixtlahuaca, Mexico

by

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ABSTRACT

This archaeological study analyses households at the Postclassic site of Calixtlahuaca (State of Mexico, Mexico), to evaluate the directness and collectiveness of local and imperial Aztec rule based on their effects on the commoner population. Scholars are divided as to whether Aztec rule was generally positive (due to opportunities for economic and cultural interaction) or negative (due to taxation and loss of autonomy). Contexts at Calixtlahuaca date to three periods, the Dongu (AD 1130-1370), Ninupi (1370-1450), and Yata (1450-1530) phases. The first two phases show the pre-Aztec trajectory, which is compared to the final period under Aztec rule to disentangle general trends toward regional integration from Aztec effects. Each phase includes six excavated households.

I assess economic changes on three dimensions: foreign trade, local craft production, and household wealth. Trade is evaluated for obsidian and ceramics (INAA, petrography, type classification) and local crafting is evaluated for ceramic, lithic, textile, and molded ceramic items. Wealth is measured using all excavated artifacts, with the relative values of artifact classes based on Colonial Nahuatl wills. Prior to Aztec rule, trade was increasing and diversifying, but craft production was low. Under Aztec rule, trade reoriented toward the Basin of Mexico, craft production remained low, and household wealth stabilized. Pre-Aztec inter-household variation for all dimensions is low, before increasing during the Yata phase.

Cultural changes are evaluated for ritual activities and foodways. I evaluate the degree of interhousehold variability, the overall similarity to other parts of Central Mexico, the degree of change under Aztec rule, and immigration versus emulation as

potential explanations for that change. Evaluation is based on the distinction between high and low visibility objects and practices. The Dongu and Ninupi phase households at Calixtlahuaca were culturally homogeneous and regionally distinctive. During the Yata phase, the site became moderately more Aztec, but this change was unevenly distributed among households.

Together, the economic and cultural patterns at Calixtlahuaca indicate that the pre-Aztec local organization of power was relatively collective, but that this was partially overlaid by relatively indirect and non-collective Aztec imperial rule, with mildly negative effects.

DEDICATION

To my parents

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	xiv
LIST OF FIGURES.....	xx
CHAPTER	
1. THE PROBLEM OF SEEING AZTEC IMPERIALISM IN THE ARCHAEOLOGICAL RECORD.....	1
Interaction in Postclassic Mesoamerica.....	2
Models of Aztec Imperialism.....	6
Hegemonic vs. Territorial Control.....	7
Degree of Collective Organization.....	8
The Site of Calixtlahuaca.....	10
Research Foci.....	11
Economic Changes.....	12
Archaeological Markers of Economic Change.....	15
Cultural Changes.....	18
Archaeological Markers of Cultural Change.....	21
Summary of Research Goals.....	23
2. THE AZTEC EMPIRE.....	24
Imperialism.....	24
Theoretical Models.....	26
Classifications of Imperial Variation.....	36
Direct and Indirect Rule.....	37

CHAPTER	Page
More and Less Collective Rule.....	42
Economic Effects of Rulership Strategies.....	47
Cultural Effects of Rulership Strategies.....	51
The Aztec Empire.....	59
Imperial and Local Strategies.....	60
Previous Studies of Aztec Imperialism.....	62
The Basin of Mexico.....	62
The Provinces.....	66
Case Study Regional and Site Background.....	71
3. SITE BACKGROUND AND PROJECT METHODS.....	77
Geology and Environment.....	77
Site Description.....	80
Archaeological Work.....	84
Field Methods.....	87
Chronology.....	89
Samples.....	90
Analyses.....	93
General Ceramic Classification.....	94
Attribute Analysis.....	96
Instrumental Neutron Activation Analysis.....	99
Petrography.....	102
Lithic Analyses.....	103

CHAPTER	Page
Other Analyses.....	105
Collections and Data Management.....	106
4. “EVERY KIND OF MERCHANDISE SUCH AS MAY BE MET WITH IN THE LAND”: REGIONAL EXCHANGE SYSTEMS.....	107
The Study of Commercial Economies in Mesoamerica.....	109
Patterns of Exchange in Postclassic Central Mexico.....	111
The Basin of Mexico.....	111
Central Mexico Beyond the Basin.....	114
Trade and Empire at Calixtlahuaca.....	115
Hypotheses About Trade at Calixtlahuaca.....	116
Ceramic Importation.....	118
INAA.....	122
Petrography.....	131
Type Based Analysis.....	140
Ceramic Exchange: Results.....	150
Import Quantities and Sources.....	155
Inter-Household Variation in Ceramic Exchange.....	159
Obsidian Exchange.....	162
Sampling Calibration.....	163
Obsidian Exchange: Results.....	166
Discussion.....	172
Conclusions.....	175

CHAPTER	Page
5. “THE GRIDDLE MAKER IS ONE WHO MOISTENS CLAY”: LOCAL CRAFT PRODUCTION.....	178
Empire and Economic Development.....	179
The Economics of the Aztec Empire.....	184
Mesoamerican Craft Production.....	186
Ceramic Vessel Production.....	188
Direct Evidence for Ceramic Production.....	188
Indirect Evidence for Ceramic Production.....	190
Molded Ceramic Items.....	196
Lithic Production.....	199
Evidence for Lithic Production at Calixtlahuaca.....	202
Cloth Production.....	209
Cotton Textile Production.....	214
Maguey Textile Production.....	217
Discussion.....	219
Possible Alternatives.....	223
Conclusions.....	225
6 .“MECÍA TEICUH BOUGHT AN OLD JÍCARA FOR 15 CACAO BEANS”: MEASURING WEALTH.....	227
Quality of Life, Wealth, and Status.....	229
Quality of Life.....	230
Wealth.....	232

CHAPTER	Page
Status.....	234
Wealth Variation in Postclassic Mesoamerica.....	236
Analyses of Wealth at Calixtlahuaca.....	238
Ceramics.....	239
Lithics.....	247
Rare Items.....	251
Summary of Individual Index Results.....	254
Master Wealth Index.....	256
Historical Values of Domestic Goods in Mesoamerica.....	258
Price Standardization.....	263
Calculation of Value Ratios.....	264
Scoring Specific Value Categories.....	266
Ceramics.....	266
Lithics.....	276
Ground Stone.....	277
Rare Items.....	278
Master Wealth Index: Results.....	278
Conclusions.....	283
7. “BY THEMSELVES THEY CELEBRATED THE FEAST DAY”:	
CULTURAL CHANGES IN RITUAL PRACTICES.....	287
Rulership and Cultural Change.....	288
Aztec Policies Toward Acculturation.....	291

CHAPTER	Page
Causes of “Aztec-ization”: Travelling Pots, People or Ideas.....	293
Migration.....	294
Local Acculturation.....	300
Ethnohistoric Evidence for Migration in the Toluca Valley.....	302
Differentiating Migration and Emulation.....	304
Questions for Calixtlahuaca.....	309
Public and Private Ritual at Calixtlahuaca.....	311
Figurines.....	313
Interhousehold Variation in Figurine Use over Time	316
Intersite Comparisons of Figurines.....	322
Local and Imported Figurines at Calixtlahuaca.....	327
Figurine Analyses: Results.....	331
Censers.....	332
Interhousehold Variation in Censer Use over Time.....	334
Intersite Comparisons of Censers.....	338
Local and Imported Censers at Calixtlahuaca.....	344
Censer Analyses: Results.....	349
Conclusions.....	350
8. “THE PRINCIPAL FOODS OF THESE WERE TAMALES, BEANS”:	
CULTURAL CHANGES IN FOODWAYS.....	355
Food and Identity.....	357
Mesoamerican Foodways.....	359

CHAPTER	Page
Questions for Calixtlahuaca.....	362
Maize Preparation Practices.....	363
Ground Stone.....	367
Cooking Ceramics.....	377
Maize Preparation Practices: Results.....	388
Food Serving Practices.....	391
Serving Vessel Form Variability at Calixtlahuaca.....	392
Regional Variation in Serving Vessel Frequencies.....	395
Serving Vessel Form Analysis: Results.....	400
Analysis of Decorative Groups.....	401
Analysis of Decorative Groups: Results.....	409
Conclusions.....	410
9. CONCLUSIONS.....	417
Economic Hypotheses and Expectations.....	420
Economic Findings.....	422
Cultural Hypotheses and Expectations.....	427
Cultural Findings.....	431
Methodological Implications.....	435
Implications for Understanding the Aztec Empire.....	438
Future Research Directions.....	440
REFERENCES CITED.....	441
APPENDIX	

A. CERAMIC TYPE LIST AND CODING SHEET.....	493
B. CERAMIC ATTRIBUTE CODES, CODING SHEETS, AND CONTEXTS SAMPLED.....	501
C. INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS (INAA) SAMPLE LISTS AND LAB REPORT.....	510
D. PETROGRAPHY SAMPLE LIST AND FABRIC DESCRIPTION REPORT.....	579
E. LITHIC TECHNOLOGICAL CLASSIFICATION CODES.....	594

LIST OF TABLES

Table	Page
1.1 Archaeological Artifact Types Associated with Various Craft Production Activities Potentially Occurring at Calixtlahuaca.....	17
3.1 Excavated Household Components in the DS-1 (core household) and DS-2 (extended household) Samples with Lot Counts, Volume Excavated, and Sherd Counts.....	86
4.1 INAA Ceramic Sourcing Results by Household Component.....	124
4.2 INAA Ceramic Sourcing Group to Project Ceramic Type Correlations.....	129
4.3 Ceramic Petrography Results by Household.....	132
4.4 Ceramic INAA Group to Petrographic Group Correlations.....	133
4.5 Ceramic Petrographic Sourcing Group to Project Ceramic Type Correlations.....	137
4.6 Number of Samples Sourced by Type, with DS-1 Total and Rim Sherd Counts, and INAA and Petrography Samples Submitted and Successfully Sourced	144
4.7 Ceramic Petrography Results by Macroregion for Each of Six Sampled Household Components.....	152
4.8 INAA Ceramic Group Frequencies by Household Component, after Weighting by Vessel Form Frequencies in the Total Original Assemblages to Account for Stratification by Form in the Original Sample.....	153
4.9 Ceramic Type Classification Based Import Frequencies by Household Component and Source Macroregion with Rim Sherd and Total Sherd Based Values.....	158
4.10 INAA-Based Obsidian Source Percentages for Excavated Phases and Survey at Calixtlahuaca.....	163

Table	Page
4.11 Grey Obsidian Sourcing Results with Sample Results Divided by Phase and Lithic Production Technology. Includes both Burke and MURR Sample Results.....	164
4.12 Primary Obsidian Sources by Phase, Showing Correction Procedure Based on Production Technology Frequencies by Phase to Adjust for Lithic Production Technology Related Bias in Original Sample Selection.....	166
4.13 Comparative Total and Green Obsidian Frequencies for Late Classic to Early Colonial Sites in Central Mexico.....	168
4.14 Green and Total Obsidian Quantities by Household Component, with Obsidian Weights, Counts, and Standardizations by Rim Sherd and Total Sherd Counts.....	170
4.15 Comparative Frequencies of Imported Ceramics at Postclassic Central Mexican Sites.....	174
5.1 Excavated Contexts at Calixtlahuaca with Overfired Sherds.....	190
5.2 INAA Based Frequencies of Local and Imported Ceramics by Macroregion Showing Adjustment for Vessel Form Frequencies during the Phase.....	191
5.3 Standardization Measure Values for Ceramic Bowls, Jars, and Hourglass Censors, by Phase.....	195
5.4 Molds for Small Ceramic Items at Calixtlahuaca by Type and Provenience.....	197
5.5 Total and Production Related Lithic Frequencies for Core-Blade, Biface and Bipolar Lithic Production Artifacts by House and Phase.....	204
5.6 Cotton and Maguey Spindle Whorl Frequencies at Calixtlahuaca and other Comparative Sites.....	212

Table	Page
5.7 Cotton (cotton-weight whorls and spinning bowls) and Maguey (maguey-weight whorls and tabular basalt scrapers) Textile Production Tool Frequencies per 1000 Total Sherds by Household Component.....	216
5.8 Summary of Craft Production Artifact Frequencies by Household Component.....	222
6.1 Simple Ceramic-Based Wealth Measures (% serving vessels, % decorated ceramics, Smith index of decorated and imported ceramics) by Household Component.....	241
6.2 Ceramic Production Step Value Scoring.....	244
6.3 Average Production Step Index Values by Household Component.....	246
6.4 Obsidian-Based Wealth Indices (Total obsidian/1000 sherds, green obsidian/1000 sherds, % green obsidian) by Household Component.....	249
6.5 Rare Item Counts by Household Component, with Frequencies per 1000 Sherds...	252
6.6 Documentary Values for Domestic Items Recovered in Mesoamerican Archaeological Contexts.....	261
6.7 Ceramic Vessel Forms and Prices in the Codex of the Potters of Cuauhtitlan.....	268
6.8 Excavated Ceramic Assemblage Value Calculations, Based on Historic Price Ratios	275
6.9 Master Wealth Index Values for Ceramics, Lithics, Ground Stone, and Rare Items, by Excavated Component, Based on Historical Price Ratios.....	281
6.10 Household Component Level Pearson's R Correlations and Chi-Squared Significances for the Master Index and its Component Factors	283
7.1 Total Figurine Frequencies per 1000 Sherds and Subject Matter Percentages of Identifiable Pieces, by Household Component and Phase at Calixtlahuaca.....	321

Table	Page
7.2 Figurine Frequencies per 1000 Sherds and/or 100 Rims at Calixtlahuaca and Comparative Postclassic Central Mexican sites.....	324
7.3 Percentages of Figurine Subject Categories at Calixtlahuaca and Comparative Sites, with K-means Clustering Results for 2-6 Groups.....	325
7.4 Figurine Paste Groups by Household Component.....	329
7.5 Rim and Total Sherd Based Frequencies of Functional Censer Classes by Household Component, with Summary Statistics by Phase.....	337
7.6 Functional Censer Form Frequencies out of Total Rim Sherds at Calixtlahuaca and Comparative Sites, with K-means Cluster Results.....	340
7.7 Functional Censer Form Frequencies out of Total Sherds at Calixtlahuaca and Comparative Sites, with K-means Cluster Results.....	342
7.8 INAA Group Results with Regional Affiliations) for Censers and Sahumadors, by Project Ceramic Classification Type.....	345
7.9 Petrography Group Results with Regional Affiliations for Censers and Sahumadors, by project Ceramic Classification Type.....	345
7.10 Summary of Results of Analyses of Ritual Practices Showing Shifts in Interhousehold Variation and Local vs. Basin of Mexico Cultural Patterns Under Local and Aztec Imperial Rule.....	351
8.1 Mano and Metate Counts and Frequencies per 1000 Sherds by Household Component at Calixtlahuaca.....	368
8.2 Grinding Stone Frequencies at Calixtlahuaca and Comparative Central Mexican Sites.....	370

Table	Page
8.3 Mano Handle Forms by Household Component at Calixtlahuaca.....	373
8.4 Means, Standard Deviations, and Coefficients of Variation for Mano Thickness and Mano Width by Phase.....	374
8.5 Mano Cross-Section Shapes by Household Component at Calixtlahuaca.....	376
8.6 Comals as Percentages of per Total Sherds and Rim Sherds by Household Component at Calixtlahuaca, with Summary Statistics by Phase.....	379
8.7 Comal Frequencies as Percentages of Total Sherds and Rim Sherds at Calixtlahuaca and Comparative Postclassic Sites in Central Mexico.....	381
8.8 INAA and Petrography Sourcing Results by Geographic Macroregion for Comals	383
8.9 Interior-Incised Jars as Percentages of Total Sherds and of Plain/Eroded Jar Sherds by Household Component at Calixtlahuaca.....	386
8.10 Relative serving Vessel Form Frequencies by Rims Sherds and Total Sherds, by Household Component at Calixtlahuaca.....	393
8.11 Serving Vessel Form Frequencies from Rim Sherd Counts at Calixtlahuaca and Comparative Sites, with K-means Clustering Results for 1-5 Clusters.....	397
8.12 Serving Vessel Form Frequencies from Total Sherd Counts at Calixtlahuaca and Comparative Sites, with K-means Clustering Results	400
8.13 Major Ceramic Decorative Groups and Associated Vessel Forms at Calixtlahuaca	403
8.14 Ceramic Decorative Group Frequencies by Household Component, with K-Means Clustering Results and Summary Statistics by Phase.....	408

Table	Page
8.15 Summary of Results of Analyses of Foodways Showing Shifts in Interhousehold Variation and Local vs. Basin of Mexico Cultural Patterns Under Local and Aztec Imperial Rule.....	411

LIST OF FIGURES

Figure	Page
1.1 Map Showing the Location of Calixtlahuaca within Central Mexico Relative to the Aztec Capital of Tenochtitlan and General Regional Topography.....	3
1.2 Postclassic Chronologies at Calixtlahuaca and Comparable Central Mexican Sites.....	6
2.1 The Maximum Extent of the Aztec Empire, showing the Imperial Core, Territorial, and Strategic Provinces.....	60
2.2 Comparative Postclassic Sites in Central Mexico used for Analysis in this Dissertation.....	63
2.3 Comparative Postclassic Sites in Western Mesoamerica with Prior Archaeological Work Discussed in this Dissertation, with the Territories of the Aztec Empire shown...	67
3.1 Map of the Site of Calixtlahuaca showing Site Boundaries, Monumental Architectural Groups, and Excavation Unit Locations.....	79
3.2 The Round Pyramid (Group C) at Calixtlahuaca.....	82
3.3 Monumental Group D at Calixtlahuaca.....	83
3.4 Typical House at Calixtlahuaca (Excavation Unit 309).....	83
3.5 Schematic of the DS-1 (Core Household Sample) to DS-5 (all Excavated Contexts) Samples of Contexts Excavated by the Calixtlahuaca Archaeological Project.....	91
4.1 Geographic Source Macroregions for Ceramics Excavated at Calixtlahuaca.....	119
4.2 Selected Ceramic Types Associated with the Basin of Mexico Source Macrogroup, Based on both INAA and Petrographic Analyses.....	121
4.3 Selected Ceramic Types Associated with the S/SW State of Mexico Source Macrogroup, Based on both INAA and Petrographic Analyses.....	122

Figure	Page
4.4 Summary of Imported Ceramics by Macroregion by Phase, Based on INAA (A), Petrography (B), Types, Rim Sherds Only (C), and Types, all Sherds (D).....	151
4.5 INAA Ceramic Imports by Household Component. Values from Table 4.6.....	160
4.6 Rim Sherd Type-Based Ceramic Imports by Household Component.....	160
4.7 Obsidian Source Frequencies per 1000 Sherds by Phase.....	171
5.1 Examples of Figurine Molds and Spindle Whorl Molds Excavated at Calixtlahuaca.....	198
5.2 Histogram of Spindle Whorl Frequencies per 1000 Sherds at Postclassic and Early Colonial Sites.....	213
5.3 Decorated and Plain Cotton Spindle Whorls from Calixtlahuaca, showing the Range of Variation in Shapes.....	215
5.4 Examples of Maguey Spindle Whorls from Calixtlahuaca.....	218
5.5 Tabular Basalt Maguey Scrapers (“Desfibradores”) from Calixtlahuaca.....	219
5.6 Relationship Between Component Size (sherd count) and the Number of Craft Activities Present.....	220
5.7 Temporal Trends in Craft Production at Calixtlahuaca, by Craft.....	221
6.1 Summary of Selected Wealth Indices by Phase.....	255
6.2 Summary of Highest and Lowest Scoring Components for Each Phase for Selected Wealth Indices.....	256
6.3 Vessel Forms Depicted in the Codex of the Potters of Cuauhtitlan.....	271
6.4 Master Wealth Index Results by Phase, with Contribution of Each Artifact Class...	280

Figure	Page
7.1 Expected Patterns of High- And-Low Visibility Items in Cases of Migration and Local Emulation.....	306
7.2 Selected Figurines from Calixtlahuaca.....	315
7.3 Hierarchical Clustering Results for Figurines for Calixtlahuaca by Phase and Comparative Sites.....	327
7.4 Figurine Frequencies per 1000 Sherds by Household Component, Subdivided by Figurine Source Group.....	330
7.5 Censer and Sahumador Forms.....	333
7.6 Hierarchical Clustering Results for Functional Censer Forms at Calixtlahuaca and Comparative Sites, Based on Percentages of Rim Sherds.....	341
7.7 Hierarchical Clustering Results for Functional Censer Forms at Calixtlahuaca and Comparative Sites, Based on Percentages of Total Sherd Counts.....	343
7.8 Frequency of Texcoco Molded-Filleted Sahumadors at Calixtlahuaca as a Percentage of Total Sherds, by Household Component.....	348
8.1 Stepwise Processing Decisions for Five Common Maize Foods.....	365
8.2 Mano Handle and Cross-Section Forms.....	372
8.3 Graph of Comals as a Percentage of all Sherds, by Household Component.....	378
8.4 Interior-Incised Jar Sherds.....	384
8.5 Scatterplot of Comal and Interior-Incised Jar Sherds, as Percentages of all Vessel Sherds.....	388
8.6 Rim Sherd Based Hierarchical Clustering Results for Serving Vessel Forms at Calixtlahuaca and Comparative Sites	398

Figure	Page
8.7 Total Sherd Count Based Hierarchical Clustering Results for Serving Vessel Forms at Calixtlahuaca and Comparative Sites	399
8.8 Primarily Local Ceramic Decorative Families.....	404
8.9 Primarily Non-Local Ceramic Decorative Families.....	405
8.10 Hierarchical Clustering Results for Ceramic Decorative Family Frequencies.....	406

CHAPTER 1. THE PROBLEM OF SEEING AZTEC IMPERIALISM IN THE ARCHAEOLOGICAL RECORD

The ethnohistoric documentation of the Aztec Empire provides a rich tapestry of alliances between cities, military victories, treacherous nobles and wise advisors.

Pointedly absent from this picture is the commoner majority of the population, especially outside of the Basin of Mexico. In an effort to provide a window on this silent majority, I ask whether political incorporation into the empire resulted in changes to the everyday lives of commoners living in provincial areas, using the Postclassic (AD 1130-1530) site of Calixtlahuaca, Mexico as a case study (Figure 1.1). Berdan and Smith (1996:216-217) identify the effects of Aztec imperialism on commoners as one of the least understood aspects of the Aztec Empire.

This project focuses on changes in economic interaction and cultural practices, two domains where previous work (Berdan, et al. 1996; Brumfiel 1998; Overholtzer 2012; Smith 2003c) suggested that Aztec processes of consolidation of control and ongoing rulership might have affected commoners as well as elites. In order to distinguish the results of imperial rulership strategies from more generalized regional cultural change, I compare three time periods (prior to the establishment of the empire, during the initial imperial formation and expansion into other areas, and after the Aztec conquest of the study site itself). I assess economic interaction by looking at regional patterns of trade, local craft production, and household wealth. My examination of cultural change focuses on foodways and domestic ritual practices. I use these to evaluate general trajectories of cultural change at the site, as well as the degree of interhousehold

variation over time. These analyses are used to compare scenarios for economic and cultural interaction based on two popular dimensions for interpreting imperial/provincial interaction: direct vs. indirect rule, and the degree of collectiveness of the state. Prior considerations of these two dimensions of rule have produced very different interpretations of the Aztec state, with descriptions (Hassig 1985, 1988; Smith and Berdan 1996b) of the Aztec Empire as an indirect-rule empire with minor negative effects on conquered areas contrasting with those that portray it as a relatively collective state where rulers were accountable to their subjects (Blanton and Fargher 2008; Fargher and Blanton 2007; Fargher, et al. 2011).

Interaction in Postclassic Mesoamerica

The Postclassic period (AD 900-1521) in Mesoamerica saw two major processes. The first was a steadily increasing degree of cultural interaction and economic integration across wide geographic regions, throughout the period. The second was the foundation and expansion of the Aztec Empire, beginning in the AD 1428 and continuing through the arrival of the Spanish in 1519. One of the major issues in investigating Aztec imperialism is differentiating the effects of these two processes, that is, the effect of Aztec rule from broader background processes of cultural and economic change.

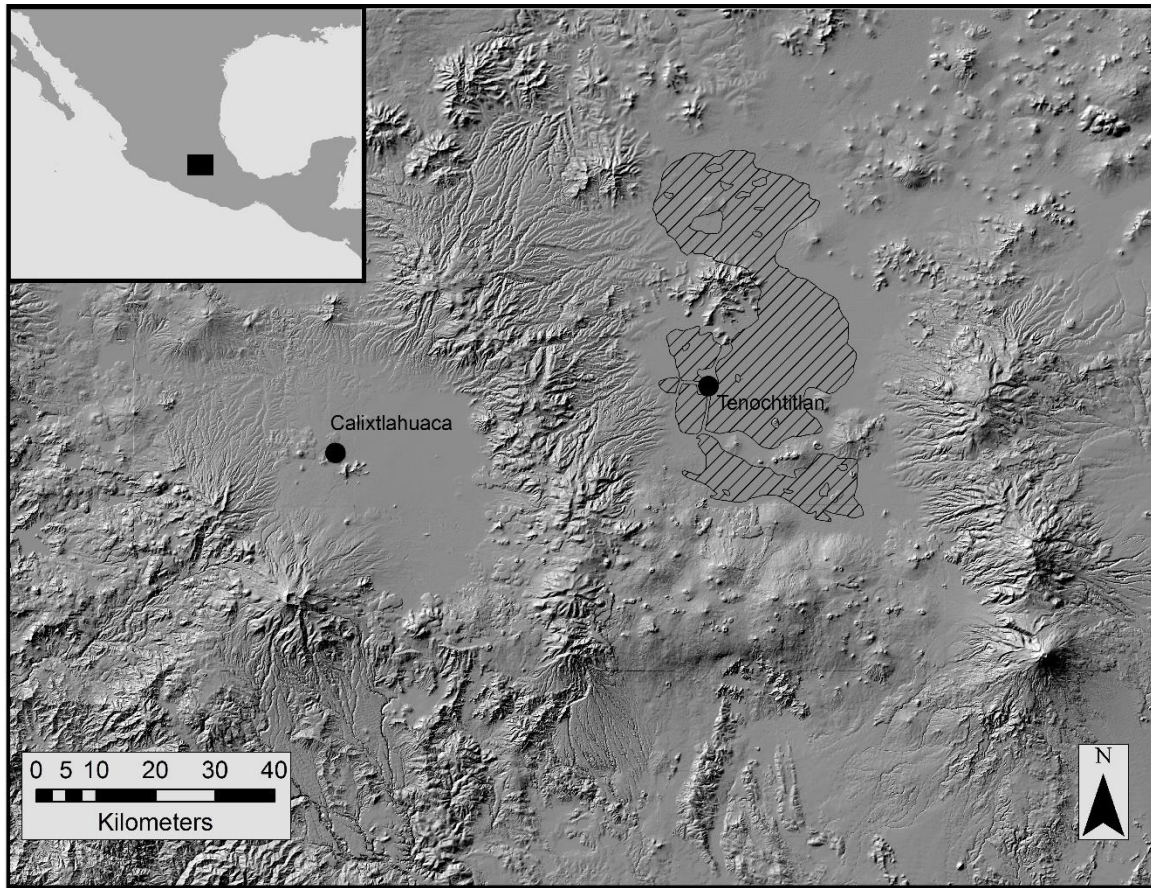


Figure 1.1 Map showing the location of Calixtlahuaca within Central Mexico relative to the Aztec capital of Tenochtitlan and general regional topography.

The first process, of increasing cultural interaction and economic integration, can be glossed as the development of the Postclassic Mesoamerican world-system. This process began in the Early Postclassic as Mesoamerican peoples sought to reformulate networks interrupted by the political collapses of states and their associated economic systems at the end of the Classic period. It resulted in widely shared cultural practices and stylistic traits across much of Mesoamerica (Boone and Smith 2003; Ringle, et al. 1998; Smith and Heath-Smith 1980). It is also closely related to the development of a well-integrated system of market exchange for both local and long-distance trade. However, at

smaller geographic scales, there is substantial variation in the degree to which individual sites and regions participated in the broader world-system.

The second process, the expansion of the Aztec Empire, took place against the preexisting backdrop of Postclassic interaction across Mesoamerica, including a city-state form of political organization, shared elite symbols and culture, and a well-integrated market system. On a more geographically specific level, the Aztec Empire also followed other attempts at state-building in the Basin of Mexico, most immediately the Acolhua and Tepaneca states. As a result, many shared traits used as markers of the Aztec Empire actually predate its establishment (Sergheraert 2009). The Aztec Empire, or Triple Alliance¹, was founded as an alliance among the Basin of Mexico city-states of Tenochtitlan, Texcoco, and Tlacopan in AD 1428. The alliance promptly conquered the remainder of the Basin of Mexico and began expanding outward. By the time the Spanish arrived in 1519, Tenochtitlan had come to dominate the alliance, which then controlled territory from one coast of Mesoamerica to the other. The empire was funded by a regularized system of taxes, paid by conquered provinces, and managed by a combination of local and imperial officials (Smith 2015a).

These two processes result in issues of equifinality when interpreting cultural or economic changes during the latter portion of the Postclassic period. Such issues can be

¹ There was never a group of people who called themselves the Aztecs nor a political unit that called itself the Aztec Empire. I follow the regional archaeological and art historical convention of using the term Aztec to refer to the occupants of Middle and Late Postclassic (1100-1521 CE) Central Mexico and use Triple Alliance and Aztec Empire interchangeably to refer to the expansionist political unit created by the AD 1428 alliance of the city-states of Tlacopan, Tenochtitlan, and Texcoco. Thus, there were Aztecs before the founding of the Aztec Empire, and not all members of the empire were Aztecs.

minimized by the investigation of sites that meet two criteria: material culture distinct from that of the Basin of Mexico, and a sufficient rate of cultural change over time to allow for the development of fine-grained archaeological chronologies. First, if there is a reasonable degree of preexisting difference between local material culture and that of the Basin of Mexico, it makes it easier to distinguish between the local adoption of foreign practices and similarities resulting from parallel development from the same starting point, such as an earlier immigrant population.

Second, many regions in Mesoamerica have Postclassic chronologies consisting of 100-200 year phases. Given that the Aztec Empire only existed for around 100 years, and that in later-conquered provincial areas, the period under Aztec rule may be substantially shorter than this, chronologies intended to address questions of Aztec rule need to be able to differentiate 50-70 year phases (Figure 1.2). When this can be done, it allows for the identification of pre-Aztec trajectories, establishing a baseline and the direction of change in interregional interaction over time. This baseline can then be compared to the changes observed under Aztec rule. Unfortunately, cultural differences and the potential for good chronological control vary inversely with each other. Sites closer to the Basin of Mexico generally have less cultural differences from the Aztec heartland, but they were also under Aztec rule for a longer period of time, making it more likely that a distinct chronological phase for the period under Aztec rule can be identified but less likely that Aztec material will be distinctive from local traditions. The reverse is true of sites closer to the edges of the empire.

	Regional Period	Toluca Valley History	Calixtlahuaca	Yautepec	Xaltocan
1550	Colonial	F: Spanish Colonial Period		Santiago	Isla
1500	Late Aztec/ Late Postclassic	E: Mexica reign over T.V.	Yata (phase 6)	Molotla	Tlalli
1450		D: Early Mexica empire	Ninupi (phase 4)	Atlan	
1400		C: Reign of Tezozomoc			
1350		Early Aztec/ Middle Postclassic	B: Early Tepanec empire	Dongu (phase 2)	
1300	A: Legendary period				Dehe
1250					
1200					
1150	Toltec/ Early Postclassic				
1100					
Source	Sanders et al. 1979	Tomaszewski and Smith 2011	Huster and Smith 2015	Hare and Smith 1996	Overholtzer 2014

Figure 1.2 Postclassic chronologies at Calixtlahuaca and comparable Central Mexican sites

Models of Aztec Imperialism

The effects of Aztec imperialism can be best understood in a broader context of research on the imperialism. Comparative research on empires has identified multiple

dimensions of variation in the organization of empires, related to different dimensions of imperial strategies and imperial/provincial relations. I present a brief introduction to two models applied to the Aztec Empire here, and these and other related dimensions of variation are discussed in more detail in the following chapter. The specific implications of each dimension of variation, for the household level, are discussed later in this chapter, under economic and cultural scenarios.

Hegemonic vs. Territorial Control

Imperial control may be characterized on a continuum between hegemonic (or indirect) and territorial (or direct) rule (Hassig 1985; Luttwak 1976). This continuum applies both within empires, where inner provinces are more likely to be directly controlled, and among empires, where some states are more territorial or hegemonic overall. Indirect rule is characterized by rule via client states, where an empire leaves most of the local power structure and administrative machinery in place. Compliance with imperial policies is generally enforced through the cooption of local elites and the threat of military force. By placing the cost of administering a province on local government, indirect rule provides an inexpensive means of controlling territories, but one that is subject to regular revolts and one that is limited in how much it can extract from provincial areas. Indirect rule is likely to produce relatively few cultural changes in provincial areas and have a neutral to somewhat negative economic effect. Proposed examples of relatively hegemonic states include first century Rome (Luttwak 1976) and the Aztec Empire (Hassig 1985, 1988).

In contrast, under direct rule, prior local rulers and administrative structures are replaced by those managed by the empire. Compliance is enforced through a much greater penetration of imperial bureaucracy into multiple aspects of society, though military force remains an option for enforcing compliance. This form of rulership is much costlier for the imperial state, but produces more stable control over provincial areas and permits a higher overall possible degree of exploitation. It is likely to produce a higher degree of cultural change at all levels of provincial society. The economic effects of direct rule are also more pronounced, but may be either positive or negative depending on the balance between new opportunities for economic development and new taxes.

Degree of Collective Organization

An empire may also be characterized by how collective it is, ranging from non-collective (or network-oriented) to highly collective (or corporate-oriented) states (Blanton and Fargher 2008; Blanton, et al. 1996; Fargher and Blanton 2007). This dimension describes the social organization of power within the empire. In relatively non-collective states, power is based on exclusivity. Elite status, and the right to rule, is confirmed by the exclusive control of particular classes of goods, especially non-local goods. Rulers are not broadly obligated to provide public goods to the population, and those goods they do provide are used to create personal relationships of clientage. There are few checks on what rulers are permitted to do (up to arbitrarily putting people to death), but rulers also have relatively little ability to motivate their populace to provide high levels of taxes to the state. States based on this organizational form are generally funded by external revenue sources, such as external trade in luxury goods. Most

Southeast Asian states, such as Vijayangara, are relatively non-collective (Blanton and Fargher 2008), and within Mesoamerica, the Classic-period Maya characterize this end of the spectrum (Blanton, et al. 1996).

In contrast, in relatively collective states, power is based on social integration. Elites rule based on broad popular support and the ability to successfully provide public goods to the population. Authority is derived from offices rather than personal authority. Rulers are accountable to their subject populations, both for the services that they are culturally expected to provide and for the limits to their authority. Because of the need to provide public goods, more collective states generally have larger, more complex bureaucracies. These also allow such states to depend more heavily on internal sources of revenue, such as taxes on staple crops. More collective states can generally leverage a higher level of taxation from their populations, but are also expected to provide a higher level of services in return. The Inka Empire is an example of a relatively collective state on a cross cultural scale (Blanton and Fargher 2008). Within Mesoamerica, Teotihuacan is considered to have had more collective rulership (Blanton, et al. 1996).

In a broad sense, these two dimensions of rulership – directness and collectiveness - should co-vary. More indirect strategies depend more heavily on drawing local elites into imperial networks, while more direct rule would require a higher degree of commoner participation, likely requiring somewhat more collective strategies. Similarly, both direct rule and collective rule usually rely on internal financing, which should produce a correlation between these two dimensions of imperial variation. As a result, the differences between Hassig's (1985, 1988) and Blanton and Fargher's (Blanton and Fargher 2008; Fargher and Blanton 2007) conclusions about the nature of the Aztec

Empire require further exploration. The two dimensions of imperialism provide a theoretical framework for predictions about the economic and cultural effects that different forms of rule are likely to produce.

The Site of Calixtlahuaca

The study site of Calixtlahuaca is located in a geographically intermediate region, where the requirements for both cultural differences and temporal control can be met. As a regional capital with a documented Aztec administrative presence, the site provides a good location for looking at the effects of Aztec rule. Calixtlahuaca is a large city-state capital located in the Toluca Valley of Central Highland Mexico, occupied between AD 1130 and 1530 (Huster and Smith 2015). The Toluca Valley (sometime called the Upper Lerma) is located immediately to the west of the Basin of Mexico core of the Aztec Empire, which places it geographically within the inner provinces of the empire. However, the Toluca Valley diverges culturally from much of the rest of Central Highland Mexico during the Early Postclassic. Among other distinctive traits, the region maintains a predominately red-on-buff decorated pottery assemblage, almost no comals among the plainwares, a heavy reliance on West Mexican obsidian sources, hilltop or hillside locations for major cities, and cemetery burials in plaza settings throughout the Postclassic, all of which differ from the cultural practices of the Basin of Mexico by the Middle Postclassic.

This degree of cultural difference is, however, accompanied by a relatively long span of time under Aztec rule, due to the region's proximity to the Basin of Mexico.

Based on ethnohistoric sources, the Toluca Valley was conquered by Axayacatl by the mid-1470s, though the region also appears in among the conquests of the subsequent ruler of Tenochtitlan, Tizoc, suggesting some degree of reconquest in the early 1480s (Hernández Rodríguez 1998; Tomaszewski and Smith 2011). These dates indicate that the area spent at least 40 years under Aztec rule prior to the arrival of the Spanish in 1519. Archaeological work at this site differentiates three time periods, the Dongu Phase (AD 1130-1380), Ninupi Phase (1380-1450) and the Yata Phase (1450-1530) (Huster and Smith 2015). While not exact matches to the historical chronology, these phases provide reasonable proxies for the periods prior to state formation in the Basin of Mexico, the periods of the Tepaneca state and the early Triple Alliance when Calixtlahuaca was still independent, and the period during which Calixtlahuaca was under Aztec rule (Figure 1.2).

Recent work at the site by the Calixtlahuaca Archaeological Project, directed by M. E. Smith, excavated a wide range of household and terrace contexts at the site. I use all of the securely associated material from a single household excavation dating to a single phase as my primary unit of analysis and refer to these units as household components. There are six household components dating to each phase of the site's occupation.

Research Foci

Beyond identifying sites where it is possible to investigate Aztec imperialism, it is also necessary to identify aspects of commoner life where Aztec rule is likely to have had

an influence under different forms of imperialism. Various authors have identified a general trio of power sources in imperial rule: economic sources, control over knowledge, and military force (Goldstone and Haldon 2009:4; Yoffee 2005:38-40). As military force is unlikely to be visible at the household level, I focus on economic and cultural changes. For both domains, variation in the directness and collectiveness of rule are likely to have produced differing effects on commoner households. Theoretically based predictions about economic and cultural change under different forms of rulership can be adjusted for local conditions based on a combination of the ethnohistoric information available for Calixtlahuaca and the existing archaeological work both in and outside of the Basin of Mexico.

Economic Changes

Research on the effects of the growth of the Aztec Empire on conquered city-states suggests a continuum of postconquest economic effects on trade, local production, and quality of life (Brumfiel 1980; Nichols, et al. 2002; Nichols, et al. 2009; Smith 2003c; Smith and Heath-Smith 1993). Mostly indirect rule and/or network-oriented rule should produce relatively few changes in regional economic patterns compared to the period prior to imperial rule. More direct rule and/or collective rule should produce more noticeable economic changes, generally oriented in more positive directions due to the potential for economic development among both commoners and elites, due to a consistent and reliable provisioning of public goods. Each of these theoretical outcomes is the product of more complex balances among the imperial tax load, the opportunities for trade provided by the Aztec Empire, and the local responses to these influences. I

present two scenarios below, based on relatively indirect, non-collective rule, and on relatively direct, collective rule. As the rulership variables are continua, intermediate positions are both possible and probable.

Economic Scenario 1. In this scenario, Aztec rule was relatively indirect, with a network-oriented rulership strategy focused on co-opting local elites. Under these conditions, I expect the conquest by the Aztec Empire to have had little effect on existing economic patterns, as is more commonly seen in the outlying provinces of the empire. I expect to see the continuation or intensification of pre-conquest patterns of local craft production and market exchange, and a relatively low frequency of artifacts from the Basin of Mexico. Overall wealth should remain steady or follow pre-Aztec trajectories. This pattern is characteristic of sites in strategic provinces or otherwise near the edges of the empire that had relatively little pre-imperial contact with the Basin of Mexico (i.e., Kowalewski, et al. 2010; Venter 2012). Calixtlahuaca might follow this pattern because, while part of a tributary rather than strategic province, the Toluca Valley still formed part of the buffer zone between the Aztec and Tarascan empires. In addition, the preliminary ceramic analysis from Calixtlahuaca suggests an almost complete lack of interaction with the Basin of Mexico prior to the Late Postclassic, which might have slowed the region's integration into Basin-centric market networks after its incorporation into the Aztec Empire. The presence of relatively indirect, network-based rule by the Aztec Empire is compatible with a range of degrees of collectivity of local, pre-Aztec governance. I consider this the more likely of the two economic scenarios presented here.

Economic Scenario 2. In this scenario, Aztec rule was more direct, with a more collective rulership strategy that worked to incorporate both commoners and elites directly into the imperial system. Under these conditions, I would expect to see more extensive changes in the local economic system under Aztec rule, as is seen at sites in the Basin of Mexico. I expect to see a reduction in either the diversity or total quantity of local craft production and an increased volume of trade with the imperial capital of Tenochtitlan and/or the Basin of Mexico at the expense of trade with other foreign regions. This may be described as a change in market systems from a primarily interlocking central-place system, with smaller centers evenly distributed between multiple next-order centers and accessing multiple markets, to a primarily dendritic central-place system, with each center trading only at single higher-order center, and the highest regional center heavily tied to a geographically distant primate center (Smith 1976). Overall wealth should decrease. Examples toward this end of the continuum include Morelos (Smith 2010) and portions of the Basin of Mexico (Nichols, et al. 2002). Calixtlahuaca may show this pattern due to its geographic proximity to the Basin of Mexico, the post-conquest rearrangement of local power known from the codices (Chimalpahin 1965 [1606-1631]:105), and the importance of the region in supplying maize to the Basin of Mexico (Paso y Tronasco 1905-1906:7[2]:6-7). This pattern is more likely to have been successful when local governance was already relatively collective, allowing for the Aztec cooption of preexisting systems.

Archaeological Markers of Economic Change

My assessment of these economic scenarios has three components; for each chronological phase I determined the quantity and diversity of foreign exchange, whether local craft production intensified or diminished relative to the other phases under consideration, and whether household wealth increased or decreased.

Analysis of Trade. I address long distance economic connections through three analyses of ceramics and one of lithics (Chapter 4). Ceramic exchange was evaluated using INAA (Instrumental Neutron Activation Analysis), petrography, and type classification, while lithic exchange was evaluated based on XRF (X-Ray Fluorescence) sourcing. These methods provided an overview of the number of trading regions with which Calixtlahuaca had connections during each phase, the volume of foreign goods arriving at the site, and their distribution among households. These show how well integrated Calixtlahuaca was into broader regional exchange networks over time. The comparisons among multiple methods of ceramic analysis and multiple artifact classes provide robust support for the trends that I identify.

First, a stratified random sample of thirty sherds, including both plain and decorated types, from each household component at the site was chemically characterized using INAA. As a random sample, the primary use of these sherds was to provide an independent measure of ceramic variation within and between households, based on the distribution of source groups. Increased Aztec influence is expected to appear as an increased frequency of ceramics from Basin of Mexico source groups, and a reduction in

the number and/or frequency of other non-local sources as Basin of Mexico ceramics became more widely available, more socially prestigious, and/or less expensive.

Second, a similar sample of twenty sherds per household was taken from two household components for each phase for petrography. This sample was used as an independent check on the trade volume, directionality, and interhousehold diversity patterns in the INAA sample. In addition, 7-10 sherds from each INAA group were also submitted for petrography to allow for the direct comparison of the source groups produced by the two methods.

Third, I used the associations between types and source groups in the preceding two analyses to assign general geographic associations to all of the basic type-classified ceramics from all household components. This allowed for a much larger sample size than the initial samples studied through materials analyses, and an associated identification of trade that occurred in very low frequencies. All three methods of ceramic analysis show a high degree of agreement in the directionality and volume of trade over time.

Lithic exchange was evaluated at the phase, rather than individual household, level. The lithic assemblage at the site consists primarily of obsidian, which was visually sorted into grey and green groups in the field. XRF was used to determine the contribution of various sources to the grey fraction for each phase, and to confirm that the green fraction came from the Pachuca source.

Identification of Local Craft Production. The intensity and inter-household variability of local craft production at Calixtlahuaca was assessed directly based on

production related artifact frequencies for maguey and cotton textiles, and bifacial, core-blade, and bipolar lithic production (Chapter 5). I assessed ceramic vessel production primarily indirectly, based on the previously discussed INAA and petrography samples (see Table 1.1 for artifact types associated with each craft.) Overall, local ceramic production is measured as the percentage of the INAA samples falling within the local source groups. In a well-integrated market system, local specialization is expected to increase, due to an increased reliability of supply of basic necessities from other sources. As a result, changes in the organization of local craft production can be used as a secondary line of evidence for participation in regional economic systems over time. Cloth production may be an exception to general trends of craft production, due to its use for tax payments.

Craft	Archaeological Indicators	Source
Ceramic vessel production	Waster sherds, concentrations of one type of sherd	Rice 1987, Stark & Garraty 2004
Lithic production (Bifacial, Core-blade, Bipolar)	Lithic artifact types associated with the production sequence for each technology	Hirth 2006a
Maguey fiber	Large (>10g) spindle whorls, tabular basalt scrapers	Parsons & Parsons 1990
Cotton fiber	Small (<10g) spindle whorls, spinning bowls	Parsons 1972, Smith & Hirth 1988

Table 1.1 Archaeological artifact types associated with various craft production activities potentially occurring at Calixtlahuaca

Evaluation of Household Wealth. Household wealth serves as a means of evaluating the overall effects of economic changes on commoner quality of life. Household wealth was evaluated for each household component using a variety of single-

artifact class measures, followed by a combined index that incorporated multiple artifact classes (Chapter 6). Single-class measures of wealth included multiple measures of ceramic wealth, such as bowl/jar ratios, the percentage of decorated ceramics, bowl and censer measures used at other Aztec sites (Smith 2006c), and production-step based values. Other measures include the percentage of green obsidian, the frequency of obsidian per 1000 sherds, and the frequency of bronze and jewelry items. These single-artifact measures tended to correlate poorly with each other, leading me to develop a combined index. In the combined index, I assigned relative weights to the values of four common artifact classes (ceramics of multiple sizes, lithics, ground stone, and jewelry/bronze) based on values given in Colonial-period Nahuatl documents. This allows for a single evaluation of overall household wealth over time, despite shifts in the availability of goods from particular regions over time, which influenced particular single artifact-class measures.

Cultural Changes

The degree and manner in which cultural practices change under imperial rule are also affected by forms of rulership. Relatively indirect and non-collective forms of rulership should have relatively little direct effect on the practices of commoner households, though commoners may choose to adopt such practices for other reasons. Relatively direct and relatively collective forms of rulership should both produce a higher degree of cultural change due to increased contact between imperial and local people.

The effect of Aztec conquest on cultural practices within commoner households is a topic on which archaeology can provide significant insights. Documentary sources

suggest that the Aztec empire promoted the use of shared elite material culture, practices, and values, but did not similarly target commoners (Berdan, et al. 1996), raising significant questions about the causes of cultural change following incorporation into the empire. At the same time, the Aztec Empire did promote stereotypes of particular ethnic groups and their practices (Berdan 2008). Previous research, based on domestic ritual assemblages, suggests that state ideology did not have a significant influence on commoner households (Brumfiel 1998; Klein and Victoria Lona 2009). Several authors, however, have proposed that changes in food preparation and consumption practices in Postclassic Mesoamerica may be indicative of broader social changes, presenting an additional line of evidence that can be used to address imperial conquest related cultural change (Biskowski 2000; Blanton, et al. 1993). In addition to looking at evidence for the directness and collectiveness of Aztec rule, I also evaluate local emulation as opposed to immigration of settlers from the Basin of Mexico as explanations for any observed cultural changes. Based on Clark (2001), these patterns can be differentiated by the presence or absence of foreign material culture and foreign style practices in low and high visibility contexts.

Cultural Scenario 1. Under conditions of relatively indirect and/or non-collective rule, commoners would not have been actively targeted by Aztec ideology, nor the direct focus of most imperial policies. As a result, there would have been little to no official pressure to adopt Aztec-style material culture or practices. In this scenario, Aztec-style artifacts would be expected to appear occasionally in high-visibility contexts, as references to one among many distant connections. Aztec-style practices, which require

more interaction to learn, should be mostly absent. Neutrality can be contrasted with an active resistance to Aztec practices, which would be visible as the complete absence of Aztec style artifacts in certain households when the household's wealth level and the overall site frequency for the phase suggest that they should be present.

Cultural Scenario 2. Under conditions of more direct and/or collective rule, commoners would have had a higher degree of day-to-day interaction with individuals using Aztec goods and/or practices, and a higher degree of participation in imperially-sponsored events, such as feasts or religious ceremonies. As a result, such forms of rulership would be likely to produce a higher degree of cultural integration in provincial areas, even if commoners were not expressly targeted by imperial ideology. Commoners may have adopted aspects of Basin of Mexico style material culture and social practice in an effort express a socially advantageous identity, either vis-a-vis local elites, Mexica migrants, or Aztec officials. This would be visible archaeologically as an appearance or low-to-moderate increase in the Basin of Mexico style artifacts and/or practices in household contexts, primarily in high-visibility settings. These proposed changes may be contrasted with a "site unit intrusion" pattern characteristic of direct migration from the Basin of Mexico, where a wide variety of forms of material culture, including low visibility items, replicate those used in the homeland (e.g. Silverstein 2001).

Cultural Scenario 3. In addition to measuring the effects of rule on local people, governmental strategies can also be examined based on their effects on their broader populations. More direct rule and/or collective rule is more likely to see the state-

sponsored migration of people between areas, due to these rulership strategies' greater penetration into the daily lives of their subjects. There is reasonable ethnohistoric evidence for the immigration of people from the Basin of Mexico into the Toluca Valley in general (Carrasco 1950:277-279; Cuauhtitlán 1985 [1606-1631]:57; Zorita 1963 [1566-1585]:22,263ff, 266), though it is unknown whether Calixtlahuaca was one of the destination settlements for these immigrants. As a result, it is possible that the appearance of Aztec style objects or practices at the site could be the result of immigration from the Basin of Mexico. I expect immigrants to appear as households with Aztec-style practices in low visibility contexts. Depending on the degree to which emphasizing Aztec identity was socially beneficial, these households may also have higher frequencies of Aztec-style objects and/or Aztec practices in high visibility contexts.

Archaeological Markers of Cultural Change

More specifically, I looked for cultural changes supporting these three scenarios in two aspects of household life, domestic ritual (Chapter 7) and culinary practice (Chapter 8). Carballo (Carballo 2015) identifies both feasting and ritual as strategies of collective rulership for gaining popular support in Mesoamerica. These two aspects could have served as arenas for the negotiation of local commoner identities relative to a variety of others using Aztec-style items, including Aztec elites, local elites, and Aztec commoner immigrants. For both ritual and culinary assemblages, local and Aztec style items can be easily distinguished, though the possibility of locally produced versions of Aztec style items muddies the relationship between style and geographic source.

Domestic Ritual Assemblages. The domestic ritual assemblages at Calixtlahuaca consist of a variety of items, but I focused my analyses on figurines, a relatively low visibility item, and censers, a relatively high visibility item. In both cases, there are distinctively local style items, distinctively Aztec style items, and some more widely distributed Central Mexican styles found in both regions. Censers were included in the INAA and petrography samples and these source attributions were used to confirm stylistic attributions of source region. Figurines (n=369) were classified by source and subject matter, but due to INAH regulations could not be exported for materials analysis to confirm geographic attributions. Figurines and censers were evaluated both on the basis of probable origin, and on the basis of probable use, based on subject matter for figurines and general form for censers.

Foodways. Following the Aztec conquest, the adoption of Mexica methods of food preparation may have provided an important means of social negotiation, especially in cases of state-sponsored feasting. I compared evidence for various forms of maize preparation, a low-visibility activity, with serving vessel form frequencies and ceramic decorative group frequencies, both of which are higher visibility. Maize preparation techniques were assessed using variation in mano form, as well as the frequencies of comals and interior-incised jars which likely represent alternative cooking methods. Food serving practices were assessed using the frequencies of three categories of serving vessels – open (bowl/plates/basins), closed (jars/pitchers), and copas. In addition, I calculated the relative frequencies of major families of decorated ceramics for each

household to determine whether there were groupings based on factors other than chronological phase.

Summary of Research Goals

I seek to contribute to the understanding of the dynamics of Aztec rulership strategies by looking at commoner households. In looking at commoner households, rather than elite contexts, I can examine the degree to which Aztec rulership actually affected the majority of the population. I use a combination of analyses of economic and cultural change in order to examine the interplay between multiple arenas of interaction.

CHAPTER 2. THE AZTEC EMPIRE

The Aztec conquest of Calixtlahuaca did not occur in a historical vacuum, and neither does this study. This chapter provides a more in-depth background for the thematic and regional topics covered in this dissertation. It covers current scholarly perspectives on imperialism and how these relate to the dimensions of rulership under consideration, an overview of the Aztec Empire, a review of previous case studies of Aztec imperialism, and an ethnohistorical and archaeological overview of the Toluca Valley in general and Calixtlahuaca in particular.

Imperialism

This section describes three aspects of empires. First, I present three frameworks commonly used to discuss imperialism: world-systems analysis, agency based approaches, and social organization of power models. These three frameworks provide complementary theoretical viewpoints, with the first looking at the core and the systemic structure, the second looking at interactions in more peripheral areas and the agency of multiple actors, and the third seeking to incorporate agency with structural models. Next, drawing primarily on organization of power models, I explore the range of variation in empires, with a particular focus on the degree of control over provincial areas. This section includes a discussion of the larger structural variables that influence why empires pursue particular strategies of control under particular conditions. This includes a focus on the pre-conquest organization of provincial areas. Finally, I consider what the cultural

and economic effects of different rulership strategies would be, and how this variation would be visible archaeologically.

I follow Doyle (1986:30) in defining empires on a behavioral basis as, “effective control, whether formal or informal, of a subordinated society by an imperial society.” This definition allows a large range of imperial formations to be considered, including those outside of the range of organizational forms seen in the traditional territorial states of the Old World. Other definitions of empire mirror this emphasis on control outside the parent society as the critical characteristic of empires (Hassig 1985; Sinopoli 1994). On a functional level, imperial control of provinces typically involves (1) military conquest, (2) construction of an imperial infrastructure, (3) imposition of tribute or taxes, (4) reorganization of settlement patterns, and (5) imperial cooption of local elites (Smith and Schreiber 2006:3-4), though the overall intensity of such activities and the balance between them vary widely among empires.

Following an initial military conquest, states must consolidate their control over newly acquired territory (Sinopoli 1994). Broadly described, consolidation usually consists of either co-opting local institutions or undercutting them and instituting new imperially focused institutions. Consolidation activities are often more focused on dividing existing local sources of power than creating or promoting a single imperial identity (Berdan, et al. 1996; Sinopoli 1994; Stark and Chance 2012). Ancient states vary widely in the degree to which their consolidation and control strategies affected local populations (Alcock, et al. 2001; Blanton and Fargher 2008). The consolidation process provides an arena for negotiation among the various groups affected, including multiple factions of conquerors and locals, elites of various levels, and commoners. While

provincial residents, especially commoners, do not usually approach such negotiations from a position of power, the imperial core has a vested interest in creating a stable, pacified, taxable population, giving provincials and commoners some degree of leverage (Fargher and Blanton 2007).

To date, most research on archaeological evidence for imperial control has focused on elite and/or monumental contexts. Pairing these investigations with a consideration of commoner contexts allows for the evaluation of how deeply imperial power reached into the population, as well as how well imperial ideologies of inclusion or exclusion conformed to the physical reality.

Theoretical Models

A brief historical overview of the models used to interpret imperial-provincial interaction demonstrates a shift from the primarily core/dominant power centric perspectives of world systems models, through a reaction in the form of agency-centric models with a peripheral/provincial focus, to multivariate models seeking to explain the variability in core-provincial relationships. While these perspectives are sometimes characterized as opposed to one another, they provide insights on different aspects of empire/province interaction. My work in this dissertation brings together the insights provided by each of these theoretical perspectives, with my analysis of the economic effects of consolidation drawing more heavily on a world-systems background while my discussion of cultural change includes ideas of resistance and negotiation.

World-Systems Models. Historically, the most common theoretical model applied to ancient empires is one of a number of variants of Wallerstein's world system model (Wallerstein 1976). Originally designed to address the 15th century to the present, the model divides the interacting area (world system) into cores, semi-peripheries, and peripheries. While the model includes political and social interaction, the primary means of integration are economic, in the form of staple finance and the regional division of labor. Core areas import raw materials from peripheries, via semi-peripheries (relatively developed sub-areas in peripheries), and export manufactured goods back to peripheral areas in exchange (Frank 1966). This leads to a concentration of wealth in the core at the expense of the periphery and the technological dependence of the periphery on the core, creating a positive feedback cycle sustaining and expanding the world system. Wallerstein also differentiates between world-empires and world-economies. In the former, an expansive geographic area is controlled by a single political entity, making the spheres of political and economic interaction essentially conterminous and relatively homogenous. In the latter, there is substantial differentiation in the level of political and economic development of cores and peripheries and the spheres of political and economic control are not necessarily the same.

The applicability of this model to ancient states has been critiqued on multiple grounds, including the excessive focus of core regions at the expense of peripheries (Wolf 1982:23), the domination of underdeveloped peripheries by cores (Chase-Dunn and Hall 1997:36), and the primacy of economic interaction generally and staple finance in particular (Oka and Kusimba 2008; Schneider 1977). As a result, archaeological and historical formulations, which often use the more relaxed term of world systems analysis,

(Abu-Lughod 1991; Blanton and Peregrine 1997; Peregrine 1996) differ from traditional world systems theory in three major aspects. First, they remove the emphasis on economic interaction over social or political interaction in many cases (Hall 1997; Hall and Chase-Dunn 1996; Smith 2003d). In many ancient cases, there were few technological differences between relatively core and peripheral areas, meaning that there was little potential for differential economic development. However, at the same time, core areas might control access to other resources, such as religious authority or political legitimation.

The second way archaeological applications differ from traditional world-systems theory is that when economic integration is considered, the stress on staple finance may be removed (Feinman 1997). Due to the difficulties of transporting staple goods over long distances in antiquity, economic exploitation of peripheral areas was more likely to focus on relatively high-value goods. Third, significant work has gone into the discussion of multi-core systems and more complex core/non-core interactions (Chase-Dunn and Hall 1997; Feinman and Nicholas 1991; Kohl 1987; Schortman and Urban 1992; Smith and Berdan 2003a). It has also been recognized that integration into a world-system may occur at various levels. Under weaker conditions of integration, the core is likely to influence peripheral areas far more than the reverse, while under stronger conditions of integration, influence is more bidirectional (Hall 1998).

The combination of responses to these three criticisms has demonstrated that ancient world systems often exhibited more balanced negotiations between cores and peripheries, especially when neither could enforce monopolies on particular goods or on the use of force. What remains central to the world-system approach is the examination

of past interaction across political or cultural boundaries and the potential for unequal relations in such interaction. Unfortunately, there is an inverse relationship between the degree of relaxation in the original model and its explanatory power in archaeological cases. As world systems theory, as a set of testable cause-and-effect predictions, shifted toward world systems analysis, or a general paradigm of looking at interaction and inequality, it became applicable to a wider range of ancient cases, but provided less specifically testable predictions about any particular case (Hall, et al. 2011).

Postclassic Mesoamerica has been constructively described as a world-system, in the more relaxed sense of the term (Smith and Berdan 2003b). Over the Postclassic, the level of interregional interaction increased, both economically and culturally.

Economically, both higher-value staples (obsidian, salt) and luxury goods across Mesoamerica were traded widely (Golitzko and Feinman 2015; Nichols, et al. 2002; Smith 1990). Due to the multi-core nature of the system and the uneven distribution of raw materials, this increase in economic interaction was not inherently exploitative of peripheral regions. Culturally, the Postclassic international symbol set and Postclassic international art style (sometimes collectively called the Mixteca-Puebla style) spread across Mesoamerica, occurring on both portable goods such as ceramics, and in fixed locations, such as murals and stone carvings (Boone and Smith 2003; Smith and Heath-Smith 1980).

During the Early and Middle Postclassic, primary centers (i.e. Tula, Cholula, Chichen Itza) tended to have greater cultural than economic influence, but both extended beyond areas directly politically controlled by such states. During the Late Postclassic, a number of larger expansionist states (the Aztec Empire in Central Mexico, the Tarascan

Empire in West Mexico, the Quiche state in western Guatemala) rose to power. Given that there were neither major changes in the distribution of raw materials nor regionally specific technological innovations between the Middle and Late Postclassic periods, world systems analysis would suggest that economic and cultural changes between these two periods were due to changes in the control of force.

I generally use the perspectives provided by world-systems analysis as a reminder that ancient states were not internally homogenous and that their variation resulted from the balance in power between core and peripheral areas. More specifically, I use the potential variation in the relative balance of power between Calixtlahuaca and the Aztec Empire in structuring the previously presented cultural and economic scenarios for Aztec/provincial interaction at Calixtlahuaca. Under relatively traditional world-systems theory predictions, Calixtlahuaca would become incorporated into the Aztec empire as a periphery (or possibly semiperiphery), leading to generally negative economic effects, and an increase in goods imported from Basin of Mexico. In a system where a core can apply an effective monopoly on force (such as the army) and/or the circulation of particular goods (such as obsidian from particular sources), the core is in a much stronger position to dictate economic relationships benefitting itself. Similarly, the core may also “export” cultural practices, at the expense of those previously found in provincial areas.

Agency-Centered Approaches. The core-centric and highly systemic focus within world systems approaches has been countered by the development of a variety of overlapping, agency-focused approaches, including middle ground theory (Malkin 2002; White 1991), hybridization (Tronchetti and Van Dommelen 2005; Van Dommelen 1997),

and resistance theory (Hollander and Einwohner 2004; Scott 1990; Spielmann, et al. 2006). These approaches share a common focus on the manners in which individuals and groups negotiate their interaction with the dominant group, and the range of possibilities for negotiation and expression under different degrees of control (Stark and Chance 2012; Stein 2002b; Van Dommelen 1997, 2012). They also generally structure interaction as tripartite, involving a homeland, colonists, and natives, and acknowledge that the balance of power between these three groups can vary widely (Stein 2002c). Many such balances of power do not fit under the definition of empire, and as such, provide a description of the alternatives to imperial rule over provincial areas.

Middle ground and hybridization models focus on processes in the interaction zone between cultural groups. Originally developed to explain North American native-European colonial interaction (White 1991), the middle ground model proposes that under conditions of loose imperial control, where neither empire nor subjects can bring overwhelming force to bear, groups are likely to develop a middle ground of mutually negotiated, often hybrid, behaviors. Both groups will feel that the meaning of such behaviors is shared, though their actual understandings of that meaning may differ. If the balance of power shifts heavily toward one party, they will shift toward dictating the terms of interaction (White 1991). Over longer time spans, hybrid cultural practices will develop in such intermediate areas, with the potential to spread outward. Direct archaeological applications of the middle ground model have been primarily limited to the Middle East and Mediterranean regions (Malkin 2002, 2005). It is most often applied to situations of limited contact, especially trading colonies (Malkin 2002; Stein 2002a). As a broader term covering both attempts at finding cultural common ground and the

blended results of this process, hybrid/hybridity/hybridization are used across a wider range of regions and time periods, though there is still bias toward the ancient Mediterranean and historical archaeology (Card 2013). Despite this geographic and temporal bias in past applications, these models have significant potential for understanding interaction under various balances of power in provincial areas. The conditions where middle ground theory have been applied strongly parallel the conditions in Schortman and Urban's (1994) independently developed argument for situations under which traditional world systems theory is not likely to apply - namely where none of the parties involved has a monopoly on exchange, technology, or military force. As a result, while middle ground and traditional world-systems theory may initially appear contradictory, it is more useful to characterize them as describing positions at opposing ends of the spectrum of the balance of power between the ruler and the ruled.

Resistance theory based approaches draw primarily on the work of James Scott (1990). Interaction within a society can be seen as consisting of multiple transcripts (viewpoints on society), including a public transcript derived from those in power, which is at least nominally ascribed to by all groups, and various subordinate, resistant transcripts produced by one or more groups. The public transcript creates, normalizes and justifies the existing inequalities within a society. It may include material domination (such as taxes/appropriation of labor), status domination (from the exclusion from particular social roles, to overt humiliation), and ideological domination (such as justifications by ruling groups for existing inequalities (Scott 1990:198)). The mode of expression of resistance is dependent on the degree of control by the dominant group in

various arenas of expression (Scott 1990:95), and may not be intended or recognized by all groups involved (Hollander and Einwohner 2004:544).

Resistance exists most commonly as an ongoing, background process in spheres outside of the control of the dominant group, but will sometime reach a flash-point and break into the public sphere. Economic resistance ranges from intentionally working slowly (hidden) to strikes and revolts (open). Resistance to status domination can range from relatively hidden activities such as gossip to the overt destruction of monuments. Ideological resistance can take forms from folk mythology celebrating countervailing norms to open rebellion based on counter-ideologies. Within both archaeology and the larger social sciences, resistance has been applied to such a wide range of behaviors as to lose much of its utility unless carefully limited (Brown 1996).

Archaeologically, resistance is generally hard to see. In its ongoing, background aspect it often takes ephemeral, hidden, or deniable forms. When resistance erupts into open expression, it becomes more visible, but such instances tend to be short-lived; either a rebellion is quashed, or it succeeds and a new set of public transcripts comes into being. Archaeological applications of resistance have focused primarily on historical rather than ancient empires (Brumfiel 1997; Liebmann, et al. 2005; Liebmann and Murphy 2011; Silliman 2001; Spielmann, et al. 2009; Spielmann, et al. 2006). Attempts to apply the concept to ancient states have met with mixed results; investigations of commoner background resistance often fail to find archaeological evidence for their claims, or rely on the presence of activities likely to have provoked resistance (such as taxation) as proof of resistance (Brumfiel 1997, 1998; Given 2004). In contrast, investigations of resistance among multiple elite factions have been more successful due to the higher visibility of

actions and higher potential for resource mobilization among such groups (Elson and Covey 2006; Hutson 2002). While these are useful for investigating elite strategies and breaking down “elites” as a monolithic category, they do not address resistance by those with the greatest propensity to engage in it.

I draw on agency-based approaches at two levels. First, in looking at provincial and commoner responses to Aztec rule, I consider the multilateral and negotiated aspects of empire in general. While Calixtlahuaca is not a middle ground in the strict sense of mutually beneficial interaction between two otherwise distinct cultural traditions, it is a colonial situation falling within the range of cultural contact, accommodation and negotiation often considered in studies of hybridity. This provides a perspective in which provincial areas have some level of choice in accepting or rejecting economic and cultural arrangements proposed by a core area. Given that is highly likely that the Yata phase occupants of Calixtlahuaca included some Aztec immigrants, the site presents a classic triad of core-immigrant-local interaction.

I also apply agency based approaches in looking at responses to Aztec rule at the household level. At this scale, I am able to see intrahousehold-level choices in response to Aztec rule and examine how these correlate to a household’s standing and choices in other domains of activity. According to the ethnohistoric record, the Toluca Valley attempted rebellion against the Aztec Empire at least once, suggesting that there was sufficient resistance to Aztec rule that it could move from hidden to overt resistance. This suggests that there was likely a transcript of hidden resistance against the Aztec Empire during a more extensive period.

Collective Action Models. The most recent developments in the understanding of ancient empires are still emerging, but may be generally described as social-organization-of-power models. Examples include corporate vs. network based leadership strategies (Blanton, et al. 1996), comparisons of direct and indirect rule (Gerring, et al. 2011), and collective action models (Blanton 2010; Fargher and Blanton 2007; Fargher, et al. 2011). While the role of elites in state formation is a longstanding one within anthropology (Morrison 1994), collective action models in particular approach the issue through the use of historical cross-cultural comparison to associate particular distributions of power with a variety of aspects of resulting state organization. Social organization of power models bridge the systemic focus of world-systems analysis and the individualistic focus of agency based perspectives.

Collective action perspectives on empires fall within a larger body of study of collective action in general, both in anthropology and related fields (Carballo, et al. 2014; Ostrom 1990). This body of work addresses conditions under which people are likely to cooperate for group benefit, even though it may go against their personal interests. It also looks at the types of institutions that develop to support collective actions and punish those who violate collective norms.

In particular, where imperialism is concerned, collective action theory assumes that states represent a pact between taxpayers and rulers, such that the more highly dependent a ruler is on internal revenue, the more he will be accountable to taxpayers, resulting in greater taxpayer voice. At the same time, the resulting bureaucratic structures must be able to keep tax evasion and administrative graft to low enough levels that they do not overburden the system. Because these models focus on states as existing along a

continuum of balance points between rulers and ruled, they have a high potential utility for explaining the diversity among and within ancient states, a point which is elaborated further in the following section on specific dimensions of state variation.

I use collective action models as the basis for generating my second cultural and economic hypotheses, which argue that the economic and cultural changes following the Aztec conquest were relatively beneficial to provincial populations. This perspective encouraged me to look for evidence of the benefits of imperial rule in commoner contexts where they might not be expected in more traditional formulations of imperial/provincial and elite/commoner interaction, and to look for systematic patterns in the diversity of potential strategies adopted by states (Berdan, et al. 1996; Gerring, et al. 2011) and provincial peoples (Stark and Chance 2012).

Classifications of Imperial Variation

The organization and structure of empires have varied widely over time and space, leading to a range of classification schemes based on different aspects of imperial organization. For the purposes of analyzing the interaction between empires and their provinces, two particularly useful dimensions are the degree of direct control over imperial territories (territorial states/direct control vs. hegemonic states/indirect control), and the social organization of power (corporate leadership/highly collective states vs. network leadership/less collective states). While these classifications share elements, each focuses on different aspects of imperial organization.

Direct and Indirect Rule

One axis of variation in empires is the degree to which the empire directly controlled administrative functions in conquered areas, as opposed to leaving them under local control. This axis of variation has been referred to both as the distinction between territorial and hegemonic empires, and between direct and indirect control (Hassig 1985; Luttwak 1976). For a wider range of positions along this axis of variation, Rodgers (Rogers 2005) gives four imperial strategies, from organization imposition (direct rule), to dual administration and overlay incorporation (intermediate forms of rule), and finally marginal incorporation (very indirect rule). Under territorial or direct control, conquered areas are ruled directly by the imperial state, via state organized and controlled institutions. The state focuses on the control of territory and the defense of this territory against external threats. This generally requires a standing army located toward the boundaries of the imperial territory, sufficient political centralization to effectively provision and direct the armies, and strong internal control to minimize the potential for revolts.

Militarily, direct-rule states require a sufficient standing army to both protect frontier areas from further aggression, and to maintain internal order (Hassig 1985:Chap. 5). Administratively, direct-rule states take on responsibility for monitoring compliance with imperial policies (such as paying taxes), and in pre-modern states geographic distance alone made monitoring geographically distant provinces a costly proposition (Hechter 2013:Chap. 4). Direct rule empires can depend on internal (Smith 2004a) or staple finance (D'Altroy and Earle 1985), due to the degree their penetration into provincial areas, potentially providing a greater and more stable tax base than would be

available from wealth finance alone. However, due to the higher degree of changes to administrative structures, the higher degree of day-to-day interaction between residents of the provincial areas and representatives of the empire, and the greater imperial investment in provincial areas, territorial strategies cause a higher degree of cultural integration of provincial areas. Due to both military and administrative costs, direct rule is costlier overall for the state, but in exchange, also tends to be more internally stable.

In contrast, hegemonic states focus on the political control of existing units. They leave existing power structures in place, as long as such structures can be co-opted to serve imperial purposes. They use buffer or client states to defend against most ongoing, small-scale aggressions from outside the empire, reducing the overall need for a standing army for external defense. As a result, the army can be deployed internally to quell rebellions, requiring less development of other mechanisms to prevent revolts. They also rely on local leaders and preexisting administrative structures to enforce state policies, collect revenue, and provide public goods, shifting the costs of rulership onto provincial leaders (Hechter 2013:Chap. 4). This leads to the development of less imperial infrastructure in provincial areas and a heavier dependence on existing local leadership and bureaucratic structures. Indirect rule is generally associated with a tendency toward wealth finance (D'Altroy and Earle 1985), as a smaller quantity of higher value goods require less provincial infrastructure to collect than a larger quantity of staple goods. As a result, indirect is less costly for the imperial state on a day-to-day basis, but is also more politically unstable since local leaders maintain control over their traditional power bases.

Gerring et al (2011) argue that empires will pursue more territorial or more hegemonic strategies of control under specific conditions. The first of these conditions is

the relative level of social development of the core and provincial areas. In order for hegemonic/indirect strategies to function effectively, the provincial area must have a sufficient preexisting level of technological development and administrative complexity to effectively function as a proxy for the imperial government. As a result, state (and some chiefdom) level societies can be effectively controlled using a hegemonic strategy, while less hierarchical societies generally require a more territorial strategy to construct a new administrative infrastructure. Historical examples of this principle may be seen in the variation in British strategies relative to their colonies (Gerring, et al. 2011), the variation in the Spanish success in establishing control over native populations at various levels of social complexity (Mahoney 2010), and the differential use of forced labor in the Americas under European rule (Arias and Girod 2014).

Geographic distance also places constraints on strategies of rule (Feinman 1998). In premodern states, the cost of projecting power increases sharply as a factor of distance. As a result, empires must accept that progressively more distant provinces will either (a) become costlier to rule at the same level of integration, or (b) will have to be ruled more indirectly. Late Imperial China resolved this problem by making the territories of officials near the edges of the empire smaller than those at the center, in order to maintain a consistent degree of control (Skinner 1977). The Aztec Empire took the opposite solution, ruling many peripheral areas more indirectly via client states, with less regularized tax collection and less formal organization into provinces (Smith 1987a).

In addition to imperial preferences for direct or indirect rule, political science predicts that residents of provincial areas will also tend to support one form of rule over the other in predictable fashions (Siroky, et al. 2013). If indirect and direct rule can

provide comparable public goods, people will generally favor indirect rule (Hechter 2013). Local leaders are easier to hold accountable for their actions than foreigners both due to their higher degree of shared cultural values and their simple geographic proximity. However, direct rule may be seen as preferable if it can provide greater public goods, or a more even distribution of the public goods. A more even distribution of public goods may be grounds for support of direct rule by some local subgroups if local leaders are perceived as favoring particular segments of the population, such as members of their own ethnicity or religion. In an empirical test of this prediction, Ferwerda and Miller (2014) found that during World War II in France Vichy controlled (indirect rule) areas had significantly fewer incidents of resistance than geographically and socially comparable areas under direct German control.

In addition to general provincial trends, particular subgroups may differentially support particular forms of rule. In semi-independent modern states, such as the ethnic republics of the Russian federation, upper-class individuals are more likely to support more indirect rule, while members of the middle class are more likely to support more direct rule (Siroky, et al. 2013). While the particulars of this modern case are not specifically applicable to prehistory, they do generally demonstrate that provincial peoples will support the form of rule that most benefits them and that this is different for different subgroups of a provincial population. Provincial elites are generally likely to favor indirect rule, as this allows them to keep most of their existing authority and benefit from providing services to the empire.

Whether commoners would favor direct or indirect rule is likely based on their prior position relationship with local elites; if this relationship is good, commoners will

likely favor indirect rule to maintain the status quo, while if elite/commoner relations are poor, commoners may support more direct imperial rule as a means of limiting the power of the local nobility. In the previously mentioned study by Ferwerda and Miller (2014), French resistance was driven by politically disenfranchised groups – the left wing in Vichy (French right-wing) territory, but both right- and left- wing groups in areas under direct German rule.

The Aztec Empire falls firmly toward the hegemonic end of this scale, due to its use of client states (“strategic provinces”), highly selective use of garrisons in frontier areas, and general practice of leaving local leaders and administrative organizations in place (Smith and Berdan 1996b). It is sometimes considered a classic example of the hegemonic end of the scale (Hassig 1985, 1988). However, while not moving the Triple Alliance from this general end of the scale, a broader consideration of the activities of the empire does provide cases of more direct control. By the time of the Spanish conquest, approximately one third (18/55) of provinces had an imperial military governor in place of their native ruler in one or more cities (Smith and Berdan 1996a). In addition, there were probably three levels of hierarchy within the imperial tax collectors assigned to each province, which indicates at least a basic imperial bureaucratic structure in provincial areas, rather than a complete reliance on local infrastructure (Smith 2015a:78). There were also differences in the directness of rule based on the geographic distance from the Basin of Mexico, with Aztec control becoming less direct with distance. This particular point is considered in more detail later in this chapter.

More and Less Collective Rule

A second axis of variation in imperial organization concerns the social distribution of power in a state. On a general level, this is described as the degree of collective action in a given state. As applied to states, collective action refers to the degree of cooperation among individuals and groups within the state (Olson 1965). Building a state along more collective lines, rather than ones based on dominance, requires overcoming human tendencies toward self-serving behavior. Doing so requires two sets of checks – one on subjects who might seek to freeload and one on leaders who would seek to exploit their subjects. Checks on commoner subjects may be provided by either other commoners or by the state, but checks on elites are only effective to the degree that commoners control some resource desired by elites. As a result, collective states are most likely to develop in contexts where state revenue is primarily dependent on internal sources (i.e. citizen taxes/staple finance) rather than external sources (i.e. long-distance trade/wealth finance). Collective states will also feature relatively high levels of public goods provided to the population, a well-developed bureaucracy to manage the collection of resources from the population, the provisioning of public goods and the limiting of freeloading, and checks on the powers of rulers.

A more specific subset of work on collective action focuses on how leaders use collective action. Corporate and network strategies (sometime also referred to as cooperative and individualizing (Carballo 2015)) describe alternative approaches to legitimizing power structures (Blanton, et al. 1996; Feinman 1995). The terms may be used to describe either the strategies of leaders, or the forms of social organization favoring the development of/resulting from those leadership strategies. Corporate

strategies draw heavily on collective action. They are socially inclusive and focus on creating a powerbase by power-sharing. They are likely to feature inclusive language between commoners and elites (such as “being part of the same lineage”), little emphasis on markers of elite status, unrestricted monumental architecture, and an emphasis on offices rather than individuals. In Mesoamerica, most Central Mexican civilizations fall toward the corporate end of the spectrum, with Teotihuacan as a particularly good example of a highly corporate state (Blanton, et al. 1996). Teotihuacan is characterized by a very homogenous provisioning of public goods such as apartment compounds and neighborhood temples (Smith, et al. 2014). It also has little evidence for individual rulers; no clear royal palaces or burials have been located to date, and artwork emphasizes markers of offices rather than named individuals.

In contrast, network strategies are based on social exclusivity and are generally less collective. Elites seek to gain power based on their control of material (foreign trade, particular types of luxury goods) or non-material resources (religious authority). Elites gain support from others elites by sharing such resources among limited groups of people. Because leadership is not dependent on popular support, network oriented states generally have less collective action, especially less controls on principals. Network oriented states tend to have origin stories that emphasize the difference between elites and commoners (such as separate creations of different classes, or divine justification for rulership), a strong emphasis on visible markers of status differences, restricted-access monumental architecture, and an emphasis on leaders as individuals rather than office-holders. In Mesoamerica, the Classic Maya city-states provide a good example of network-oriented leadership strategies (Blanton, et al. 1996). Luxury goods were

produced by specialists attached to elite households (if not by elites themselves), and distributed as gifts along patronage networks. Monumental architecture often has limited public access and artistic depictions of rulers emphasize their individuality and relationships to other individuals.

As with territorial and hegemonic rule, there are certain preconditions under which more or less cooperative strategies are likely to develop. One of the primary conditions is the ease of exit from a society. In societies with higher exit costs, either due to sunk costs in infrastructure or a lack of alternative destinations, commoners are more likely to remain under less collective regimes, due to a lack of options. It is also easier for highly collective societies to develop in relatively small states, where information and sanctioning costs are lower, as is the cost of developing a strong bureaucracy.

Within large, heterogeneous states, such as empires, the degree of collectiveness of rule may vary, a point which is not taken into consideration in all studies of the topic. Scheidel (2006, 2015) argues that states organized along non-republican (i.e. network/non-collective) lines can expand indefinitely with little to no loss of privilege to those who are already members of the state. In such states, benefits accrue primarily to elites and are not diluted by the addition of provincial elites to the system. In contrast, in what Scheidel calls republican states, which generally correspond to collective forms of rulership, territorial expansion has the potential to result in a dilution of benefits to current members. As a result, such states may end up with dual (or more) layer membership, with different groups having differing rights and privileges. In a historical example, this can be seen in the distinction between Roman subjects and Roman citizens.

Different subsets of a population may also pursue different types of corporate or network strategies, based on which they see as most beneficial to themselves. While Teotihuacan generally follows a corporate strategy, Manzanilla (2015) argues that the bottom (similar apartment compounds housing most of the population) and top (few named leaders, no known royal burials) of society were highly corporate, while intermediate elites practiced a somewhat more network-oriented strategy based on restricted control over non-local goods from particular regions. As a general rule, network-based imperial strategies will focus on integrating provincial elites, while more corporate strategies will reach a broader section of the provincial population. As a result, the degree of economic and cultural integration of commoners in provincial areas can serve as a useful marker of rulership strategies.

In their cross-cultural analysis of collective action, Blanton and Fargher find that the Aztec Empire was relatively collective, ranking sixth out of thirty state societies for overall evidence of collective action (Blanton and Fargher 2008:Table 10-11). Rankings in individual subcategories of the analysis (Public goods provided by the state, Bureaucratization, and Control of leaders) are generally similar (5-7th place) to the overall ranking indicating that the overall placement is not driven by a single anomalous factor. However, within Postclassic Central Mexico, an analysis of relative collectivity (Fargher, et al. 2011) found that there was substantial variation among subregions and cultural traditions, with Tlaxcalla as the most collective, the Mixteca Alta and the Puebla Valley outside of Cholula as the least, and the Basin of Mexico, Morelos and Cholula in an intermediate position. This variability is visible both in early colonial written descriptions of the various regions, and in archaeological evidence. Based on written sources, the

commoners in the more collective areas generally had stronger rights to land as freeholders rather than landless laborers, and more opportunities for social advancement within the government bureaucracy. Archaeologically, the more collective areas generally have more dispersed urban monumental architecture with open, easily accessible plazas, and a more even distribution of non-local goods across sites at various levels of the settlement hierarchy.

The possibilities of regional and class-based differences in collective action raise an important point for interpretations of the Aztec Empire. The underlying cultural traditions in Central Mexico were relatively collective (Carballo 2015) and as such Aztec society can also be considered fairly collective. However, prior to the expansion of the Aztec empire, collective obligations and benefits were largely organized at the neighborhood or city-state level. Under Aztec rule, the majority of these collective obligations continued to be provided by the city-state or neighborhood, rather than by the empire. As a result, it is misleading to describe the Aztec Empire, at a minimum those portions of it outside of the Basin of Mexico, as especially collective in and of itself. Within the Basin of Mexico may be a somewhat different story, as the capitals of the Triple Alliance both provided more public services to the population in general (dikes on the Basin Lake system, aqueducts, market administration), and were more accountable to the local population, especially the advisory councils of major city states.

The two dimensions of variation in imperial rule discussed here are measuring somewhat different aspects of control. Territorial/hegemonic rule primarily describes the degree of imperial interference in provincial areas, and can be measured by the degree of changes following imperial conquest, regardless of the directionality of change. In

contrast, the collectiveness of rule measures the particular strategies used by rulers to consolidate their power, and particular forms of rule are linked to broader directional changes. These differences notwithstanding, the two dimensions should be reasonably correlated. Indirect rule provides relatively few public goods, and allows for relatively little accountability of imperial rulers. Direct rule will require a higher overall level of collective action, as at least some imperial bureaucracy (for the collection of taxes, if nothing else), and some public goods (to replace those previously provided by the local state) will be provided by the empire. However, within these general limits, direct-rule empires may pursue more or less collective strategies.

Economic Effects of Rulership Strategies

World-systems analysis predicts that cores will generally economically exploit their peripheries (Wallerstein 1976). However, as Schortman and Urban (1994) point out, this effect is lessened in cases where more peripheral areas can play multiple cores against one another, due to any given core lacking a monopoly on force or necessary goods. As a result, incorporation into an empire is likely to push peripheral areas toward a more subordinate economic status as they lose the ability to access cores outside of the empire due to military hostilities or protectionist economic policies. In the particular context of the political economy of empires, this agrees fully with Eisenstat's (1993 [1963]:Chapter 7) assertion that the primary goal of empires is the economic exploitation of their hinterlands. The differences in the economic effects of rulership strategies can be considered primarily in terms of how effective the imperial core was at extracting

resources from the province and what, if any, reciprocal benefits the imperial presence provided.

More indirect forms of imperial rule will generally have fewer economic effects on provincial areas. They produce few changes to existing economic structures, for either production (no imperial workshops) or distribution (no reorganization of market networks). Provinces under indirect rule also retain a greater ability to negotiate their position vis-à-vis multiple cores. Indirect rule will generally have somewhat negative overall economic effects on provincial areas, since the empire extracts an additional level of taxes from provincial areas while providing few additional services that might otherwise promote economic development. Indirect rule may not even result in an increase in trade with other provincial areas due to increased interregional stability, as indirect rulers often allow interregional conflicts among provinces to continue as a means of channeling aggression away from the state. As a result, the economic (non)effects of highly indirect rule should be visible as a continuation of pre-imperial economic trends, including little change in the quality or diversity of long-distance trade, or the organization of craft production. Overall wealth levels may show a slight tempering of any prior trends toward economic growth.

Direct rule has the potential to produce much larger economic effects in provincial areas, but the degree to which it will produce economic changes is a product of how different the provincial and state economic systems are, as well as how collective a state is. It may result in changes to the organization of production, either directly (such as state-sponsored workshops) or indirectly (such as the intensification of production due to increased market opportunities). It is also likely to cause changes in the regional

circulation and distribution patterns of goods, due to a greater imperial ability to enforce preferential trade with some areas at the expense of others. Due to the general trend for core areas to favor themselves, this is likely to produce a pattern of increased trade with the imperial core, at the expense of prior trade partners. The shift from local provincial to imperial rule will likely result in changes to the basic spatial patterning of economic institutions, either due to the introduction of new institutions or if the empire places its center of control in a different geographic location than the previous independent provincial center of power. As a result, direct rule can be expected to produce visible changes in household-level economic activities. However, outside of a general shift toward increased trade with the imperial core, the specifics of such changes are dependent on variables other than the presence of direct rule alone.

Non-collective or network oriented rulership will also cause relatively few broad economic changes in provincial areas. Due to this form of rulership's reliance on external finance, leaders have little incentive to develop local economies, as these are not their primary tax bases. In addition, elite control over most of the resulting long-distance trade goods is unlikely to promote widespread demand for such items. While elites pursuing network strategies are likely to develop geographically extensive trade ties in order to access a broad range of exotic goods for marking their statuses, the products exchanged along these ties do not enter general circulation. In fact, elites may seek to restrict commoner access to broader exchange networks in order to preserve the exclusivity of their own access to particular goods. In addition, rulers in non-collective states generally have less penetrative social power, and thus less ability to change existing or establish new economic institutions in general. As a result, non-collective rule should generally

appear archaeologically as a limited and uneven distribution on non-local/luxury goods among commoner households. It should also not promote an increased reliance on market provisioning, thus limiting the development of higher levels of independent (rather than elite-attached) craft specialization.

Relatively collective rulership is more likely to promote internal economic development. This is due in large part to its greater reliance on internal finance; a growing internal economy offers a growing tax base for a collective state. In addition, the lower degree of restrictions on purchasing offers greater potential for economic growth. This is likely to result in an increase in market exchange and an increase in craft production for trade above the household level in a feedback loop of economic growth (Millett 2001). As a result, collective rulership is likely to result in increased trade (though it may be biased toward the imperial core), increased productive specialization, and have neutral to positive effects on local levels of wealth.

In summary, direct and indirect rule can primarily be differentiated by the degree of interruption they produce in existing systems, including in commoner households, regardless of the directionality of that change. In contrast, the collectiveness of rule is marked by both the direction and evenness of changes. Relatively non-collective rulership is likely to produce uneven and generally negative effects in commoner households, while relatively collective rule promotes general economic growth among much of the population.

Cultural Effects of Rulership Strategies

Ancient states² were generally multiethnic, as a fundamental result of their processes of expansion, and generally did not see internal ethnic homogeneity as an inherent goal (Hall 1998). In many cases, differences among subject populations of empires were fostered, or at least tolerated (Sinopoli 2001). The association of a state with a uniform cultural identity, and the association between ethnicity and demands for self-determination are products of modern nation-states and should not necessarily be projected into the past (Kedourie 1960). However, identity differences also provided potential fracture-lines leading to conflict and collapse (Emerson and Hedman 2016). The combination of these two factors means that the provinces of ancient empires are fertile grounds for the study of the formation and maintenance of cultural identities. While the initial imperial decisions about the rule of particular provinces were based on the relationship between the core and province, the structure of ongoing interactions depended on the relationships among three groups – the imperial core, the local provincial population, and the individuals from the core who take up residence in the province (Stein 2002c). This is particularly true of cultural (rather than economic) interaction, where provincial groups are likely to have a greater range of choices whether they participate in imperial systems or not. Official state/provincial interaction is likely to be concerned with official imperial ideology. In contrast, colonist/provincial interaction is

² In this case, I use the term “state” in a sense closer to my definition of “empire”, rather than a broader definition including city-states, which may well be largely monoethnic.

likely to promote the transmission of a wider range of quotidian practices from the imperial core, as well as more diverse forms of hybridization between foreign and local practices (Wells 2005). As a result, I consider both forms of interaction as possible vectors for the introduction of non-local cultural practices and objects into provincial settings when evaluating the effects of different rulership strategies. In addition to discussing the general cultural effects of different rulership strategies, I also consider how these strategies would be expressed in two particular domains of commoner household activity: ritual practices and foodways.

The results of imperial economic policies can be separated from the effects of imperial policies targeted toward cultural integration based on the visibility of the artifact classes involved. Economic shifts are likely to cause changes in the frequencies and sources of a wide range of goods, including both differentiated (“branded” or producer/regionally identifiable items, such as decorated pottery) and non-differentiated items (“commodities” or goods that generally cannot be distinguished among producers, such as obsidian blades or plainware pottery). In contrast, imperial policies specifically oriented toward producing cultural changes, such as the integration of diverse cultural groups, are likely to concentrate on differentiated types of goods, especially those used in high-visibility contexts.

As with economic change, the directness of imperial rule is associated with the generally expected degree of cultural change. In cases of relatively indirect rule, there is less contact overall between local people and people from the core. Because the majority of the service provisioning and tax collection remains in local hands, there are fewer officials assigned to provincial areas and they are less likely to personally interact with

the lower levels of the bureaucracy, let alone the bulk of the population. In addition, it may be less likely to see large numbers of colonists under conditions of indirect rule. There is no strong state mechanism for promoting the official movement of groups into provincial areas and provisioning them with goods once they arrive. In addition, the indirect state generally lacks the authority to directly enforce privileges toward colonies in provincial areas, such as preferential tax statuses, military protection from local aggression, and/or differential access to non-local goods. As a result, those colonies that do occur under indirect rule are likely to be largely self-organized (e.g. religious exiles, trade outposts) and depend heavily on their maintaining good relationships with their host communities. Indirect rule states are unlikely to seek to impose cultural changes on provincial areas. First, they generally lack the power to do so, and second, because they rule through local proxies, the local cultural justifications for rule by these proxies cannot be overtly challenged.

In contrast, under more direct forms of rule, there will generally be a higher degree of overall cultural interaction between the imperial core and provincial areas. Under this form of rule, the empire has both the infrastructural penetration to interact with a broad portion of the local population and sufficient control of force to mandate and support colonies. Bureaucratic functions, including public service provisioning, are largely taken over by the empire, which means that they can be run according to imperial norms or adjusted to incorporate imperial elements. As a result, the local population is exposed to imperial practices in relatively formal settings. In addition, direct rule states have a greater ability to support state-sponsored colonies, either of people from the core or of people moved from one provincial area to another, likely leading to greater

interaction in informal settings as well. Whether or not direct rule states seek to impose cultural practices on conquered areas is largely subject to ideological factors, and as a result, the overall degree of integration is subject to substantial variation.

From an imperial perspective, the relationship between the directness of rule and the maintenance of local identities is a double-edged sword:

“At the same time that direct rule stimulates cultural identities in some contexts, it also affords the center with a greater capacity to suppress collective action on the basis of these same identities. Indirect rule does the reverse – it supplies more autonomy to peripheral groups, endowing them with a greater capacity to challenge the state, but by the same token it also removes much of their incentive to seek greater autonomy.” Siroky et al 2013, p.3.

As a result, the intensity of local resistance cannot be taken as a direct reaction to a particular form of imperial rule, but rather should be considered part of an ongoing feedback process between imperial and local strategies.

The degree of collective action in a state and the associated rulership strategies impacts the vectors for cultural interaction. Less collectively oriented states will generally have a high degree of elite integration into pan-imperial elite cultural practices, but will not have strong reasons to promote imperial cultural practices among non-elites. As a result, local elites are likely to serve as the primary brokers of imperial culture in local settings. As with economic benefits in relatively non-collective states, this is likely to produce an overall low level of integration into imperial cultural systems and an uneven distribution of those traits that are present, as exposure to foreign practices and access to

the necessary knowledge will be strongly mediated through patron-client relationships between local elites and commoners.

More collectively oriented states will generally feature a higher degree of cultural integration due to multiple aspects of their organization. They will promote the development of a shared group identity between leaders and subjects in order to promote civic participation and improve voluntary compliance with social norms. In addition, public goods provided by the empire will serve to develop a shared set of practices among their users. However, public goods are by definition provided above the household level and their use is not likely to be visible in household contexts.

In addition to interaction with imperial practices in official settings, local people may also interact with colonists. Relatively collective states have sufficient social penetrative power to enforce the movement of people from one area and then support them once they arrive in the new area. They generally also allow greater individual rights relative to the state, so households which choose to move for economic or personal reasons are generally permitted to do so. Both of these means of commoner movement allow for relatively high levels of interaction between local and immigrant populations, with a higher subsequent potential for the transfer of cultural practices and goods.

The widespread presence of imperial material culture in commoner households will be the most common in relatively collective states, as this type of rulership will encourage commoner participation in state activities (such as festivals and feasting), and will not place barriers on the circulation of foreign goods. In contrast, less collective/network orientations among elites will tend to limit the circulation of imperial-

linked items as these are an important means of demonstrating exclusive ties among provincial and imperial elites.

Ritual Practices. Religion – and its material expression in ritual – extends across a spectrum from inclusive to exclusive practices (Insoll 2004:Chapter 2; Renfrew 1994:50), though archaeologists often focus on one side or the other (Fowles 2013). This distinction between inclusive and exclusive religious practices maps well onto the distinction between more and less collective forms of governance (Carballo 2015:Table 3.3). Cross-culturally, Peregrine (2012), finds that that the secular vs. divine basis of rule is strongly correlated with the degree of social collectivity of a society, with less collective societies being more likely to use religiously based justifications for rulership. The degree of social collectivity in a society is also likely to influence which contexts ritual is used as a legitimating force. Smith (2002) divides Aztec ritual practices along public/private and state/domestic dimensions. In network-oriented societies, elite energy will primarily be invested in private state rituals, or public rituals that reinforce social differences. In contrast, in corporate-oriented societies, state rituals will generally be public affairs drawing on broad participation and may grade into public household practices. This distinction has broader implications for the degree of homogeneity in domestic ritual practices, as more collective/corporate social organizations will promote broadly integrative practices, resulting in increased household homogeneity, while the individualistic (and often ancestor-linked) orientation of network strategies will produce more variation as households or other social grouping seek to distinguish themselves from others.

In Central Mexico, there is a contrast between religious concepts and symbol sets linked to concerns of general (corporate) interest, especially agriculture, and those linked to rulership (Carballo 2015). The former are much more stable over broad temporal and geographic ranges of Mesoamerica and are found in both commoner and elite contexts. In contrast, items and symbols linked to rulership cults and found primarily in elite contexts, tend to have much shorter cycles of use. In the Aztec case, this distinction between corporate and network strategies in religion can be seen in the dual-pyramid form of the Templo Mayor itself. The Tlaloc side of the temple is the expression of a very longstanding Mesoamerican symbolic complex, which dates back to at least the Formative period. With agricultural associations to water and fertility, the Tlaloc side of the temple drew on concerns of collective societal interest. In contrast, the Huitzilopochtli half of the temple, while partially drawing on longstanding symbolic complexes surrounding the Old Fire God, gave them a particular Mexica ethnic- and elite class-based focus by conflating older traditions with the Mexica patron god.

Foodways. Foodways also provide a useful means of evaluating forms of rulership, as they have both economic and cultural dimensions. Direct and indirect rule are likely to be related to the overall degree of change in food-related practices, as an aspect of overall cultural interaction under the two forms of rulership. In addition, forms of rulership which produce economic hardship and/or reward economies of scale are likely to result in changing strategies of food consumption. In the Basin of Mexico, Aztec rule resulted in changes to both the intensity of work devoted to food preparation and in the portability of the resulting foods (Biskowski 2000; Brumfiel 1991).

The distinction between corporate and network leadership strategies maps onto the difference between inclusive and exclusive feasting events (van der Veen 2003). The former demonstrate power through the volume of food provided and the number of people served. They generally feature cuisine similar to that served in other contexts, distinguished primarily by its quantity during the feasting event. Such events are socially integrative, involve individuals from multiple social classes, and are often provided as rewards for cooperative labor. In traditional communities in modern Mesoamerica, collective community labor must be reciprocated with alcoholic beverages and/or food provided by the town leadership, or people will not participate (Carballo 2015). This makes such events an integral part of corporate leadership strategies. Archaeologically, inclusive feasting events will be visible as unusually large accumulations of serving vessels and food refuse that are otherwise similar to what is found in domestic contexts. Inclusive feasting events are also likely to have effects on more quotidian household foodways, as they can introduce new foods to a broad portion of the population at once.

In contrast, exclusive feasting events are characterized by restricted invitations and distinctive cuisines. They are likely to be hosted by elites for other elites. Hosts serve exotic foods or food involving complicated preparation methods, allowing them to demonstrate their connections to restricted goods and/or knowledge. Visitors will be expected to reciprocate, at which time they are expected to demonstrate their own ability to acquire rare foodstuffs and their knowledge of the status-appropriate methods for preparing and serving them. As such, exclusive feasting plays an important role in network-oriented leadership strategies. Archaeologically, exclusive feasting should be visible as a higher diversity of vessel forms and rare food remains in both immediate

feasting contexts and elite households in general. On an everyday household level, exclusive feasting's broader effects will result in uneven knowledge of or access to new food related practices.

The Aztec Empire

The Aztec Empire was founded in AD 1428, when the city-states of Tenochtitlan, Texcoco, and Tlacopan formed an alliance and tribute-sharing agreement. This arrangement developed out of a background of competing central Mexican city-states and confederacies embedded in a larger Postclassic Mesoamerican world-system (Smith and Berdan 2003a) characterized by a high degree of economic and information exchange. The alliance promptly proceeded to conquer the rest of the Basin of Mexico and by the 1440s had begun a series of conquests farther afield. By the Spanish arrival in AD 1519, the alliance was dominated by Tenochtitlan and received regular tax payments from city-states across Mesoamerica (Barlow 1949; Smith 2015b). The imperial territory can be broadly divided into tributary provinces, which were city-states grouped into provincial administrative units that owed regular tax payments to the imperial capitals, and strategic provinces, which were allied client-states that served as military buffers against hostile states and were negotiated with on an individual basis (Berdan, et al. 1996) (Figure 2.1).

Traditional conceptions of the Aztec Empire hold that it exercised a relatively low degree of direct control over its conquests, even characterizing it as the quintessential hegemonic state (Hassig 1988). This directly contrasts with the results of collective action based evaluations of the Aztec Empire, which found that it was highly collective

(Fargher and Blanton 2007; Fargher, et al. 2011). This apparent contradiction is likely a result of the latter perspective conflating services provided by the empire proper, with those provided by the local city-state, especially outside of the Basin of Mexico. The results, however, still suggest that commoner choices could and did impact Aztec state policy, especially at intermediate levels of the control hierarchy.

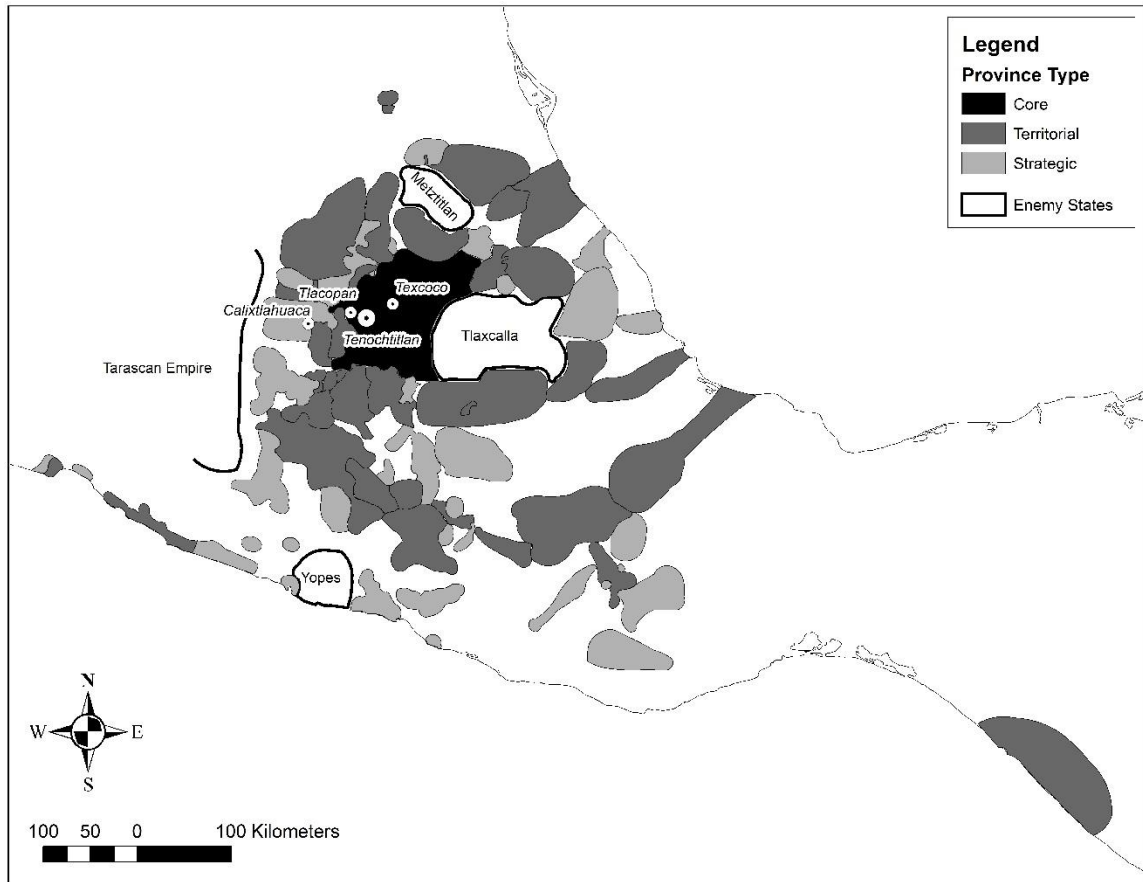


Figure 2.1 The maximum extent of the Aztec Empire, showing the imperial core, territorial, and strategic provinces.

Imperial and Local Strategies

The negotiation between state and local goals can be seen in the interplay of the strategies used by each. The Aztec Empire's strategies are divided into four major

categories, referred to as political, economic, elite, and frontier strategies (Berdan, et al. 1996; Berdan and Smith 2003). Activities in these four categories overlap, but the divisions make a useful framing device. Ethnohistorically, applications of these strategies included the promotion of imperial ideology through public ceremonies, elite intermarriage, interference in questions of succession, reassignment of market and/or head-town locations, and the immigration and resettlement of populations. All of these strategies were part of longstanding Mesoamerican traditions of political control, though the Aztec Empire expanded them to their largest extent (Smith and Berdan 1996b). The goal of imperial strategies, Aztec or otherwise, is to provide a steady income stream to the imperial core in a cost-effective manner.

In contrast, provincial strategies include bolstering (elite collaboration with imperial political interests), emulation (elite and non-elite use of an imperial style), resistance (the attempted blocking of imperial interests up to and including active rebellion), exodus and internal population movement (migration beyond or within imperial boundaries), information control (concealing information for provincial benefit), appropriation (the selective adoption of imperial styles for local ends), complicity (collaboration, usually by elites, for economic gain), and assimilation (integration into the dominant society) (Stark and Chance 2012). As can be seen in the diversity of options in this list of provincial strategies, provincial populations have a wide range of potential responses to imperial actions.

Both imperial and provincial strategies include options that reinforce, options that undercut, and options that are effectively neutral relative to the goals of the opposing group. None of these strategies are limited to a particular form of rulership, either.

Instead, they provide a general perspective on the more concrete, specific methods that rulers and ruled can employ in their interactions with either other.

Previous Studies of Aztec Imperialism

I now provide a brief sketch of the relationship between the commoners and the empire and the provinces and empire more generally, based on existing research. Because world systems approaches and middle ground/hybridization models both predict that distance plays an important role in structuring empire/province interaction, I discuss the evidence from the Basin of Mexico and the provinces separately.

The Basin of Mexico

The Basin of Mexico formed both the political core of the Aztec Empire and one of the primary cores of the greater Postclassic Mesoamerican world system. The region has a long history of archaeological investigation, though it has not always been oriented toward the types of contexts that can be used to answer questions about the organization of imperial rule. Projects that do have the potential to contribute to such questions include the Basin of Mexico survey project (Parsons 1971, 2008; Parsons and Whalen 1982; Sanders 1965), which systematically recorded sites across most of the Basin, more intensive surveys at Huexotla (Brumfiel 1976), salvage work in Tlateloco (González Rul 1988a, 1988b), reconstructions of historical excavations at Chiconautla (Elson 1995; Nichols, et al. 2009), and excavations at Chalco (Hodge 2008), Xaltocan (Brumfiel 2005b; De Lucia 2011; Overholtzer 2012), Cihuatecpan (Evans 1988) and other rural

sites in the Teotihuacan region (Parsons 1966). In addition, there has been extensive work at the Templo Mayor site, covering the primary temple of the Mexica capital of Tenochtitlan and some surrounding buildings (Boone 1987; López Austin and López Luján 2009; López Luján 2005), which provides a view of official Aztec state ideology (See Figure 2.2 for site locations). In the Basin of Mexico, the beginning of the Triple Alliance in the early 1400s traditionally marks the division between the Middle and Late Postclassic periods (sometimes also called the Early and Late Aztec periods). Archaeological studies of Aztec imperialism have documented substantial changes within the Basin of Mexico during these periods, as well as substantial intraregional variation.

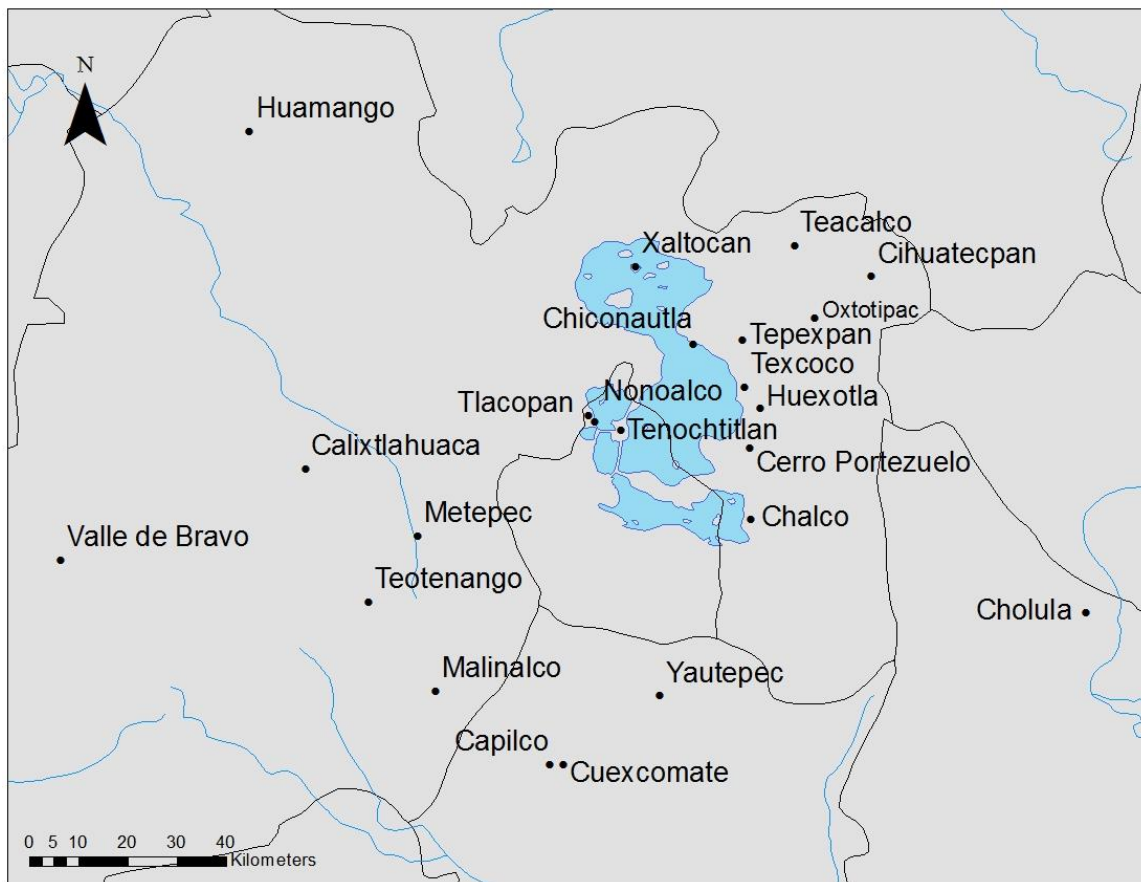


Figure 2.2 Comparative Postclassic Sites in Central Mexico used for analysis in this dissertation

Economically, there are three major trends in the Basin of Mexico during these periods. The first is an increasing amount of trade within the Basin. A combination of stylistic analysis and INAA sourcing of ceramics from a variety of sites across the Basin of Mexico demonstrates a shift from Middle Postclassic multi-producer, multi-directional trade primarily limited by the political boundaries of the mini-empires of this period, to decreased interregional trade combined with increased trade with the capital cities of the Triple Alliance following their political consolidation of the Basin in the Late Postclassic (Garraty 2007; Garraty and Stark 2002; Hodge, et al. 1992; Minc 2009; Minc, et al. 1994; Nichols, et al. 2002; Nichols, et al. 2009). Obsidian provisioning shows a similar shift to heavy dependence on the Aztec-controlled Pachuca source and a decrease of local blade production in most of the Basin (Millhauser 2005; Pastrana 1998).

Second, there is an increase in site and/or regional craft specialization within the Basin. Cotton spinning increased across the Basin, either in response to increased tribute demands or increased market opportunities (Brumfiel 1991). Evidence for the production of other types of goods outside of the imperial capitals is highly variable, with both high (Charlton, et al. 1991; Evans 1992; Otis Charlton, et al. 1993) and low (Brumfiel 1980, 2005b) frequency cases. The overall pattern is of food production intensification where possible, primarily in the southern portion of the Basin, accompanied by the intensification of craft activities in both urban and less agriculturally productive areas (Blanton 1996; Nichols, et al. 2002).

Third, trade from outside the Basin of Mexico decreases. The diversity and quantity of ceramics from outside the Basin decrease over time (Huster 2015). In addition, the very high dominance of Pachuca obsidian (and near-exclusive secondary use

of the Otumba source) at Late Postclassic sites in the Basin (Golitzko and Feinman 2015; Pastrana Cruz 2007) can be considered another aspect of this reduction in external trade. This point has not traditionally been considered, but is an important corollary to the increase in goods exported out of the Basin of Mexico during this time.

Culturally, the Basin of Mexico becomes increasingly culturally homogenous over the course of the Postclassic and the high degree of pre-imperial cultural interaction within the Basin of Mexico makes it difficult to distinguish cultural changes resulting from imperial actions. In addition, the Triple Alliance drew on and manipulated preexisting symbols as a means of establishing legitimacy (Brumfiel 2007). Despite these difficulties, the presence of the empire appears to have had little effect on the symbolic repertoire of the average commoner household (Brumfiel 1996, 1998; Klein and Victoria Lona 2009), with household ritual assemblages showing few connections to official state ideology.

In one of the few case studies to address identity at the local level, genetic research at Xaltocan has demonstrated that ethnohistorical sources likely overemphasized the degree of site abandonment and population replacement which occurred as a result of Aztec conquest (Mata-Míguez, et al. 2012). However, substantial population movement did occur earlier in the site's history providing a good benchmark for identifying archaeological population movements within Central Mexico (Overholtzer 2014), and the period under Aztec rule did see the active manipulation of ethnic symbols (Overholtzer 2015).

In summary, the archaeological evidence from the Basin of Mexico under Aztec rule supports what could be considered an intermediate position between Hassig's

argument for indirect rule (Hassig 1985, 1988), and Blanton and Fargher's argument for relatively collective rule (Blanton and Fargher 2008; Fargher and Blanton 2007). The period under Aztec rule did produce significant changes at the level of the commoner household. These included greater local economic integration and increased regional specialization, both of which can be considered markers of economic growth (Millett 2001). However, this was accompanied by a reduction in the standard of living in some areas, which would indicate that the local degree of collective action was only semi-effective at protecting commoner interests. Culturally, Aztec rule did produce greater cultural homogeneity within the Basin, but this appears to have been a side effect of increased intraregional interaction, rather than a deliberate effect of imperial policy.

The Provinces

The provincial evidence for the effects of incorporation into the Aztec Empire is more diverse than that seen in the Basin of Mexico, a not unexpected result of the variability in Aztec strategies and local responses (See Figure 2.3 for site locations). Three general trends are apparent, however. First, distance from the Basin of Mexico played a large role in the degree of interaction, both economic and cultural. Second, when distance is taken into account, the amount of imperial effort invested in controlling a province was generally inversely related to the cooperativeness of the province. Third, the local elite adoption or non-adoption of aspects of Aztec culture had a significant influence on what commoners in the surrounding region also chose to use. Previous studies in four regions, Morelos, Veracruz, Oaxaca, and Guerrero, can be used to illustrate these points. Data for these regions are drawn from case studies representing a

wide range of pre-and post-Aztec conquest settings and balances of power, including rural Cuexcomate and Capilco and urban Yauhtepec for Morelos (Smith 2006a, 2006c; Smith, et al. 1989), urban Totogal and its surroundings, lowland secondary center Callejon del Horno and rural areas in the Mixtequilla and urban Cuetlaxlan for Veracruz (Garraty and Stark 2002; Ohnersorgen 2001, 2006; Skoglund, et al. 2006; Venter 2008), Coixtlahuaca and the central Oaxaca Valley for Oaxaca (Blanton 1983; Kowalewski, et al. 2010), and several settlements including an Aztec fortress in the Oztuma area for Guerrero (Silverstein 2000) (Figure 2.2, Figure 2.3).

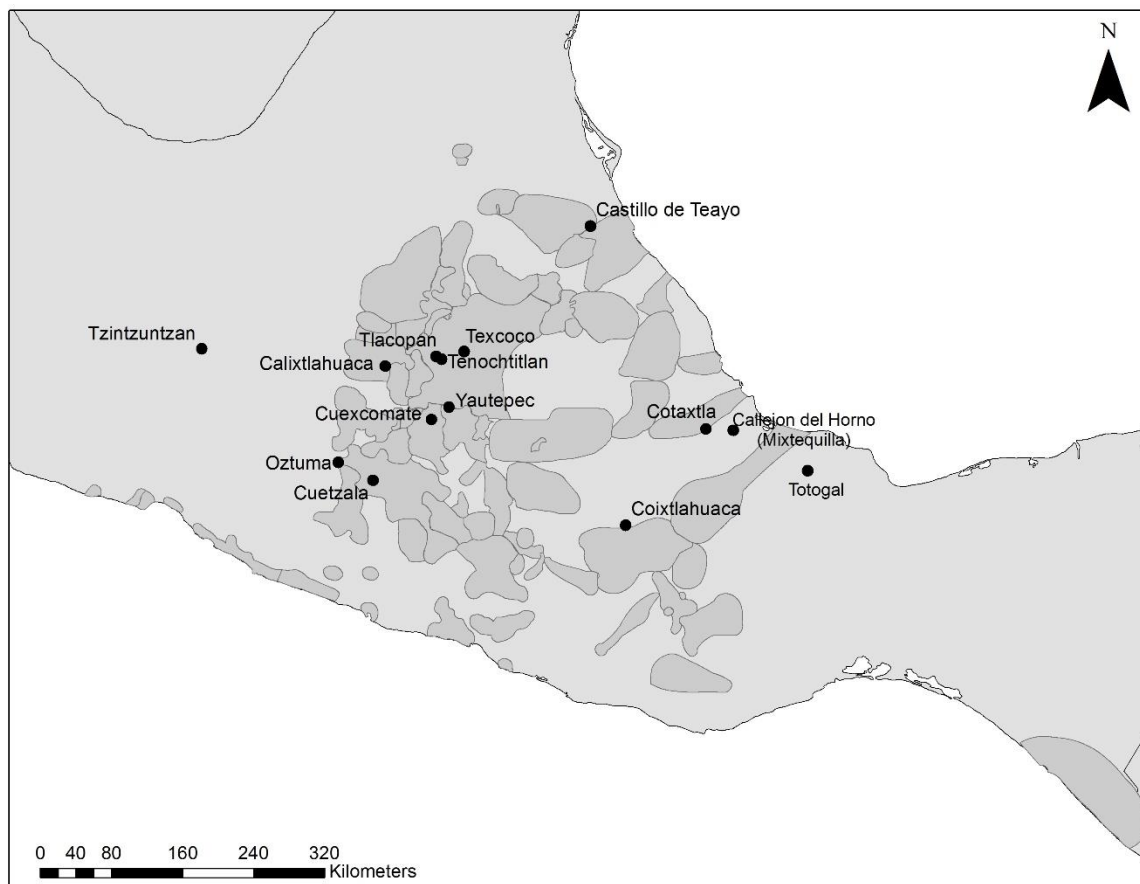


Figure 2.3 Comparative Postclassic Sites in Western Mesoamerica with prior archaeological work discussed in this dissertation, with the territories of the Aztec Empire shown

To begin, provincial regions closer to the Basin of Mexico tended to have both a longer history of pre-imperial interaction and a higher degree of economic integration once under Aztec rule. Sites in Morelos show that local marketing regions expanded, but regional networks contracted in favor of increased trade with the Basin of Mexico once the region became part of the Aztec Empire. The standard of living decreased for most people, with the exception of nobles in the regional capital of Yautepec (Smith 2010). This closely parallels the pattern seen in the Basin of Mexico and while technically a province of the empire, Morelos may more accurately be considered part of the imperial core. While sites in Morelos contain the full range of Aztec decorated vessel types as tradewares, more distant regions, such as Veracruz, tend to be limited to a few types. When plotted against each other, the distance from the Basin of Mexico and the frequency of Aztec ceramics form a clear drop-off curve (Sergheraert 2009; Smith 1990).

Several sites and regions present clear exceptions to this drop-off curve, however. These can generally be described as “problem areas” for the Empire. For example, the Oztuma region was both rebellious and on the Aztec/Tarascan frontier, resulting in the establishment of a Nahua-Aztec colony and a border fortress. Frequencies of Aztec ceramics are significantly higher in the fortress than in the surrounding area (Silverstein 2001). Likewise, Cuertlaxlan was a former Tlaxcallan ally, with an unstable relationship with the Aztec Empire. Within the region, the frequency of Aztec ceramics (including local imitations) is highest in a particular area within the capital of Cuertlaxlan, followed by large sites generally and finally by the rural hinterland. The entire region, however, has higher than geographically predicted frequencies (Garraty and Stark 2002; Ohnerson 2006). As in Morelos, the differences in wealth become far more

pronounced during the Late Postclassic, with (mostly urban) elites becoming wealthier at the expense of lower-class households. The Middle to Late Postclassic rearrangement of settlement in the Mixtequilla may also be a result of imperial actions, though this hypothesis remains tentative until surface remains can be better dated (Garraty and Ohnerson 2009).

Third, the types of Aztec items adopted by elites were a large factor in what was subsequently used by commoners in the same area. At Cuertlaxlan, imports are dominated by Aztec III Black-on-Orange and Texcoco-Molded frying-pan censers (sahumadores). These are the same types that are found in the surrounding hinterland, often as locally produced imitations. In a negative case, most Mixtec and Zapotec elites in Oaxaca did not adopt Aztec-style goods (Boone 1996), and neither did the surrounding commoners, resulting in the recovery of only a few dozen Aztec sherds in the entire Oaxaca Valley survey (Flannery and Marcus 2003; Kowalewski, et al. 2010), and only occasional Aztec artifacts in more extensively investigated contexts (Whittington and Workinger 2015).

As a result of this variation, Aztec/provincial interactions can be grouped into three general categories. First, there are regions, such as Morelos, which closely follow the general Basin of Mexico pattern of increased integration into the Basin economic system at the expense of other regions, increased local specialization, and slightly decreasing wealth. Like the Basin of Mexico, these sites can be considered intermediate on both the directness and collectiveness of rule which they experienced. Second, there are provincial sites with higher levels of Aztec material culture than their surrounding areas, such as Cuertlaxlan and Castillo de Teayo on the Gulf Coast and Oztuma on the Tarascan frontier. These can generally be matched to historical accounts of Aztec

administrative centers, garrisons and/or colonies. (Interestingly, the reverse is not true – some known garrison/colony locations cannot be located on the ground.) Economically and culturally these sites are strongly tied to the Basin of Mexico, with a wide range of Basin-style goods used in both high and low visibility contexts. In and of themselves, these sites were likely directly ruled outposts of the Aztec Empire, but their degree of leverage relative to the empire is unknown. While such sites could potentially offer a venue for more intensive interaction with local people, this does not usually appear to have been the case, and they cannot be considered sufficient evidence for direct rule of broader provincial areas in the absence of other evidence. Third, there are sites, scattered across a wide portion of the empire, which show more limited Aztec influence. These sites include cases such as the Mixtequilla region on the Gulf Coast and Coixtlahuaca and its surrounding area in Oaxaca. In these cases, only a narrow range of Aztec goods occur at the provincial site and these are often accompanied by local imitations. The frequency of Aztec goods is generally higher in urban areas, and they may be absent in surrounding rural communities. Unfortunately, to date, none of these sites has been investigated in sufficient detail to differentiate the pre- and post-Aztec portions of the Late Postclassic, making specific conclusions about economic and cultural change difficult. Due to the limited evidence for Late Postclassic Central Mexican influence in general, these sites can be considered examples of relatively indirect rule, most likely with little collective power relative to the empire.

Case Study Regional and Site Background

Calixtlahuaca and the surrounding Toluca Valley can be placed against these three variables for empire/province interactions described above: distance, loyalty, and elite preferences. The Toluca Valley is located immediately west of the Basin of Mexico, making it one of the most centrally located provinces. Ethnohistoric sources document at least one episode of rebellion and reconquest, suggesting a “problem province” status for the region. Finally, the evidence for elite interaction appears relatively high, with the region appearing a fair number of times in documentary histories, and Aztec style goods found in burials near monumental architecture. Calixtlahuaca is not a clear fit within any of the three types of Aztec/provincial interaction described above. The site lacks the history of interaction and co-development with the Basin of Mexico characteristic of Morelos, but also shows a higher degree of evidence for changes under Aztec rule than most “limited influence” cases.

Ethnohistorical work on the area has drawn on both the traditional Mexica-centric sources and a steadily increasing number of local colonial documents. The local colonial documents from the region include both the records of extensive court cases between the Marquesado del Valle (Hernán Cortez’s personal estate), the Spanish Crown, and local communities (García Castro 2006; Hernández Rodríguez 2011), records of other court cases (Ruiz Medrano and Noguez 2004), and Nahuatl-language wills spanning several centuries (García Castro 2000; Pizzigoni 2007). As is common in documentary sources, those for the Toluca Valley contain a number of contradictions and have been subject to very little archaeological verification to date. In particular, the place-name Matlatzinco is

variably used to refer to the greater Toluca Valley as a region, the city-state of Calixtlahuaca, and the city-state of Tollocan (Umberger 2008). Similarly, the site/city-state of Calixtlahuaca is referred to as Matlatzinco and Calixtlahuaca, both of which are Nahuatl terms, and once, given the pre-Aztec name of Pintambati (Hernández Rodríguez 2011:189).

The Toluca Valley was a multi-lingual and probably multi-ethnic region, with speakers of Matlatzinca, Mazahua, Otomi, and Nahuatl all recorded in the early colonial *Relaciones Geographicas* for the region (García Castro 1999). Basalenque (1975 [1642]:prologue) lists three group names for the Matlatzinca who lived in the Toluca Valle: Nentambati (“those from the center of the valley”), Nepyntatuhui (“those from the land of corn”), and Matlatzingos (“those who make nets”, but this is a Mexica name). He also lists Pirindas and Charenses as names for those Matlatzinca living within the boundaries of the Tarascan Empire, outside of the Toluca Valley proper, demonstrating the fuzzy relationship between location of residence, language, ethnicity, and terms for group identity in Postclassic Central Mexico. The Florentine Codex describes multiple named groups in the Toluca Valley, but describes their lifeways collectively, suggesting that cultural differences among such groups were subtle (Sahagún 1950-82: Book 10: Chapter 29).

During the Early Postclassic, the Toluca Valley follows the same general trajectory as much of central Mexico, with mention of Toltec, Chichimec, and unspecified previous occupants variously intermarrying and fighting with each other and outsiders. According to (Alva Ixtlilxochitl 1975-77 [1600-1640]:53), the rulers of Tula

sent children to marry into families in the Toluca Valley, though this may be part of the later ideological justification for bringing the area under Aztec rule.

By the Middle Postclassic, Calixtlahuaca was the dominant city-state in the Toluca Valley, based on textual sources (Tomaszewski and Smith 2011). If this is the case, the site rose to prominence quickly as modern archaeological work places its foundation during this same time period (Huster and Smith 2015). This contrasts with García Payón (1956/57), who had argued for a site chronology beginning during the Classic period. While there were some Classic and Epiclassic vessels recovered during his excavations, they are from offering contexts and, given the lack of other evidence for an earlier occupation of the site, are best interpreted as heirloom objects. This period may also see the origin of the Chimalli (shield) dynasty, centered at Calixtlahuaca. Multiple members of the Late Postclassic and Early Colonial native nobility in the Toluca Valley had surnames incorporating the term *chimalli*, and there is a more generalized reference to the “Chimallis of Calixtlahuaca” in one court case (Hernández Rodríguez 2011). Umberger has argued that this term is associated with the bird image often depicted on shields in Matlatzinca style sculptures and reliefs at Calixtlahuaca, and less frequently on portable stone items at other sites in the region. At this time, there were three “lords of the Matlatzinca” (Zorita 1963 [1566-1585]:194-200), though scholars disagree as which site or sites they may have ruled (García Castro 1999:53-56). Calixtlahuaca/Tenango/Malinalco, Calixtlahuaca/Toluca/Tenango, and Calixtlahuaca/Toluca/Tenancingo have all been proposed as possible sets of candidates.

During the 14th century, the northeastern portion of the Toluca Valley was briefly incorporated in the Tepanec state before regaining independence in the turmoil

surrounding the formation of Triple Alliance (Hernández Rodríguez 1988). While sites in the northwestern Toluca Valley are more clearly subordinate to the Tepanec state, the central valley is only mentioned as providing tribute twice – referred to once as Tollocan in the *Anales Tepanecas*, and once as Matlatzinco in the *Carta de Azcapotzalco de 1561* (Santamarina Novillo 2006:509-511). Given that both references list one toponym but not the other, they most likely refer to the same place, and Calixtlahuaca is a strong contender for the location in question. If this is the case, there was likely a short period of time during which Calixtlahuaca was at least nominally subordinate to the Tepanec state.

In the 1470s the Toluca Valley was conquered by the Triple Alliance in an effort to form a buffer zone between the expanding Aztec and Tarascan Empires and to acquire access to a productive maize-growing area (García Castro 1999:58). The conquest occurred under the Mexica rulers Tizoc and Axayácatl (Berdan and Anawalt 1992 [1541]; Umberger 2008), with further campaigns to deal with rebellion under Ahuitzotl and Moctezuma II (Chimalpahin 1965 [1606-1631]; Cuauhtitlán 1985 [1606-1631]). During the conquest, the Aztecs were aided by the ruler of Tollocan (modern Toluca), against the ruler of Calixtlahuaca. Of the three “Lords of the Matlatzinca” at this time, only Chimaltzín of Toluca survived.

Following the Aztec victory under Axayácatl, many Matlatzinca (traditional residents of the Toluca Valley region) fled west into Tarascan territory, and lands in the Toluca Valley were divided between Tollocan, Basin city-states that had assisted in the conquest, and high-ranking Aztec individuals. Calixtlahuaca fell under the direct control of Tenochtitlán in this subdivision. Lands left empty by fleeing Matlatzinca were resettled by large numbers of agriculturalists from the Basin of Mexico (Carrasco

1950:277-279; Cuauhtitlán 1985 [1606-1631]:57; Zorita 1963 [1566-1585]:22,263ff, 266). Settlers came from the particular Basin cities that had been granted control over a particular Toluca Valley town, resulting in a mosaic of communities occupied by Matlatzinca and groups from different Basin of Mexico source communities.

Officials of the Triple Alliance were established in both Calixtlahuaca and Tollocan (modern Toluca), but the latter became the primary tribute collection point, creating a reversal of the pre-Aztec local balance of power (Alva Ixtlilxochitl 1975-77 [1600-1640]:2:145; Chimalpahin 1965 [1606-1631]:105-107), a situation that continues to the present day. Hernández Rodríguez (2011) argues that this power shift was largely political and that Calixtlahuaca maintained much of its religious importance. The primary deity image from Matlatzinco (in this case probably Calixtlahuaca) was removed to Tenochtitlán, where it was kept in its own temple (Durán 1951 [1581]:2:272; Sahagún 1950-82:2:171-172).

Based on recent survey work, Calixtlahuaca covered 234 hectares at its maximum extent, making it relatively large for a Postclassic urban center (Smith 2008). Recent radiocarbon dates demonstrate that the site was founded around AD 1130 and abandoned by 1530, shortly after the Spanish conquest. The ceramic chronology for the site allows this span to be divided into three phases, described in more detail in Chapter 3 (Huster and Smith 2015). The site provides an interesting contrast between local and Aztec cultural traditions. On one hand, it features a highly distinctive local ceramic tradition, has limited Aztec imports in domestic contexts, and has a distinctive of a single monumental architectural core. This is juxtaposed against distinctively Aztec-style architectural elements in the last phase of monumental construction (Sergheraert 2011)

and, regionally, the largest collection of Aztec-style sculpture in the provinces (Umberger 1996).

Even based on this brief summary, it is clear that the ethnohistory of the Toluca Valley provides examples of multiple imperial and provincial strategies. Imperial actions include intermarriage and alliances with local nobility, the rearrangement of economic systems, propaganda in the form of capturing and replacing the central deity statue, and the introduction of colonists. Local responses include bolstering, migration, and resistance. Archaeology offers a means of identifying additional strategies and measuring the effects of those already described.

CHAPTER 3. SITE BACKGROUND AND PROJECT METHODS

This project is based on data from the site of Calixtlahuaca in the Toluca Valley of central highland Mexico. Calixtlahuaca was a Middle-Late Postclassic (AD 1130-1530) city-state capital. My research for this project occurred in conjunction with the broader Calixtlahuaca Archaeological Project (CAP), a multi-year investigation of urban processes and political change at the site directed by Dr. Michael E. Smith. This chapter describes the physical setting of the site, field and lab work by the CAP, specialized artifact samples and analyses used in later chapters, and the development of the site chronology.

Geology and Environment

The Toluca Valley (sometimes called the Upper Lerma) is located immediately west of the Basin of Mexico, in the Central Mexican highlands. It is slightly higher than the Basin of Mexico, resulting in both cooler temperatures and higher rainfall. It is part of the Neovolcanic axis, and the landscape is dominated by the Nevado de Toluca, Mexico's fourth highest mountain. The Toluca Valley forms the headwaters of the Rio Lerma, which eventually drains much of west Mexico. The geology is primarily igneous, with both tertiary and quaternary formations. Temperatures are lowest during January, and nighttime freezes are not uncommon. The area receives an average of 29.4 inches of rain annually, with the majority falling between June and September. During portions of prehistory with higher than modern rainfall levels, parts of the Toluca Valley were

covered with shallow lakes and/or marshes, but these features never dominated settlement and transport patterns to the degree that the lakes in the center of the Basin of Mexico did for that region. Human occupation of the Toluca Valley began as early as the Archaic, but settlement density remained light until the collapse of Teotihuacan (Sugiura Yamamoto 1998). Stylistic similarities and chemical sourcing of artifacts show fluctuating ties to central and west Mexico (Kabata 2010; Sugiura Yamamoto 2005).

The archaeological site of Calixtlahuaca is mostly located within the boundaries of the lands of the modern village of San Francisco Calixtlahuaca, in the Municipio of Toluca, State of Mexico, Mexico (Figure 3.1). The site area is bounded to the south by the Parque Sierra Morelos, to the east by the village of San Marcos, to the north by the village of San Francisco Calixtlahuaca, and to the west by the ejido lands belonging to the community of Tecaxic. The site covers a primary hill, Cerro Tenismo (Tenhizo on some maps), and extends across a smaller secondary hill to the east, Cerro San Marcos. The central portion of the site is an official Instituto Nacional de Arqueología e Historia (INAH) archaeological zone. There is a small on-site museum, managed by the Municipio of Toluca. Much of the site (including most of the INAH zone) is held as “Tierras Comunales” by the residents of San Francisco Calixtlahuaca. For practical purposes, this is similar to an ejido, with land title controlled communally, but with particular families or individuals having usufruct rights to particular plots. However, in a unique situation, the land is owned by a communal village organization, rather than by the federal government. Based on pedestrian survey by the Calixtlahuaca Archaeological Project, evidence for ancient occupation extends well beyond the official site zone boundaries, covering approximately 264 hectares (Smith, et al. 2009).

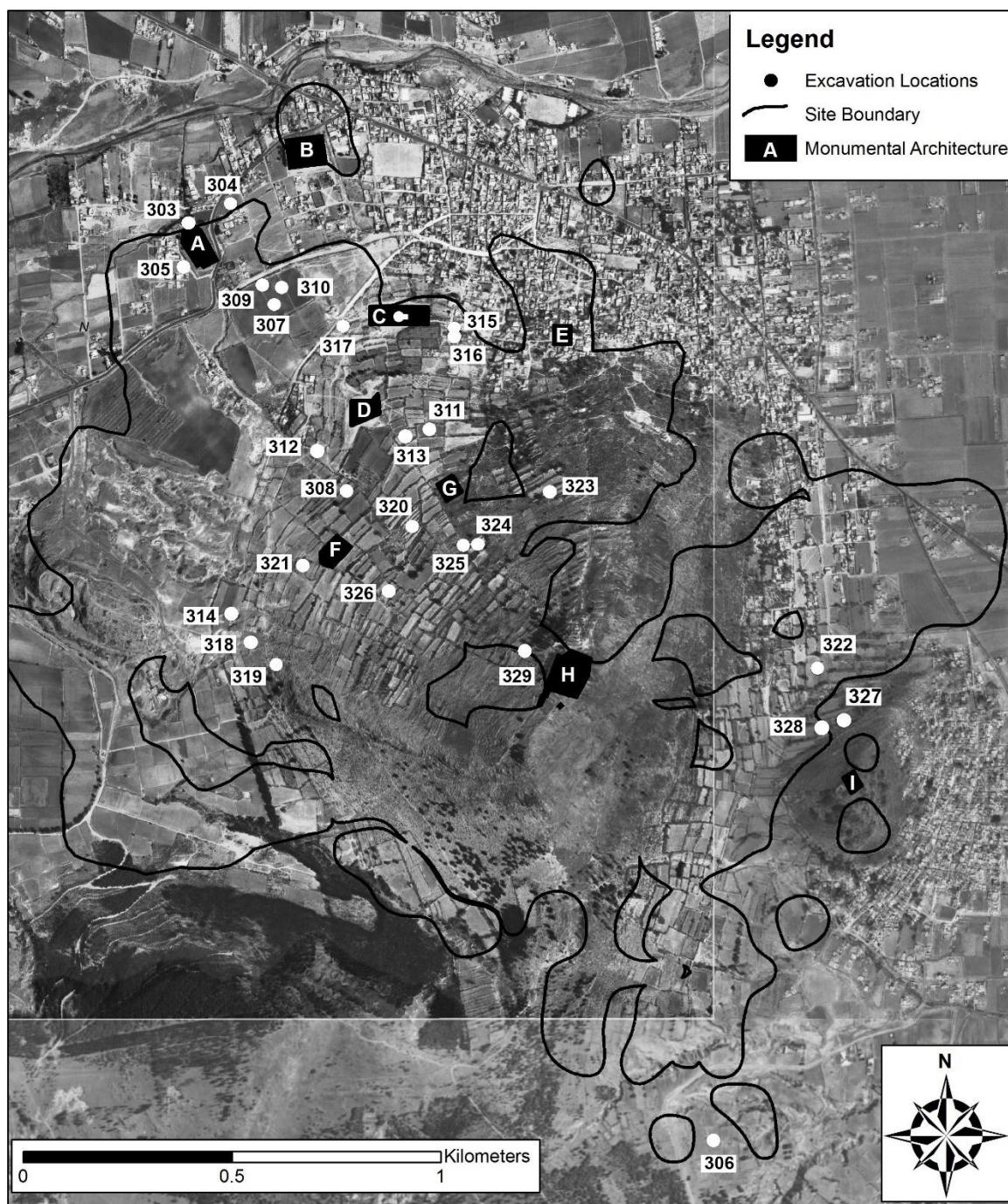


Figure 3.1 Map of the site of Calixtlahuaca showing site boundaries, monumental architectural groups, and excavation unit locations

The site's environment is characteristic of highland Central Mexico. Cerro Tenismo ranges from approximately 2650 to 2920 masl. The site receives around 800mm of rainfall annually, with the majority falling during the July-September rainy season. The lower two thirds of the site are currently used for subsistence maize milpa and maguey cultivation. The upper portions are used primarily for grazing (mostly sheep, with some cattle and turkeys), though evidence of past cultivation and discussion with local residents suggest that this is due to decreased interest in subsistence agriculture among younger villagers, rather than any inherent unsuitability of the land for agriculture. There are tejocote (crabapple) and capulin (wild cherry) fruit trees on the hill, which are harvested opportunistically. The village of San Francisco Calixtlahuaca is steadily encroaching on the site, even within the officially designated archaeological zone.

Site Description

As noted above, the archaeological site of Calixtlahuaca covered a maximum extent of about 264 hectares. The site contains a number of monumental structures, originally located, mapped and excavated by José García Payón. In contrast to most Postclassic cities, which feature a single monumental core, Calixtlahuaca's monumental architecture is scattered from the base to the summit of Cerro Tenismo (Figure 3.1). This arrangement of two-to-four structure clusters is likely a result of the hillside nature of the site, where creating sufficiently large, flat, terraced areas would have required more labor than the construction of the monumental architecture itself. The monumental architecture includes a palace (Figure 3.1 A, known locally as the Calmecac), a round pyramid

(Figure 3.1 C, Figure 3.2), a two pyramid and altar complex (Figure 3.1 D, Figure 3.3), a probable elite residence (Figure 3.1 F, known locally as the Panteon due to the number of burials encountered there), and several other unrestored mounds or mound groups. The results of García Payón's excavations of the monumental architecture were partially published in a number of works (García Payón 1936, 1938, 1941a, 1941b, 1956/57, 1979, 1981), but the specific details of what artifacts came from which monumental structure are decidedly fuzzy (Smith 2003e). What can be ascertained is that many of the monumental structures had multiple (2-4) construction phases, the last of which is likely associated with the Aztec occupation of the site, due to differences in stone selection and construction techniques (Sergheraert 2011). Sculptures recovered at the site include both pieces in the imperial Aztec style and pieces in a distinctly local style (Umberger and Hernández Fahan submitted 2014). The majority of the surviving artifacts from García Payón's excavations are stored at the Centro Cultural Mexiquense, on the outskirts of the city of Toluca.

Outside of the complexes of monumental architecture, the majority of the site was covered with terraces, featuring a mixture of residential architecture and agricultural fields. The ancient terraces covering the majority of the site were narrow and connected to a system of large paved drains to prevent erosion during the rainy season (Borejsza, et al. n.d.). Soil on the terraces was heavily manipulated by humans in order to produce consistent textural characteristics beneficial for agriculture. The Postclassic terrace system collapsed after the site was abandoned following the Spanish conquest, and the modern terraces in use on the hill offer only the most general outline of the ancient system. The majority of the Postclassic houses excavated at the site were one or two

room structures, built of wattle and daub on stone wall foundations (Figure 3.4) Some houses may have had adobe walls. Exterior pavements were common and some small interior rooms were also paved. Unlike in many Postclassic Central Mexican urban settlements, houses occur singly, rather than being grouped into compounds or clusters around a central courtyard. Like the lack of a single monumental core, this pattern may be result of the effort needed to produce large level areas on a steep hillslope.



Figure 3.2 The round pyramid (Group C) at Calixtlahuaca



Figure 3.3 Monumental Group D at Calixtlahuaca



Figure 3.4 Typical house at Calixtlahuaca (Excavation Unit 309)

Archaeological Work

Archaeological work in the Toluca Valley has been relatively limited to date, especially for the Postclassic period. Sugiura (2000) has surveyed the majority of region, but she is just beginning to publish the Postclassic portion of the resulting dataset (e.g. Sugiura Yamamoto 2011). All of the Late Postclassic towns listed in the Toluca Valley provinces of the *Matricula de Tributos* can be confidently matched to geographic locations (Smith and Berdan 1996a). However, other than Calixtlahuaca itself, only three other Postclassic sites in the Toluca Valley, Huamango, Teotenango, and Cerro Toloche have been subject to systematic excavation. In the cases of the first two of these sites, excavation focused primarily on the Early Postclassic monumental cores of the sites (Piña Chán 1975, 1981). The third site, Cerro Toloche, is only located a few miles from Calixtlahuaca but would have been part of the prehispanic city of Tollocan (Toluca). Work at Cerro Toloche began after the completion of the Calixtlahuaca project and artifact analyses are still underway at this time (Jaramillo Lunque and De la Peña Virches 2012, 2014). Based on initial results, the site has a very similar artifact assemblage to what has been found at Calixtlahuaca, and future comparisons will be informative. A few other sites in the broader Toluca Valley and surrounding areas have also been excavated during salvage work, including the Cerro de los Magueyes at Metepec (Carbajal Correa and González Miranda 2003), and various excavations in Valle de Bravo (Murillo Rodríguez 2002; Reinhold 1981). Unfortunately, these projects have not been comprehensively published, making comparisons difficult.

Calixtlahuaca itself has long been recognized as an archaeological site, and was a regular stop on the 19th century Central Mexican antiquities collecting circuit (Huster 2013). More formal archaeological work at the site has consisted of the excavations of José García Payón on the monumental architecture from 1930-1938 (García Payón 1932, 1936, 1941a, 1941b, 1956/57, 1979), various consolidation projects by INAH (Villanueva Villalpando 1999; Zúñiga Bárcenas 1992), and the current Calixtlahuaca Archaeological Project (CAP) (Smith 2006b, 2011). The García Payón project mapped the site, and excavated and restored approximately two thirds of the monumental structures at the site. These include the royal palace, several temple complexes, and several architectural groups of unknown function.

Beginning in 2006, the modern Calixtlahuaca Archaeological Project collected data from household and terrace contexts, as a complement to the previous work on monumental architecture at the site. The project consisted of one summer survey season, one six-month excavation season and five subsequent summer lab seasons. The survey established the site boundaries and produced a set of systematic surface collections. The survey material has been analyzed by Novic (2015) for information on neighborhoods and social clustering within the site. The 2007 season featured excavations in twenty-seven areas scattered across the core of the site (Figure 3.1). The targeted goals of the excavations were approximately evenly divided between domestic contexts and broader terracing and land modification processes. Thirteen of the excavations produced middens and/or domestic architecture with associated refuse scatters. Once the various stratigraphic levels within the excavations were dated, several proved to have components dating to multiple phases of the site's occupation, providing a total of

eighteen chronologically distinct household components for analysis (Table 3.1). During the subsequent lab seasons, all artifacts recovered from domestic contexts were cataloged and subjected to basic visual classification. I did four additional months of attribute analysis in the lab during fall 2011 specifically for this dissertation.

Unit	Phase	DS-1 Contexts			DS-2 Contexts		
		N. Lots	M ³ Excav.	N. Sherds	N. Lots	M ³ Excav.	N. Sherds
307	Dongu	6	0.87	4,770	9	2.49	5,810
315	Dongu	24	5.29	13,890	41	10.50	16,775
316	Dongu	11	2.34	3,050	17	4.77	4,710
320	Dongu	9	2.02	3,840	37	8.03	12,189
323	Dongu	13	3.91	8,915	44	14.05	26,947
324	Dongu	3	0.59	914	3	0.59	914
303	Ninupi	7	1.75	8,951	8	1.75	9,043
307	Ninupi	5	1.98	20,280	10	3.83	22,330
308	Ninupi	5	0.76	3,729	9	1.35	4,359
311	Ninupi	13	3.08	5,030	22	6.22	7,838
316	Ninupi	27	9.46	15,800	47	13.76	22,563
322	Ninupi	4	0.91	1,668	7	1.52	1,855
307	Yata	11	3.47	10,200	13	4.41	10,257
309	Yata	9	4.08	3,094	17	5.75	4,217
316	Yata	7	3.89	7,451	17	6.08	10,091
317	Yata	14	5.42	9,638	25	6.64	10,860
324	Yata	6	1.76	3,438	6	1.76	3,438
327	Yata	4	1.26	948	8	2.96	1,266

Table 3.1 Excavated household components in the DS-1 (core household) and DS-2 (extended household) samples with lot counts, volume excavated, and sherds counts.

Field Methods

During the 2006 survey season, the project worked out of the site museum. The immediate goals of the survey were to establish the boundaries of the site, locate potential areas to excavate during the subsequent season, and identify broad spatial patterning in artifacts. In addition to providing information on the spatial layout of the site, this season also allowed the project to adjust the previously developed whole-vessel ceramic classification system for use with sherds (Smith 2003e). Details of the survey methods and findings can be found in the survey project report (Smith 2006b) and associated articles (Smith, et al. 2009; Tomaszewski 2006).

Beginning in 2007, the immediate excavation goal was to generate a sample of house and terrace contexts from across the site, in order to better understand the occupational history of the site as an urban center. This resulted in the placement of 27 excavation units³ across the site, labelled as Units 303 through 329. Unit placement was based on a combination of the archaeological potential of a given section of the site, cross referenced against landholder attitudes toward archaeological investigation.

³ The CAP used the terms Unit-Locus-Lot to identify both survey and excavation contexts, rather than the more common Operation-Unit-Lot. This work uses the project terminology, so “Unit” is a major excavated area, such as a house excavation or several test pits within a single field. Unit codes are also used to refer to several other non-excavated contexts, including “300” for all survey collections, “301” for a profile drawn during the survey, and “302” for donations by local residents. “Locus” refers to the grid square within the unit. Excavated loci were of variable dimensions, but usually covered between one and four square meters. Architectural features were also assigned locus numbers if they were excavated apart from the grid system. In the survey, locus is used to refer to a single surface collection. “Lot” refers to the excavated level within the locus, beginning with 1 at the surface. Lot depth is variable, using a combination of arbitrary and stratigraphic breaks, so a given lot number may refer to variable depths in different loci. For further descriptions of excavation procedures, see Smith 2011.

Approximately half the units were targeted toward locating domestic structures and half were focused on aspects of the terraces and drain system. About one third of each category did not locate its targeted objective, and units intended to investigate one topic sometimes located features of interest to the other and were expanded accordingly. Each unit was excavated by a team of one or two archaeologists and 4-10 local workers, and checked at least once a day by Dr. Smith. I personally supervised the excavation of units 304, 306, 309, 313, 317, 324, and 325, and was able to observe the remainder of the house excavations on a regular basis.

Within each house-focused unit, excavation began with a trench through the highest probability area. If this trench encountered architecture or midden deposits, additional loci were added until an area one to two meters around all architectural remains was completely exposed. Once the architecture was exposed, a limited number of units would be further excavated to expose any deeper layers of cultural material. When possible, a two-meter zone around the architecture was cleared down to just below the Postclassic ground level in an effort to locate midden deposits, or, if no clear midden could be delimited, to produce an adequate sample of medium-to-high density secondary refuse. Middens were excavated until they reached sterile. Within each locus, lots were removed in 10 or 20 cm arbitrary levels unless a change in stratigraphy was observed. Excavated soil was screened through ¼ inch mesh at the discretion of the lead archaeologist for the unit, and the screened/not screened status of each lot was recorded. For most house excavations, plowzone lots were not screened but most lots associated with architecture and all lots from middens were screened. For unscreened lots, workers removed and bagged all artifacts observed during excavation. Details of the excavation

method and findings can be found in the project report (Smith 2011) and associated articles (Smith, et al. 2013).

All excavated artifacts were initially processed at the field lab in San Francisco Calixtlahuaca. All artifacts were washed and the very high priority ceramic lots and all lithics were given a basic analysis. Following the end of the excavation season, all of the project artifacts were moved to a lab facility at the Colegio Mexiquense, in the nearby town of Zinacantepec. All further artifact analyses, which took place between 2008 and 2012, took place at this lab, and are discussed as appropriate below.

Chronology

One of the primary data analyses for the CAP was the establishment of a site chronology. Because of the relatively limited previous work in the Toluca Valley, most local ceramic types did not have known date ranges other than “Postclassic,” limiting the possibility of using marker types to date particular components. The full process of developing the site chronology is presented in Huster and Smith (2015), and I present a brief summary of the results here. We first created three clusters of ceramic lots, based on discriminate analysis of ceramic lots, with the initial seed lots for each group selected based on ceramic cross-ties to other regions. These groups were confirmed to be chronological due to their stratigraphic consistency across the site. We assigned absolute dates to the three groups based on a series of 54 radiocarbon dates. These dates were used to generate phase date ranges using Bayesian analysis, and further confirmed the temporal distinctiveness of the three ceramic groupings.

Based on ceramic seriation and the Bayesian analysis of associated radiocarbon dates, Calixtlahuaca was occupied from AD 1130 to 1530. The occupation of the site can be subdivided into three phases, Dongu (AD 1130-1380), Ninupi (AD 1380-1450) and Yata (AD 1450-1530) (Huster and Smith 2015). These were referred to as Phases 2, 4 and 6 during analysis and the numbered labels are retained for identifying household components by phase. On a regional scale, these can be considered equivalent to Middle Postclassic, Late Postclassic-A, and Late Postclassic-B phases at other Central Mexican sites.

Samples

The Calixtlahuaca Archaeological Project excavations included over one and a half thousand individual lots. These recovered approximately half a million sherds as well as smaller numbers of artifacts of other classes. These artifacts come from a range of contexts representing both different original contexts of use and deposition, and different formation processes in the time between deposition and excavation. As a result, the project defined five potential samples, referred to as DS-1 through DS-5, of which three are used in this dissertation (Figure 3.5).

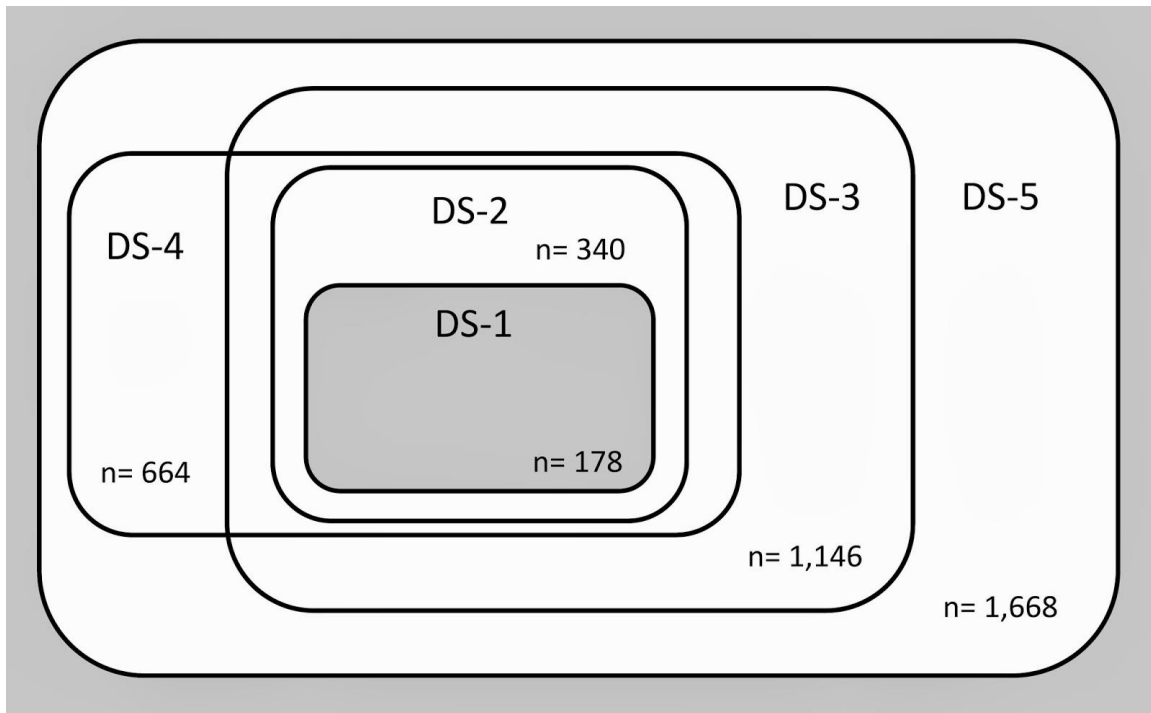


Figure 3.5 Schematic of the DS-1 (core household sample) to DS-5 (all excavated contexts) samples of contexts excavated by the Calixtlahuaca Archaeological Project. N values are the number of excavated lots in the sample.

The samples begin with the DS-5 sample. This sample includes all of the artifacts from all of the project's excavations. This encompasses a wide range of contexts, featuring everything from middens to slopewash. It also includes lots that received a range of post-excavation processing, ranging from a brief looking over before discard to full artifact classification. I use this sample when I am discussing the range of variation present in a particular artifact class at the site, because good examples of particular artifact types may not have come from the most secure contexts.

The DS-4 and DS-3 samples were generally not used in this dissertation. The DS-4 sample consists of all of the lots at the site with completely classified ceramics. The DS-3 sample consists of all of the lots at the site which could be confidently assigned to

one of the three primary phases of occupation. Many of these lots do not have completely classified ceramics. The DS-4 and DS-3 samples partially overlap each other; there are phased lots without completely classified ceramics and lots where the classified ceramics could not be assigned to a phase.

The next sample, the DS-2, is an extended household sample. It includes all securely dated lots peripherally or well associated with household contexts. As a result, associations are somewhat more tentative than in the more restricted DS-1 sample. I use this sample for analyses of rare artifact classes, such as figurines or jewelry, where using a broader sample is the only way to establish a reasonable sample size.

The most commonly used sample of contexts is the DS-1, or core domestic context sample. A subset of the Calixtlahuaca Archaeological Project excavations was designated as the domestic context sample and is generally used as the core sample by all project researchers focusing on household information (as opposed to terraces and broader landscape use). The domestic context sample consists of lots with a good chronological assignment to a single phase and that are clearly associated with house architecture, from clear midden deposits, and/or from unassociated high-density deposits that did not show signs of significant redeposition. It does not include plow zone or other surface disturbed contexts, terrace fill or gully fill. The sample includes lots from thirteen excavation units. Because many of the units have more than one temporal component, there are eighteen discrete components within the thirteen excavation units. Two units are continuously occupied through all three phases, one included portions of unrelated Dongu and Yata phase occupations, and the remainder are single-phase occupations. There are six components dating to each of the three phases. The unit locations cover a broad swath

of the site core, from the valley floor to the upper hillslopes, including materials from multiple neighborhoods in each phase. None of the components with architecture are highly distinctive on the basis of architectural style or house size, suggesting that the sample does not include any elite households. (For a further discussion of household status and wealth, see chapter 6.) For the purposes of my analysis, I treat all of the DS-1 lots dating to a single phase in a given excavated unit as a single analytical unit, referred to as a household component. This means each household component usually includes materials from more than one stratigraphic context. This lumping is necessary to provide sufficient sample sizes for many of the smaller components.

Each component should be interpreted as a household series (*sensu* Smith 1992b), rather than a household in the ethnographic sense. While the ethnographically observable household is a single family grouping, which may grow, shrink, and reform over time, the archaeological household is a composite view of a series of households over a time span much longer than the life of any one individual member of the household. As a result, the archaeological remains in each household component are an average of activities over multiple generations.

Analyses

The work in this dissertation draws on four major ceramic datasets and references a number of additional analyses of specific ceramic artifact types (i.e., figurines, spindle whorls) or non-ceramic artifacts (i.e., chipped, ground stone). The following sections

provide details on the nuts-and-bolts of classification, sampling and recording procedures.

General Ceramic Classification

All of the ceramics for the DS-1, DS-2, and DS-4 samples were given a basic classification during the 2007 excavation season or the 2008-2012 lab seasons. The classification system used by the project is based on a combination of vessel form and decoration. Paste is generally only factored into the classification system as a secondary means of identifying certain imported types, such as Aztec Black-on-Orange wares. Local ceramics lack clear differentiation in pastes, with most being made from a medium-coarse buff paste.

The ceramic classification system divides ceramic sherds into six major form categories, cross-cut by decorative families. As a result, “type” refers to a specific decorative pattern for a specific vessel form. The form based categories are bowls (including simple, tripod, and molcajete bowls), jars (necked vessels without spouts), basins (large open vessels), comals (tortilla griddles), other vessel forms (a miscellaneous category including freestanding censers, sahumadors, spinning bowls, pitchers, copas, and other rare forms), and non-vessel ceramics (figurines, spindle whorls, beads, pipes, worked sherds, etc). Major decorative groupings are referred to as families. Decorative groups identified from the regional review of museum collections are named using the letters A through H and J to K, though the latter two families did not occur in the excavated project material. In addition, comparable groupings of material from the Basin of Mexico, such as Aztec Black-on-Orange wares and Black-on-Red wares are also

referred to as decorative families. Decorative families are usually based on color combinations; thus all Family C types are polychrome on white, while all E types are red-on-natural. A full listing of families and illustrations of representative sherds can be found in Chapter 8. Within each family, specific decorative types are numbered, so sherds are recorded as A-1, A-2, B-1, B-2 and so on. While the “0” number for a family is always “Family known, specific decorative type unknown”, all other numbers are unique to the family and an A-1 has no particular relationship to a B-1. About one third of the vessel types in the classification system fall outside the decorative family system. These are either non-local types (e.g., Chalco-Cholula Polychrome), or undecorated/simply decorated pieces with distinctive forms (e.g., Biconical censers). Within each type, sherds were identified as rims, molcajetes (grater bowls), appendages, or bodies. The general ceramic classification system used at the site was developed prior to the beginning of the project by Smith (2003e) for recording whole vessels in museums around the Toluca Valley. It was subsequently amended in 2006 for use on sherds and continued to be amended as necessary throughout the lab seasons. When type definitions were changed, all potentially affected previously classified sherds were reclassified to insure consistency throughout the dataset. Any lots from which I drew the random sample for attribute coding in 2011 were briefly reclassified at the time of sampling to insure standardization. The final dataset includes between 900 and 20,000 classified sherds per DS-1 domestic context component. Copies of the type list and lot coding sheet may be found in Appendix 1 and a more detailed ceramic coding guide will be uploaded to the Digital Archaeological Record (tDAR, www.tdar.org) as part of the project’s data management plan.

The majority of the general ceramic classification was completed by lab workers from the village of San Francisco Calixtlahuaca. Once they completed a provisional classification, the ceramic lot was checked by one of the season's senior project members (Dr. Michael Smith, Cynthia Heath-Smith, Juliana Novic, or myself, depending on the season). In cases where someone other than one of the lab workers did the initial classification, the lot was still checked by a second person to insure consistency. The resulting data were entered into an Access database in the field.

I use the general ceramic classification data in analyses in four chapters. When I am using all classified sherds of all types, even for limited samples of contexts, this is my largest dataset and allows for strong conclusions. All DS-1 household components have at least 900 sherds. In my discussion of trade in Chapter 4, I analyze all DS-1 sherds by likely source region. Similarly, in my discussion of wealth in Chapter 5, I use either all sherds or all non-eroded sherds as my sample for analysis. In other cases, I use subsets of the classified ceramics. These include ritual vessels in Chapter 7 and separate analyses of cooking and serving vessels in Chapter 8. In order to maintain adequate sample size, I use total sherd counts for all intra-site comparisons and some inter-site comparisons. When performing comparisons with other sites where ceramics were reported using rim-sherd only classifications, and where this would result in sample of less than ten sherds for a given household at Calixtlahuaca, I either remove the household from comparison, or compare the Calixtlahuaca households as a single phase-based total.

Attribute Analysis

The second major dataset collected and used in this dissertation was a more detailed attribute analysis of a sample of sherds from each domestic component. The sample consisted of a randomly selected sample of up to 200 rim, 50 appendage (handle/support), and 30 interior-incised sherds per component. Attribute data consisted of up to nine items for each sherd, including detailed vessel form, rim and appendage form, rim thickness and diameter, decorative motifs, paste type, and incision patterns in grinding bowls (see Appendix 2 for code descriptions and sample coding sheets). These attributes encompass a range of functionally equivalent variation in technological style, likely resulting from learned differences in production techniques (Hegmon, et al. 2000; Lemmonier 1986). However, because later analyses showed that many of the attributes recorded in the field did not correspond to the groups produced by INAA and ceramic petrography, much of the collected attribute data were not included in this dissertation.

Sherds were selected for attribute analysis as follows. For each component, lots were randomly selected until reaching either 5000 total sherds, or three lots, whichever involved a larger number of lots. Lots that had previously had samples taken for thin section petrography were selected only after all other lots in the component to avoid the difficulty of reuniting sherds that were boxed for export. For each component, the three selected lots with the highest sherd counts were weighed by type. If the three largest lots were all from the same unit, the smallest was replaced with the largest lot from a different unit (see Appendix 2 for lots selected for each component). This weighing provided data on fragmentation rates by type.

Within the selected lots for a component, the rim sherds, appendages, and incised pieces (molcajetes and ollas) were each laid out as a group. Using a list of random

numbers generated for the range necessary by <http://www.graphpad.com/quickcalcs/randomn1.cfm>, with numbers put in order and duplicates removed, I then counted from the first sherd, taking for attribute analysis those that corresponded to the numbers on the randomly produced list. Counting continued directly from one lot to the next. Pieces belonging to more than one category were placed with rims if including a rim and anything else, and as supports if molcajetes and support were both present. If selected, however, all applicable attributes were recorded. If there were fewer sherds of a given group in the DS-1 component than the total to be sampled, attributes were recorded for all sherds present, but additional sherds were not added from other non-DS-1 lots. This occurred most often when sampling incised sherds.

All of the original attribute analysis was completed between August and December, 2011. With the exception of three household components where Rosario Endañu, a Mexican archaeology student, assisted with recording less subjective variables (paste, sherd thickness, vessel diameter, and rim-arc percentage), I personally did all of the analysis. I revised the attribute coding for the first five classified components in summer 2012 to insure consistency. The resulting data were entered into an Access database by student volunteers at Arizona State University. A revision of 10% of the entries found errors in less than .5% immediately after data entry, and this was further reduced by ongoing checking and correction of clearly anomalous cases during analysis.

The attribute data is a reasonably large sample per household, and has the advantage of being a randomly selected and consistently sized sample for each household component. In chapter 5 I use attribute data on rim diameter, thickness, and lip form from three common vessel forms to address the standardization of ceramic production by

phase. In chapter 6 I also use attribute information on average rim arc percentage by household component to compensate for variation in formation processes when calculating vessel equivalents as a component of household wealth.

Instrumental Neutron Activation Analysis

Neutron Activation Analysis is considered the most accurate method for identifying the bulk chemical composition of artifacts. It functions by bombarding a sample of the artifact (for ceramics, a powdered sample) with neutrons and then measuring the resulting decay of the radioactive isotopes formed. At the Missouri University Research Reactor, samples are subjected to both a short and long irradiation cycle, allowing for the identification of 27-33 elements. The method has been widely used in Mesoamerica. Within the Basin of Mexico, where there is long history of using the technique and a strong comparative database of sherds and clay samples. These data have been used to distinguish at least six major source groups, with eighteen possible subgroups (Crider 2011:80). The areas to the north (Tula), east (Basin of Mexico), and southeast (Morelos) of the Toluca Valley are represented in MURR's comparative database, allowing for the identification of sherds from these areas. However, previous work in the Toluca Valley itself is limited to a single study of 64 sherds from the site of Tlacotepec (McVicker, et al. n.d.) and a small, currently unpublished sample of Epiclassic sherds from the southern Toluca Valley. As a result, geographic source group assignments are stronger for sherds imported from outside the Toluca Valley.

A stratified random subsample of thirty sherds from seventeen of the eighteen domestic components was selected for INAA analysis at the Missouri University

Research Reactor (see Appendix 3 for INAA samples). (The eighteenth household component, 327-Ph6, was identified and defined after INAA samples had been submitted.) The rim sherds from the attribute analysis of each domestic component were divided into bowl, jar and other vessel categories, and sherds too small for INAA (2 cm²) were removed. Because there is little apparent variation in breakage rates due to differences in paste or vessel form at the site, the removal of small sherds was not expected to introduce significant bias into the sample. A sample of 15 bowl, 10 jar, and 5 other vessel rims was then selected from the remaining adequately-sized sherds using the same procedure as the attribute random sampling. Sherds were assigned to stratification groups based on their primary vessel form code from the attribute analysis, with tripod bowls, molcajetes, and simple bowls stratified as bowls, jars sorted as jars, and all other vessel forms placed in the other vessel stratification category. This produced a very close correspondence with the broad vessel form categories used in the general ceramic classification, with two specific exceptions. Thick-rim vessels, listed as an “other vessel form” in general classification, were sampled with the jars. Decorated basins, which were included with bowls of the same decorative pattern in the general classification, were sampled with other vessels for INAA. Due to the reassessment of the site chronology between the time of sample selection and the writing of this dissertation two household components, 303-Ph2 and 311-Ph4, ended up with double samples of 60 sherds. In addition, the broader CAP also submitted 150 sherds for INAA. These sherds were selected by type from types suspected to be non-local, and greatly improved MURR’s ability to identify rare, imported, source groups.

I use the INAA source group assignments provided by MURR. These include nine groups, referred to as Groups 1-9, and a remaining unknown fraction, referred to as Group Unknown. One group, Group 9, consists exclusively of sherds from a single component, including types that should not otherwise cluster together. As a result, it is considered a result of contamination, either prior to excavation, or during processing and is excluded from analysis. Of the remaining groups, three (Groups 1-3) are generally associated with the Toluca Valley, three are associated with the Basin of Mexico (Groups 4-6), and two are associated with areas to the south or southwest of the Toluca Valley (Groups 7 and 8). These groups are described in more detail in Chapter 4.

The INAA sample had two primary functions. The first was, as a random sample, to provide an independent measure of ceramic variation within and among households, based on the distribution of source groups. The second was to associate decorative types from the general classification or particular attributes from the attribute analysis with geochemical source groups. For this second function, I also included the INAA results of the sample of 150 sherds from the general project. This general sample consisted of samples of suspected imported types. As most of these types are relatively rare overall and thus appear infrequently in the random sample, the addition of the general project data allows for much firmer source attributions for these types.

The INAA sample is used to support my discussion of regional trade patterns over time, as well as my attributions of particular types as local or non-local for purposes of signaling foreign ties. The number of INAA samples per household (30, usually minus 4-9 sherds which could not be assigned to a group), provides large, representative samples per phase, which I use to discuss trade over time. Due to the increased probability of

random variation in individual households, I use INAA results to discuss inter-household variation only in conjunction with the larger samples provided by the general classification. Both the random and type-based INAA samples are used to establish regional affiliations for specific ceramic types. Types of particular interest were overrepresented in the type-based sample, but there were still a fairly large number of types which were only represented by a few INAA samples. In these cases, geographic attributions from INAA are supported by a broad literature-based discussion of sites and time periods where the types are present or absent elsewhere in Central Mexico.

Petrography

Thin-section petrography is a technical analysis method that complements INAA, and the CAP used it as a supplemental sourcing method. While INAA identifies the bulk composition of ceramics, petrography focuses on the inclusions (non-clay fraction). These may include natural inclusions in the clay which were not removed during processing or intentional additions during processing, such as shell, grog, or sand. This provides information both about manufacturing decisions in the production of the pottery, and provenience information, based on geologically or culturally distinctive combinations of inclusions.

The CAP submitted three sets of samples for petrography to Dr. Jennifer Meanwell. The first group consisted exclusively of material from the surface survey. Sherds were selected by macroscopic paste group, in an effort to check the validity of these groups. The results of this set of sherds generally showed that the field-designated paste groups were not analytically valid categories. The second group was a stratified

random sample of sherds by household component, for the two excavation units with continuous occupation through all three phases. These samples consisted of 22 sherds from each phase at each household, plus a small number of additional sherds from suspected non-local types. The sample from each household component was stratified by vessel form, with bowls, jars, and other vessels selected separately. The third group was selected for correlation between the INAA and petrographic datasets. It consisted of 87 sherds from the INAA sample, selected to provide 7-10 examples of each INAA source group.

Based on the combination of these three groups of samples, Dr. Meanwell defined three major local petrographic groups (I-III), one minor local group which occurred only in the survey (IV), one general unspecified local category (V), and eight much less common non-local source groups (VI-XIV). The non-local groups can be divided between those associated with types from the Basin of Mexico (VI-IX), and those associated with types from areas to the south or southwest of the Toluca Valley (X-XIV). These groups are described in more detail in Chapter 4. All further analyses use Dr. Meanwell's petrographic group assignments.

My use of the petrographic analyses is similar to those from the INAA samples. The petrographic results are used in conjunction with INAA and the general ceramic classification to identify changes in interregional trade patterns over time, with results considered at the phase level. Because most households were not sampled for petrography, this analysis is not used to discuss inter-household variation. The petrography samples were also used to establish source regions for ceramic types, in conjunction with the INAA and literature-based evaluation of sources.

Lithic Analyses

Lithics were analyzed by form and function, and samples were submitted for XRF analysis. All excavated lithics were given a basic classification by form (blade, flake, tool, eccentric, etc.) and by material (grey obsidian, green obsidian, chert, basalt) by the lab staff. In addition, Dr. Bradford Andrews performed a more detailed analysis of most of the DS-1 and DS-2 lithics, recording source material, technological artifact type, and wear visible with a hand lens. Each artifact type code is also associated with a production technology (core-blade, bifacial, bipolar, unknown), and a stage of production (general production, core rejuvenation, finished tool, etc). (See Appendix XX for a list of lithic codes, and Andrews (2013) for the initial results). The lithic classification is primarily used to discuss craft production at Calixtlahuaca in chapter 5. In addition, the total lithic counts and green obsidian counts are used as one line of evidence for evaluating household wealth in chapter 6. Most household components have reasonable lithic samples; only 316-Ph2 and 327-Ph6 have less than 50 lithic artifacts.

A sample of the obsidian artifacts was also analyzed via XRF by Dr. Adrian Burke to determine provenience. While the obsidian samples were originally selected as a quasi-random sample from about half of the household components, the sourcing revealed that there was substantial sampling bias introduced due to the correlation between obsidian sources and particular artifact types. As a result, the obsidian sourcing data are valid at the overall phase level, but not at the individual household level. The XRF samples were initially processed by Dr. Adrian Burke to test experimental analytical methods. Any samples that he could not process due to technological limitations on sample object size were then sent to MURR for analysis. In addition, two or three

samples from each of Dr. Burke's source groups were sent to MURR to confirm their geographical assignments. (See Burke and Gauthier (2013) for initial sourcing results.) The double tested samples showed near-perfect agreement between labs. The lithic sourcing data are primarily used to discuss trade at Calixtlahuaca, and they provide a valuable comparison to the patterns identified in the ceramic analyses.

Other Analyses

In addition to the primary ceramic and lithic datasets, this project also drew on a number of additional analyses of CAP data, performed both by me and others associated with the project. These include an analysis of ceramic figurines, an analysis of textile-production artifacts, and an analysis of ground stone forms.

The excavations recovered 369 figurines or figurine fragments, of which 136 come from DS-2 household contexts. The figurine assemblage was initially analyzed by Rosario Endañu, a Mexican archaeology student at the Universidad Autónoma de Estado de México, for use in her licenciatura thesis. It was later reanalyzed by Dr. Michael Smith to create a higher degree of coding comparability with his previous projects. Both coding systems recorded combinations of paste, stylistic affiliation, and subject matter for each piece. Efforts to have a small number of figurines exported for INAA were unsuccessful. Figurines are used to discuss cultural changes in ritual practices in chapter 6. In order to maintain adequate sample sizes, figurines are formally analyzed at the phase level, with some more subjective discussion of the patterns seen in individual households.

I analyzed the textile production artifacts, including spindle whorls, spinning bowls, and tabular basalt desfibrador scrapers, from the site for one of my MA papers

(Huster 2009). While refinements to the site chronology and the DS-1 sample list have rendered many of my original conclusions obsolete, I do draw heavily on the basic catalogs and artifact classifications generated by my previous work. Textile production artifacts are used to discuss changes in craft production.

The ground stone artifacts from the excavations (n=560) were originally classified into broad functional categories by Charles and Maria Stapleton, with input from Dr. Michael Smith. I recorded more detailed attributes for the ground stone by functional class, including details of form and wear. Maize grinding tools were analyzed on a comparative regional basis by Justin Mortensen for his Honors thesis (Mortensen 2014). Ground stone artifacts are used to discuss changes in both household wealth, and changes in food preparation practices.

Collections and Data Management

The artifacts excavated by the CAP are currently stored at the project's lab at the Colegio Mexiquense in Zinacantepec, Mexico. Upon submission of the final project report to INAH, the majority of the ceramics not included in the DS-1 or DS-2 samples will be discarded. With the possible exception of burned daub, all other artifact classes will be kept, regardless of context of recovery. One copy of the project's paper records (excavation forms and lab forms) is stored with the artifacts in Mexico and a second copy is located at Arizona State University. A copy of project records, including scans of field and lab forms, databases, artifact catalogs, and photographs will be uploaded to tDAR beginning in summer 2016 and will be publically available there (tDAR id: 401248).

CHAPTER 4. “EVERY KIND OF MERCHANDISE SUCH AS MAY BE MET WITH IN THE LAND⁴”: REGIONAL EXCHANGE SYSTEMS

The Postclassic period in Mesoamerica is characterized by an increase in interregional interaction. One of the major ways this occurred was an increase in trade, including increased medium and long distance trade, trade in a broader range of goods, and greater access to trade goods across a wide spectrum of the population (Berdan 2003; Blanton, et al. 2005; Golitko and Feinman 2015). However, the degree to which this increase in trade was affected by the political expansion of the Aztec Empire remains subject to substantial uncertainty (Nichols, et al. 2009), especially in those portions of the Aztec Empire outside of the Basin of Mexico. The Aztec Empire is known to have relocated markets to remove them from local elite control, which may or may not have affected commoner access to goods. In addition, the need for regular tax (tribute) payments could have either promoted long distance exchange or reduced the surplus available for purchasing luxury goods. Thus, the economic impacts of Aztec rule on provincial households have important implications for evaluating Aztec imperial activities in provincial areas.

In this chapter, I address the question of interregional exchange at Calixtlahuaca over time, in order to distinguish between broader Postclassic economic trends and the

⁴ Cortés, Hernando
1962 Five Letters of Cortés to the Emperor. Translated by J. B. Morris. Norton, New York. Pp 87-89

effects of Aztec rule. I focus on three aspects of exchange: the volume of material traded, the diversity of regions from which it came, and the evenness of household access to non-local goods. The first two of these aspects address the influence of the directness of Aztec rule; to what extent was the Triple Alliance able to alter preexisting trade patterns in directions that benefitted themselves? I expect more direct rule to appear as a noticeable deviation from prior trends in trade, particularly as a greater proportion of imported material from the Basin of Mexico, at the expense of trade connections with other areas. The second two of these three aspects of exchange are used to address the balance between more and less collective strategies of rulership. Under more collective forms of rulership, provincial areas have greater leverage relative to the core and are thus more likely to maintain preexisting trade connections. In addition, under relatively collective rule, changes in household wealth are more likely to be evenly distributed, meaning that interhousehold variation in access to foreign goods should remain relatively stable.

I analyze exchange patterns for ceramics using a combination of INAA, petrography, and type based classification. I analyze exchange patterns for obsidian using XRF sourcing. The results of these analyses show an increase in the diversity and volume of long distance trade between the Dongu (MPC) and Ninupi (LPC-A) phases. This demonstrates that prior to the Aztec conquest of Calixtlahuaca, the site was becoming progressively better integrated into broader Postclassic market systems. The preexisting local organization of social power was also sufficiently collective to insure that access to non-local goods was relatively evenly distributed among households. Under Aztec rule, during the Yata (LPC-B) phase, the source diversity and evenness of source distribution among households decrease for both ceramics and obsidian. However, the total quantity

of imported ceramics increases, while the total quantity of imported obsidian decreases. The percentage of non-local goods from the Basin of Mexico increases from each phase to the next for both ceramics and obsidian. This corresponds to a sufficient degree of imperial economic control over economic processes to reorient them in directions favorable to producers and traders from the imperial core. However, this control was most likely achieved primarily via network strategies of rulership, as the distribution of non-local goods becomes more uneven under Aztec rule and access to prior trade connections was diminished.

The Study of Commercial Economies in Mesoamerica

The presence of longstanding, well-integrated market systems in Postclassic Central Mexico has been well documented on the basis of early historic documents (Cortés 1962:pp 87-89; Díaz del Castillo 1963:232-234; Sahagún 1950-82:Book 8, p. 67-69; Torquemada 1975-83:v.4, 348-352) and archaeological analyses of various forms of material culture (Garraty 2007, 2009; Nichols, et al. 2002; Smith 1999, 2010; Stark and Ossa 2010). Together, these two forms of evidence provide a baseline for the Aztec economy. They describe a market system in which diverse types of goods were available to all consumers and with negotiable prices. This description provides a good broad-brush picture. Stylistic similarities (Boone 2003; Smith 2003d) and shared types of artifacts (Smith 1990) during the Postclassic demonstrate, at a minimum, the widespread exchange of ideas. Sourcing techniques (e.g. Braswell 2003 for obsidian; Skoglund, et al. 2006 for ceramics) and more quotidian ethnohistoric information on trade in the

Relaciones Geograficas (Hirth 2013) support this perspective, demonstrating the movement of goods as well as ideas across much of greater Mesoamerica.

However, the widespread acceptance of a commercial economy during the Postclassic has not come easily to archaeology. Historically, there has been a sense that premodern economies were relatively static, with most production oriented primarily toward household subsistence, and that any longer-distance economic interaction was driven by elite actions (Polanyi, et al. 1957; Wittfogel 1957). This perspective also appeared in Mesoamerican archaeology, in both culture-historical and ecological-adaptation paradigms (Chapman 1957; Sanders and Santley 1983; Sanders and Webster 1988). More recently, widespread work has demonstrated that Mesoamerican economies featured substantial long distance exchange (Hirth 2013), that the organization of trade changed over time (Braswell 2010; Feinman 1996; Golitko and Feinman 2015), and that at least during the Epiclassic and Postclassic periods, commercial exchange played a significant role in provisioning commoner households (Garraty 2009; Hirth 1998; Smith 2003c).

At the same time, this research has produced an emphasis on the commercial nature of the Postclassic Mesoamerican economy, which masks a large degree of variation in the volume of goods traded and the distances over which they travelled. Studies of exchange patterns on a smaller geographic scale have demonstrated the presence of reasonable diversity in the quantity and types of items, distance of exchange, number of trading partners, and the relationship between political units and trade patterns (Hodge and Minc 1990; Kowalewski, et al. 2010; Minc 2009; Skoglund, et al. 2006; Venter 2008). More recent syntheses have emphasized that market economies do not

exist on a presence/absence basis and that looking at why and how particular aspects of commercialization develop is more useful than simply identifying the presence of a market based economy (Feinman and Garraty 2010; Garraty and Stark 2010). Similarly, the relationship between increasing general commercialization and the political economy of the state also bears investigation.

Patterns of Exchange in Postclassic Central Mexico

Traded goods have both a source and a destination. As a result, studies of trade can examine what is traded within a region, what is traded out of, and what is traded into a region. Each of these dimensions of trade can also be examined on multiple geographic scales, such as the site, the sub-region (such as the Basin of Mexico), a region (the Central Highlands), or a macroregion (all of Mesoamerica). Studies of trade in Central Mexico have focused largely on exchange within or out of the Basin of Mexico, with few attempts to examine the multidimensional trade networks in which the Basin was enmeshed.

The Basin of Mexico

The Basin of Mexico provides one of the most in-depth case studies of Mesoamerican trade, with the majority of information coming from Instrumental Neutron Activation Analysis (INAA) sourcing studies of ceramics, which have produced the largest set of INAA data on ceramics in Mesoamerica (Nichols, et al. 2014), over the course of multiple studies (Brumfiel 2005b; Crider 2011; Garraty 2007, 2013; Hodge

2008; Hodge and Minc 1990; Hodge, et al. 1992; Minc 2009; Stoner, et al. 2013). While pottery cannot be taken to characterize the movement of all goods in an exchange system, it provides a broad-brush proxy for the general characteristics of exchange in a region.

During the Middle Postclassic, intra-Basin trade occurred primarily, but not exclusively, within political subdivisions of the Basin. After the establishment of the Triple Alliance, the former economic divisions of the Basin relaxed, but remained present, and the Mexica capital of Tenochtitlan supplied increasing amounts of pottery to other portions of the Basin at the expense of ceramic producers in other portions of the region (Garraty 2007). After the Spanish conquest, the city of Texcoco came to dominate the production of many of the types of decorated ceramics used in the Basin (Garraty 2013).

Research on goods exported out of the Basin of Mexico has focused on ceramics and obsidian. The frequency of exported ceramics generally follows a drop-off curve as a function of distance (Sergheraert 2009; Smith 1990). There are three types of commonly exported ceramics: Aztec Black-on-Orange, Aztec Black-on-Red (Guinda Redwares), and Texcoco molded/filleted *sahumadors*. Measuring the export frequency of these types is complicated by their local production in some provincial areas (e.g. Ohnerson 2006). A fourth type, Texcoco Fabric Marked (sometime also called Texcoco Saltware), is found in limited areas outside of the Basin, but has a much smaller distribution than the previous four types (Smith 1990), and likely travelled as packaging for salt rather than for its own sake. Green obsidian, from the Pachuca, Hidalgo source, the majority of which was routed through the Basin of Mexico, drops off with distance from the Basin of Mexico (Smith 1990). Cities located on trade routes, such as Otumba, became specialized

producers of trade goods, destined for markets both within and beyond the Basin of Mexico (Nichols 2013).

The discussion of goods imported into the Basin of Mexico has focused primarily on goods brought into the Basin as tax payments to the Triple Alliance, rather than on trade-based mechanisms. While calculations of goods brought into the Basin as taxes demonstrate that such items would have met a small but consistent portion of the region's needs (Drennan 1984; Sanders, et al. 1979:184, 378), this movement of goods is next to invisible archaeologically. This is partially due to the perishable nature of many tax goods, such as foodstuffs or textiles, and partly due to the lack of systematic excavations in the imperial capitals where the majority of taxes in kind likely ended up. Excavations at the Templo Mayor have recovered a great diversity of items imported from many different regions, but it is a unique context and should not be considered characteristic Tenochtitlán more generally, let alone the Basin of Mexico as a whole. Wide-scale test pits at Tenochtitlán's sister city of Tlatelolco recovered extremely few non-local ceramics (González Rul 1988a), despite the site being location of the largest market in the Late Postclassic Basin of Mexico

Excavations at other locations in the Basin have generally focused on intra-Basin political and economic relationships, rather than on ties to regions outside the Basin of Mexico, and many project typologies do not even report categories for imported wares from outside the Basin. This is likely a combination of a historically nationalistic focus in Mexican archaeology emphasizing the primacy of the Basin of Mexico (Robles García 2012), a low level of imported ceramics, and a lack of familiarity with imported types. Michael Smith noted that he sometimes finds Tlahuicua (Morelos-style) polychromes

misidentified by researchers in the Basin of Mexico, and my personal experience suggests that many Middle and Late Postclassic Toluca Valley types would be misidentified as “odd” examples of Mazapan wavy line by researchers more accustomed to the Basin of Mexico ceramic sequence. Overall, however, most excavations of domestic contexts in the Basin of Mexico show very low levels of ceramics from outside the region.

Central Mexico Beyond the Basin

Outside of the Basin of Mexico, both intra- and interregional trade appear to have been more multidirectional. In an analysis of both modern and historic excavation collections, Smith (2003b) showed that ceramics stylistically characteristic of four different subregions in Central Mexico (Toluca Valley, Malinalco, Eastern Morelos, and Western Morelos) were traded among all four areas. In addition, ceramics from the Basin of Mexico were recovered in all of these areas, and most areas also had ceramics from other areas in or beyond Central Highland Mexico (ranging from Tonalico to the Huasteca). While the focus on elite contexts in many of the older excavations included in this study may elevate the quantity of imported ceramics recovered, the general pattern is still one of far more diverse exchange than is seen in the Basin of Mexico proper.

In adjacent regions, imported ceramics from the Basin of Mexico usually increase in frequency over the course of the Postclassic, while those from other regions decrease (Huster 2015). This generally indicates that outside of the Basin of Mexico, Aztec rule produced a shift from a more laterally integrated market network to a dendritic market pattern centered on the Basin of Mexico. However, where there is sufficient

chronological control, Aztec ceramics often began increasing prior to an area's political incorporation into the empire, suggesting that the increase in Aztec ceramics was not exclusively a result of political conquest.

Trade and Empire At Calixtlahuaca

Both geographic and cultural distance can serve as potential barriers to trade, though the latter likely played a larger role at Calixtlahuaca. The site is approximately 60km from Tenochtitlan, and within 100km of most of the Basin of Mexico. This places Calixtlahuaca outside of the 4-8 km radius which people will generally travel for their regular market needs (Blanton 1996). However, assuming 36km/day as a reasonable travel distance (Drennan 1984), Calixtlahuaca is within two days travel from Tenochtitlan. It is also well within the 550km calorically efficient radius for the transport of maize by overland human transport (Drennan 1984, 1985). This theoretically predicted radius of trade is supported by documentary evidence. The Matrícula de Tributos page of taxes demanded from the Toluca Valley includes maize (Matrícula de Tributos 1980:lamina 13), and maize from the Toluca Valley is among the varieties sold by the maize seller in Florentine Codex, which is presumably describing vendors in the Basin of Mexico (Sahagún 1950-82:Book 10:65-66). Ethnographically, peasant craft producers from the Toluca Valley continued transporting mats and other reed products to Mexico City on foot, in 70kg loads using tumplines, well into the 20th century (García Sánchez 2008:198-202). This demonstrates that the regions were close enough to allow for the transport and exchange of both foodstuffs and relatively bulky items of other types. As a

result, geographic distance should not be considered a barrier to trade, and a lack of exchange between the two regions is more likely due to either a lack of economic integration or political barriers to trade.

After the Aztec conquest of the Toluca Valley, the Aztec Empire shifted the primary regional center of administration from Calixtlahuaca to Tollocan, where they established a military garrison and governor (Smith and Berdan 1996a). Calixtlahuaca remained under the nominal control of local rulers. Calipixque (tax collectors) were present in both Tollocan and Calixtlahuaca. It was a common Aztec strategy to remove markets and their associated revenue from the control of local elites. This likely occurred at Calixtlahuaca, though whether this involved the movement of political control, economic control or both to Tollocan is not clear.

Hypotheses About Trade At Calixtlahuaca

The Toluca Valley sits between the areas traditionally considered the cores of the Central and West Mexican culture areas. During the Late Postclassic, these two regions came under the political control of the Aztec and Tarascan Empires, respectively. Due to limited prior work in the Toluca Valley, it is relatively unknown to what degree the region was integrated into the market networks extending from either of these core areas during the Postclassic. I evaluate regional trade at Calixtlahuaca for both ceramics and obsidian.

The two dimensions of variation in rulership, directness and collectiveness, produce partially overlapping expectations, due to the degree of correlation between

indirect rule and network (non-collective) imperial rulership. However, the directness of rule can generally be evaluated based on the degree of resulting change in the provincial area, regardless of the directionality or form of the change. In contrast, the collectiveness of rule is broadly associated with the directionality of change, with more collective rule generally expected to produce outcomes more favorable to commoners. Based on the expectations of either relatively indirect (Hassig 1985) or relatively collective rule (Blanton and Fargher 2008), I present two scenarios for the effect of Aztec rule on long distance trade:

1. If Aztec rule was primarily indirect, as argued by Hassig (1985, 1988), it should have had relatively few effects on long distance trade at Calixtlahuaca, but those effects which do occur should be primarily negative for the local population. Under indirect rule, more goods are extracted out of provincial areas, but this extraction is done using preexisting mechanisms. As a result, there will generally be an overall reduction of wealth, resulting in less ability to purchase foreign goods. However, at the same time, there should be relatively few changes in the diversity sources of goods available. Non-local goods may also become more unevenly distributed if access to distant source locations becomes interrupted due to imperial attempts to control local elites.
2. Alternatively, if Aztec rule was relatively collective, as argued by Blanton and Fargher (2008), it should be expected to be accompanied by increased economic growth and generally positive economic effects for provincial areas.

Under such conditions, the expansion of the Aztec Empire should reinforce the prior development of well integrated market systems. This should be visible archaeologically as an overall increase in the degree of trade, both due to increased purchasing power and increased regional specialization in the production of particular goods. However, due to imperial influence over the development and organization of the market system, a disproportionate portion of the increase in goods moving within the system may be from the imperial core. Under relatively collective rule, lateral trade links, visible as the diversity of sources from which goods come, should remain comparable (or increase) to the period prior to imperial rule, as commoners have relatively high market access to such goods and the state has no reason to interrupt access. Finally, the interhousehold variation in access to non-local goods should remain comparable to pre-imperial levels, due to most commoners acquiring such items on the market rather than via elite patronage.

Ceramic Importation

As a result of the general lack of knowledge about regional trade patterns and potential proveniences for ceramic types found at Calixtlahuaca, I used multiple methods to investigate ceramic exchange at the site. I used INAA and thin section petrography to establish source regions and provide a general overview of exchange over time. The results of the specialized analyses were then used to support literature-based assignments of probable source regions by type, allowing for a broader discussion of trade based on

the general CAP classification of household ceramics. Source regions were assigned based on three lines of evidence: INAA analysis, petrographic analysis, and type frequencies at other sites within and outside the Toluca Valley.

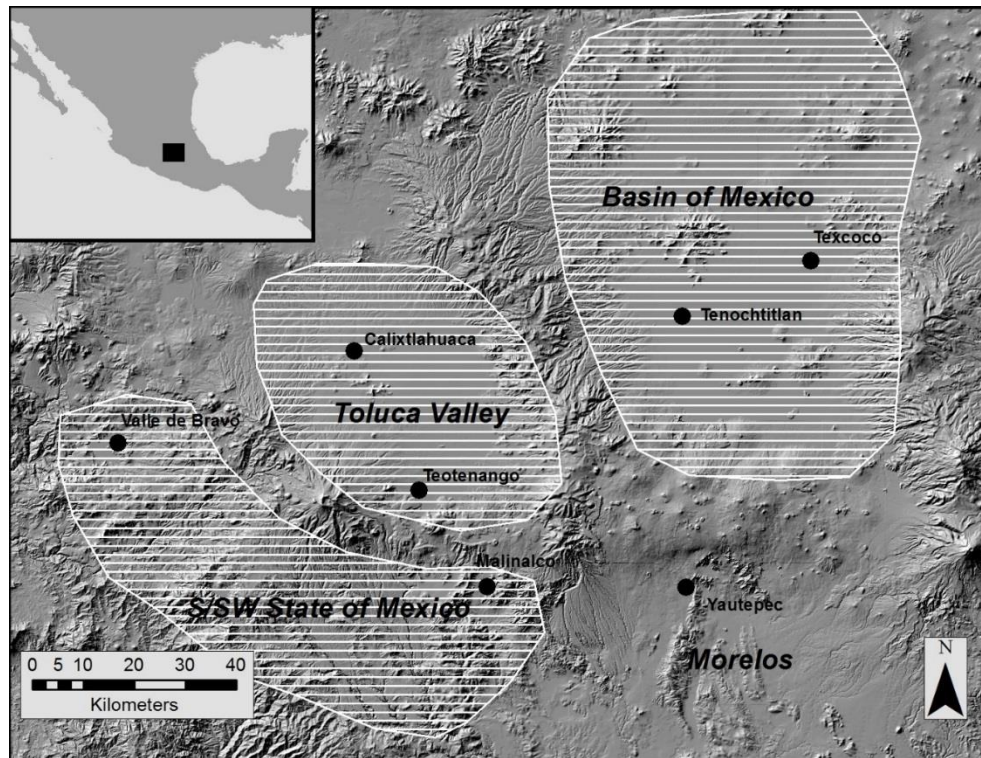


Figure 4.1 Geographic source macroregions for ceramics excavated at Calixtlahuaca

The two technical analysis methods both identify a number of individual groups. While the different methods produce different specific groupings, they can be cross-correlated to each other and to geographic locations at macroregional levels. As a result, I assign ceramics to one of three regional macrogroups: local, Basin of Mexico, and the South-Southwest portion of the modern state of Mexico (Figure 4.1). Source groups assigned to the local macrogroup are assumed to be from the Toluca Valley, though not

necessarily exclusively from Calixtlahuaca itself. They make up the majority of the sampled ceramics, have geology consistent with the Toluca Valley, and consist primarily of vessel forms and decorative types found at sites in the Toluca Valley. The Basin of Mexico macrogroup consists of those groups made up of types stylistically characteristic of production in the Basin of Mexico (Figure 4.2), and, in the case of INAA, which match the chemistry of the Basin. The S/SW State of Mexico macrogroup consists of groups primarily of decorative types found in Malinalco, Ixtapan de la Sal, or Valle de Bravo museum collections (Figure 4.3). These groups are both chemically and petrographically distinct from the Toluca Valley, but their geographic assignment is based strictly on type comparisons, as MURR has no reference samples from this macroregion. A small number of very rare decorative types, none of which were included in the petrographic or INAA samples, were identified as being from other geographic regions on a stylistic basis.

At the macroregional level, ceramics at Calixtlahuaca show an increase in imports from the Basin of Mexico over time, with the largest increase between the Ninupi and Yata phases. Imports from the S/SW and other minor regions decrease over time, though the differences are not statistically significant for all methods.

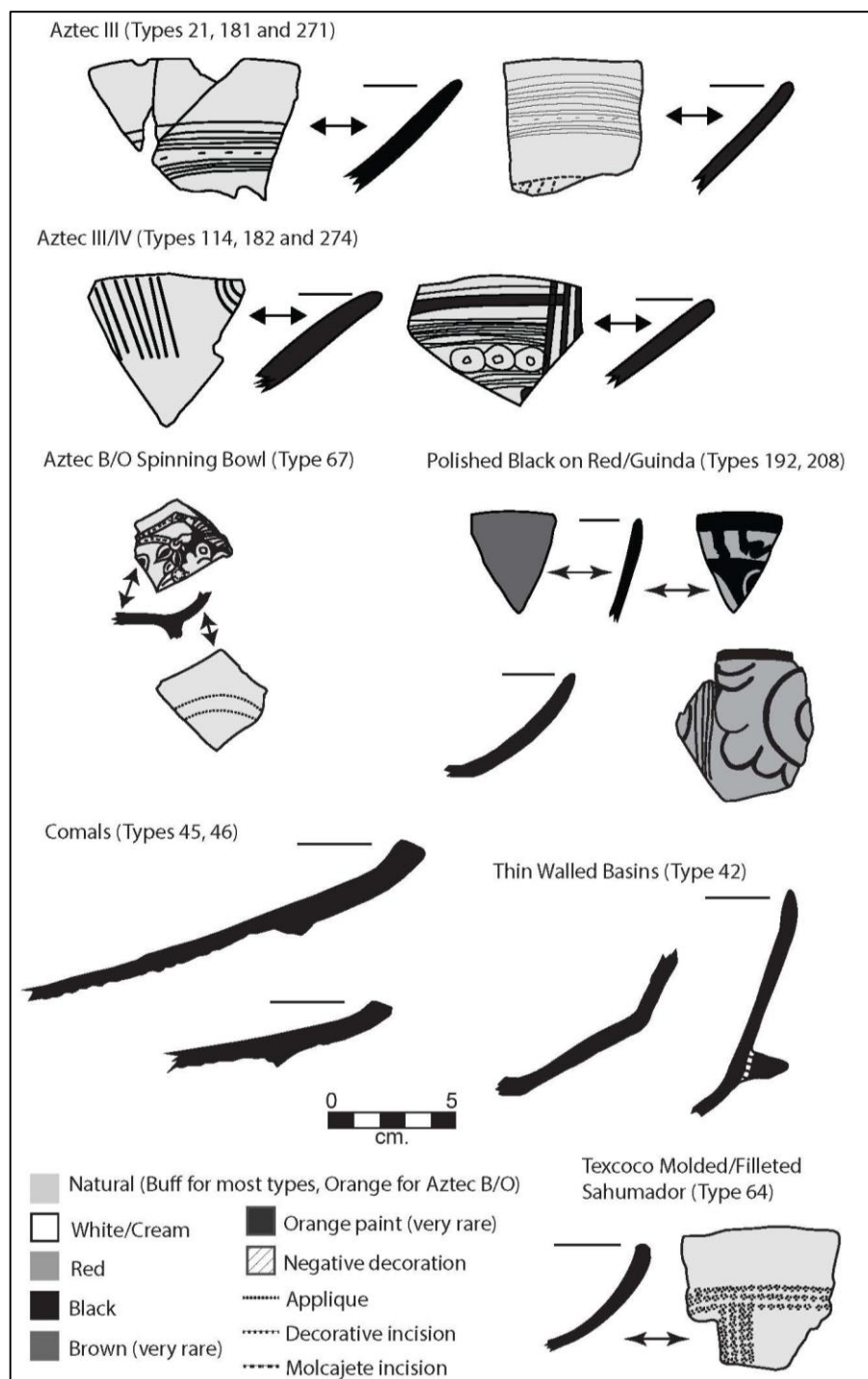


Figure 4.2 Selected ceramic types associated with the Basin of Mexico source macrogroup, based on both INAA and petrographic analyses

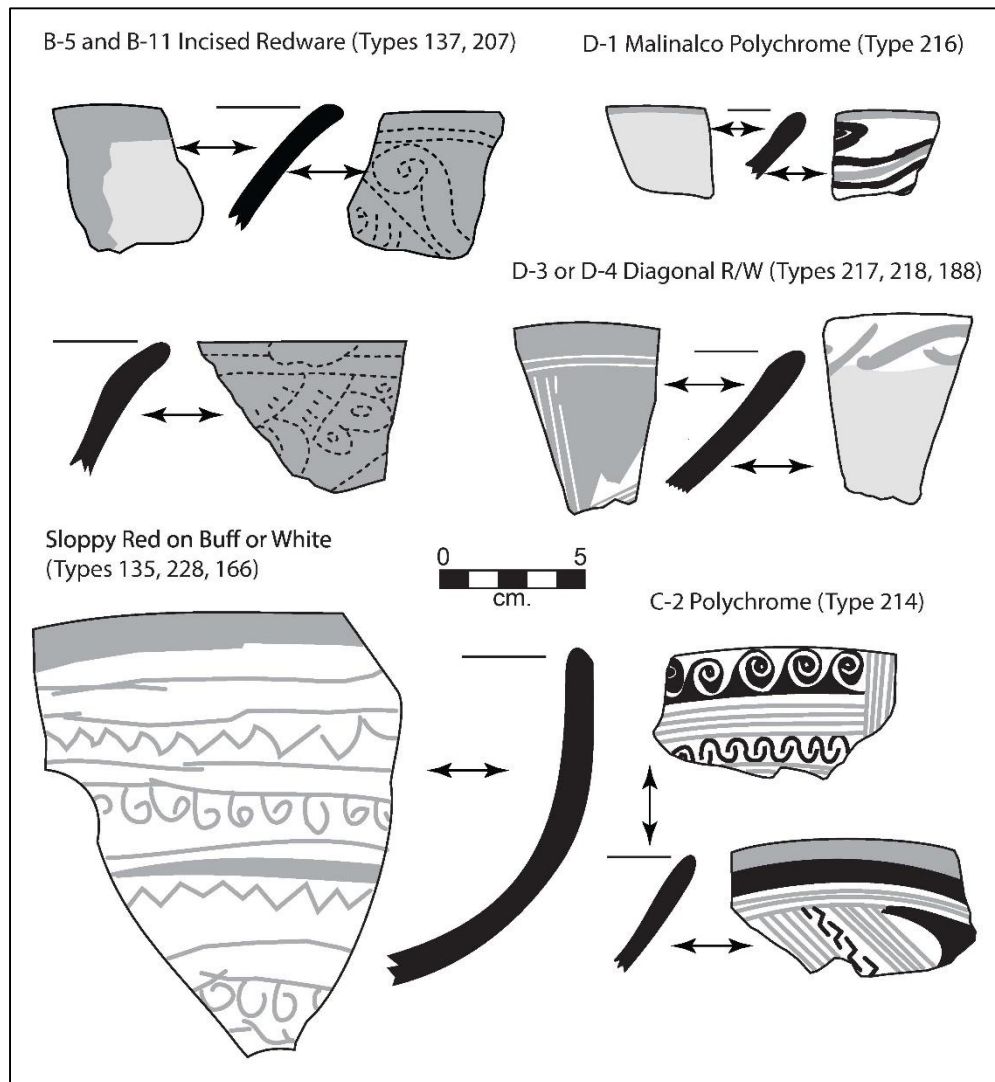


Figure 4.3 Selected ceramic types associated with the S/SW State of Mexico source macrogroup, based on both INAA and petrographic analyses

INAA

I submitted 569 ceramic sherds for INAA at the Missouri University Research Reactor (MURR). As described in the previous chapter, these sherds represent a stratified random sample of seventeen out of the eighteen excavated household components at Calixtlahuaca (“Household sample”). The random sample of sherds was supplemented by

an additional 150 sherds selected by type (“Type sample”). These additional sherds were selected to represent 5-6 sherds per type for a variety of suspected non-local types, as well as some common local decorated types. As a result of this dual sampling strategy, the frequency of imported ceramics can be considered both on a household-by-household basis and on a type frequency basis. The catalog of INAA samples and the results from MURR can be found in Appendix C.

Based on the INAA results, MURR assigned ceramic samples from Calixtlahuaca into nine groups (Stoner and Glascock 2013). These are identified as Groups A-H and Group Guinda in the original report, but I have relabeled them as Groups 1-9 to avoid confusion with the letter-named ceramic decorative families used at Calixtlahuaca. Approximately 18% of the sherds could not be assigned to one of these groups. These groups include three local groups (Groups 1-3), three Aztec-associated groups (Groups 4-6), two groups associated with areas of the State of Mexico to the south and southwest of the Toluca Valley (Groups 7-8), and one group resulting from contaminated samples (Group 9). I made geographic assignments on the basis of MURR’s chemical reference groups for the Basin of Mexico and Morelos, and stylistic similarities for all other regions.

The INAA samples generally show an increasing frequency of imports from the Basin of Mexico over time (Groups 4, 5, and 6), accompanied by a decreasing level of imports from the regions to the west and southwest of the Toluca Valley (Groups 7 and 8) (Table 4.1). However, due to sample size, the a chi-square test comparing phases does not show significant differences for this analysis ($\chi^2=4.63$, $df=4$, $p=.33$). The average diversity of groups per household component increased from each phase to the next, from

four groups per household during the Dongu phase, to four and a half during the Ninupi phase, and just over five and a half during the Yata phase.

Unit	Phase	Local			Basin of Mexico S/SW St. Mex.					Unknown		Total	
		1	2	3	4	5	6	7	8	9	Unkn.	Total	Known
307	Dongu	19				1					10	30	20
315	Dongu	18		11							1	30	29
316	Dongu	25		2							3	30	27
320	Dongu	22	1					1			6	30	24
323	Dongu	11	5		1			1	3		9	30	21
324	Dongu	3	6		2			2			17	30	13
<i>Dongu Total</i>		<i>98</i>	<i>12</i>	<i>13</i>	<i>3</i>	<i>1</i>		<i>4</i>	<i>3</i>		<i>46</i>	<i>180</i>	<i>134</i>
303	Ninupi	18	1		1	1		1		34	4	60	22
307	Ninupi	18		2	1					1	8	30	21
308	Ninupi	19		2	2	1					6	30	24
311	Ninupi	48	1	2	1					1	7	60	52
316	Ninupi	24									6	30	24
322	Ninupi	21			1		1	3			4	30	26
<i>Ninupi Total</i>		<i>148</i>	<i>2</i>	<i>6</i>	<i>6</i>	<i>2</i>	<i>1</i>	<i>4</i>		<i>36</i>	<i>35</i>	<i>240</i>	<i>169</i>
307	Yata	15	2	1	2	1		1	1		7	30	23
309	Yata	21		2	1	1	1				4	30	26
316	Yata	20	1	1	1		1				5	29	24
317	Yata	21	1		1				1		6	30	24
324	Yata	22	3								5	30	25
<i>Yata Total</i>		<i>99</i>	<i>7</i>	<i>4</i>	<i>5</i>	<i>2</i>	<i>2</i>	<i>1</i>	<i>2</i>		<i>27</i>	<i>149</i>	<i>122</i>

Table 4.1 INAA ceramic sourcing results by household component, with groups arranged by macroregion (Local, Basin of Mexico, South-Southwest State of Mexico, and Unknown). Household sample only.

Local INAA Groups. Group 1 (Group A in the report) is the most common local group (n=422). It accounts for 70% of the total sherds and 75% of the sherds in the household sample that could be assigned to a group. It is the dominant group during all

three phases of the site's occupation. It includes examples of all major vessel forms, and a wide range of plain and local-style decorated types. It also includes some, but not all, of the pieces originally identified as locally produced versions of Aztec III or III/IV Black-on-Orange. (See Table 4.2 for all INAA group to ceramic type correlations.)

Group 2 (Group C in the report) is a secondary local group of 24 samples, accounting for 4-4.5% of the sourceable sherds in both the combined and random samples. It is somewhat associated with excavation units 323 (5 sherds), and 324 (10 sherds). Like Group 1, it contains a range of plainware and local decorated types, in all major vessel forms. The only one of the two analyzed negative design sherds (G-types) assigned to a group is in this group.

Group 3 (Group H in the report) is a minor local group, consisting of 26 samples. It is somewhat associated with material from 315-Ph2, with this component accounting for 58% of the group. This suggests that either this unit had an unusual depositional environment, or unique trade ties to a particular group of nearby potters. In contrast to Group 9, this group is unlikely to be the result of processing contamination, as the 315-Ph2 sherds include cases from both the household and type-based samples, which would have been processed on different days, both in the field and at MURR. The group includes a wide range of local vessel forms and decorative types, though jars are noticeably underrepresented.

Aztec INAA Groups. Group 4 (Group B in the report) is an imported group of unknown origin consisting of 33 samples. The types in the group consist exclusively of plainwares and Aztec Black-on-Orange bowls. The Black-on-Orange bowls in this group

crosscut the field classification of pastes, including examples of all three paste groups associated with the decorative style. Chemically, the group matches neither the local groups in this sample, nor the general or sub-regional Basin of Mexico or Morelos clusters in the MURR database. It may represent the northeastern Toluca Valley, an area which saw more interaction with the Tepanec state, or a previously unknown production location in the Basin of Mexico. The group as a whole is temporally sensitive, increasing in frequency from each phase to the next, but the types assigned to the group also shift over time, from mostly plainwares to mostly Aztec Black-on-Orange. Based on the decorated types in the group, it is considered an Aztec-associated source group for the purposes of further analyses.

Group 5 (Group D in the original report) consists of imports from the Basin of Mexico. It includes 24 samples, only five of which are from the random sample. This is a direct result of the emphasis on selecting presumably non-local types for the type based sample. The majority of sherds assigned to this group are Aztec Black-on-Orange, with two plain or eroded bowls as the only exceptions. With one exception, this group consists of pieces field-typed as being “imported” (the unmodified Aztec III and III/IV codes) or “unsure” (Local B types) pastes, rather than locally produced imitations of Aztec wares (Local A types). The group also shows a motif-based bias, including only two examples of the later Aztec III/IV variant, though it occurs in equal quantities in the Ninupi and Yata random samples. While the chemistry of this group is consistent with the Basin of Mexico as a general region, none of the samples are a clear match to any of the known sub-regional source groups within the Basin of Mexico.

Group 6 (Group Guinda in the report) is closely correlated with Basin of Mexico style guinda Black-on-Red wares; the group contains only type 192 and 208 sherds (the two type codes for guinda bowls), and ten of the eleven samples from these types were assigned to this group. While two of the sherds match the Tenochtitlan reference group specifically, the majority are not a clear match to a single subregion within the Basin of Mexico. They may be sherds drawn into a single cluster based on the underlying similarities of the type of clay used in different subregions, rather than due to a common origin. Guinda Redwares have a distinctive very fine buff or light grey paste. This suggests specialized processing, as clays from the Basin of Mexico generally fire to an orange or at least orange-tinted color. Guinda wares sourced to the Basin of Mexico and Morelos by other projects show no distinction in macropaste or decoration between the sherds from the two regions (Smith 2006c). The samples analyzed at Calixtlahuaca are definitely not locally produced, and this group is treated as an Aztec source group for further analyses.

S/SW State of Mexico INAA Groups. Group 7 (Group E in the report) includes 18 sherds and consists of some plainwares and a variety of relatively uncommon decorated types. The decorated types include C-1 and C-2 polychromes, incised redwares, and some Red-on-White types (decorative family D). Based on the types included in this source group, it is probably from an area peripheral to the Toluca Valley, likely to the south, such as Malinalco or Ixtlan de la Sal. Eight of the sherds in this group were matched to Morelos references groups by MURR. Given that they are stylistically clearly not from Morelos, it is likely that the sourcing is picking up on similar geological formations to the

south of the Toluca Valley, rather than south of the Basin of Mexico. It is treated as an imported group in further analyses.

Group 8 (Group G in the report) includes 10 sherds, consisting exclusively of incised redwares and a few plainwares. Based on the frequency of incised redwares from archaeological contexts around the Toluca Valley and surrounding regions, this source group likely comes from the greater Valle de Bravo (Malacatepec) region. Based on the amount of chemical variation among the samples, it is likely that this group includes pieces from a relatively wide geographic area, which could be subdivided if there was a larger set of reference samples for areas peripheral to the Toluca Valley. The samples in this group are treated as imports in further analyses.

Unassigned INAA. Group 9 (Group F in the report) (n=39) has an almost one to one association with the first set of samples taken from Unit 303 and is considered contaminated and treated as unassigned in later analyses, as there is no reason that the range of types present in this component should form a unique group. Based on the elevated concentrations of Mn and Co that cause these samples to form a group, it is unclear whether the contamination resulted from the depositional environment or from some aspect of sample preparation.

There is also a remainder of sherds not assigned to any of the above groups, referred to as “unknown”, which accounts for 18% of the total sample. The majority of these sherds are probably moderately anomalous paste variations from the regions described above. A sample of 14 INAA-unassigned sherds was included in the INAA/petrography cross-correlation sample and could all be assigned to existing

petrographic groups, supporting the premise that they were the result of occasional variations in production.

Type	Code	Local			Basin of Mex.			S/SW		Unassign.		N.
		1	2	3	4	5	6	7	8	9	Unk.	
<i>Aztec Imports¹</i>												
Aztec III	21				3	10					1	14
Aztec III/IV	114				4	1					2	7
Aztec III, Local B	181	2			2	7		1			4	16
Aztec III/IV, Local B	182				4	1					1	6
Aztec III, Local A	271	3	1		5	1				2	2	14
Aztec III/IV, Local A	274				2						2	4
Aztec Or, unkn.	1					1						1
Aztec Or Spn. Bowl	67					1					1	2
Guinda Bl/R	208						7					7
Guinda, fine line	192	1					3					4
Copa, Guinda	113	1										1
Sahumador, Mold/Fillet	64	1									1	2
Thin-Walled Basin	42	1			1						1	3
<i>Other Imports</i>												
B-5 Bowl	207							1	3	1	2	7
B-11 Bowl	137							2	2	1	2	7
C-2 Bowl	214							1				1
D-0 Bowl	215	3	1					1			2	7
D3 or D4 Bowl	188	1						2				3
G-0 Bowl	230		1								1	2
Coyotlatelco Bowl	166							1				1
Other dec Bowl	122	1										1
Other dec Jar	38										1	1
<i>Plain and Eroded</i>												
Bowl, Eroded	10	32	1	1	1	1				3	8	47
Bowl, Plain	11	42	1	9	3	1		2	1	6	19	84
Jar, Eroded	30	40	1						1	9	8	59
Jar, Plain	31	56	5	3	2			2	2	3	15	88
Thick-Rim Jar	167	21	1		1						5	28
Comal	45/46	4	1		3						8	16

Table 4.2 INAA ceramic sourcing group to project ceramic type correlations

Type	Code	Local			Basin of Mex.			S/SW		Unassign.		N.
		1	2	3	4	5	6	7	8	9	Unk.	
<i>Decorated Bowls</i>												
B/E frag	264	10								1	3	14
Red rim	200	14		2	1						4	21
B-0	202	21	1	1				1	1		1	26
B-1	203	2										2
B-2	204	8									1	9
C-1	213	14		2				2			1	19
E-0	221	5								1	1	7
E-1	222	13	1	1							4	19
E-5	225	13	3	1							4	21
E-6	226	3	1									4
E-9	277	18		1						4	4	27
E-10	132	17	2	1							2	22
E-11	133	4	1									5
E-12	173		1									1
E-14	185									2		2
E-16	184	1										1
<i>Decorated Jars</i>												
B/E frag	266	1										1
B-0	253	2										2
E-0	255	6									4	10
E-2	256	19						1			2	22
<i>Other Forms</i>												
Biconical Censer	267	14						1			5	20
Other Censer	170	2		1						1	1	5
Scored Censer	101/18	2	1	1						1		7
Sahumador, Toluca	262	8		1							2	11
Crude Unfinished	134	9		1						3	8	21
Miniature Vessel	71	1										1
Copa	70	1										1
Asymmetrical	168	1			1							2
Pitcher	72	1								1		2
Spoon	100	2									1	3
<i>Total</i>		<i>421</i>	<i>24</i>	<i>26</i>	<i>33</i>	<i>24</i>	<i>10</i>	<i>18</i>	<i>10</i>	<i>39</i>	<i>134</i>	<i>741</i>

¹Bowl unless other form given

Table 4.2 (continued) INAA ceramic sourcing group to project ceramic type correlations.

Petrography

Petrographic thin section analysis was used as an independent check on the results produced by INAA. As described in the methods chapter, the petrography samples were selected using a triple strategy. First, Julie Novic selected samples based on macropaste from the surface survey material (Meanwell 2013b). Second, a stratified random sample of 22 sherds was selected for each of the three phases from the two households with continuous occupation, Units 307 and 316, to provide a general picture of the relative frequency of petrographic groups at the site over time (Meanwell 2013a). In addition, following the completion of INAA, a sample of 8-15 sherds from each INAA source group (n=85) were also selected for petrography for two reasons. First, this sample allows for the correlation of the ceramic groupings produced by the two methods. Second, it created for a much wider petrographic sample of types, allowing for more relatively rare types to be assigned to petrographic groups (Meanwell 2014). All petrographic analyses were performed by Dr. Jennifer Meanwell and her reports are attached as Appendix E.

The petrographic analysis resulted in the identification of 13 groups, labelled groups I-III and VI-XV. (IV and V were excluded from the final numbering scheme to avoid confusion with earlier versions). Based on the mineral inclusions and the decorative types in each group, the groups correspond to the same three macroregional divisions as INAA groups. Each macroregion includes a general group for sherds that could only be identified at the macroregional level. There are three major local paste groups, I-III and group VI is a used for local sherds that were not a match to a specific group. Groups VII-IX are from the south or southwest of the State of Mexico, and Group X is the general macroregional group for this area. Groups XI-XIII are from the Basin of

Mexico and Group XIV is the general group for this macroregion. Group XV is used for all sherds that did not match one of the previous groups, and are thus probably imports from another region. Approximately 5% of the samples could not be assigned specific or macroregional groups.

			Local						Basin of Mexico				S/SW	Other
Unit	Phase	N.	I-A	I-B	I-C	I-D	II	III	XI	XII	XIII	XIV	X	XV
307	Dongu	22	4	4	6		2	6						
316	Dongu	22	3	6	3	1	2	4					2	1
			7	10	9	1	4	10	0	0	0	0	2	1
307	Ninupi	22	6		6		1	4				1	3	1
316	Ninupi	22	2	7		2	1	5			1	3		1
			8	7	6	2	2	9	0	0	1	4	3	2
307	Yata	22	6		4		2	4			2	2	1	1
316	Yata	22	2	6	4		1	2	1	1	2	1	1	1
			8	6	8	0	3	6	1	1	4	3	2	2
Total		132	23	23	23	3	9	25	1	2	3	8	6	6

Table 4.3 Ceramic petrography results by household, with fabrics grouped by geographic macroregion (Local, Basin of Mexico, South-Southwest State of Mexico, Other). Household random petrographic samples only.

The average household pattern, based on the stratified random household samples from Units 307 and 316, shows a dramatic increase in imported ceramics between the Dongu and Ninupi phases (Table 4.3). The total average frequency of imported ceramics remains approximately even between the Ninupi and Yata phases. The pattern also shows a steadily increasing frequency of Aztec imports from each phase to the next, at the expense of other imports. Based on a chi-square test with Yates correction, the phase

totals do deviate significantly from random, when unassigned sherds are excluded (Yates $\chi^2=8.03$, $df=4$, $p=.09$). There are some differences among households in the sources of imports, as well as the total frequency of imports, but these do not override the general pattern, and are generally consistent with the INAA results for these individual household components. There is also a general agreement between the two methods about which specific sherds were imported from a general macroregion, though specific groups do not map onto each other perfectly (Table 4.4).

		Local							Basin of Mexico			S/SW State of Mexico				Unk.
		I-A	I-B	I-C	I-D	II	III	VI	XI	XII	XIII	VII	VIII	IX	X	XV
Local	Group 1	4	2		2	2	2								1	2
	Group 2	4		2			2									
	Group 3	1	1	2	2		2									
Basin of Mexico	Group 4								2	7						1
	Group 5								4	2						2
	Group 6										1					
S-SW Mex.	Group 7						1	1				6			1	
	Group 8	1		1									3	2	1	1
Un-known	Group 9	1	1			1	2									
	Unknown	5			2		5		1					1		

Table 4.4 Ceramic INAA group (rows) to petrographic group (columns) correlations, arranged by macroregion (Local, Basin of Mexico, South-Southwest State of Mexico, Unknown) for all sherds analyzed using both methods.

Local Petrographic Groups. Group I is the most common petrographic group at the site, accounting for approximately 50% of the household sample and 121 sherds overall. It contains intermediate to mafic inclusions, primarily plagioclase feldspar, with

little evidence for deliberate tempering. It consists primarily of local types, and includes the full range of vessel forms found at the site. Meanwell divided it into four subgroups, referred to as I-A to I-D. The subgroups are distinguished by combinations of dark and light amphiboles in the temper and moderately and very optically active paste fabrics. Of the subgroups, I-B and I-D occur in a more limited range of types and INAA groups, while I-A and I-C generally occur in a wider range. (See Table 4.5 for all petrography to ceramic type correlations.)

Group II accounts for approximately 7% of the household sample (n=19 overall). It is generally similar to group I, but contains smaller mineral fragments and fewer voids. The fabric is also generally lighter in color than Group I. Due to the mineralogical similarities with the previous group, this is also considered a local variant. This group includes common plainware forms, and a somewhat unusual mix of decorated types. It also includes all three of the Aztec style Black-on-Orange sherds which were assigned to a local petrographic or INAA group. With the exception of one Polychrome-on-White, the other decorated sherds are small fragments which could not be assigned to a specific decorative type.

Group III accounts for approximately 16% of the household sample (n=46 overall). It is generally similar to both Groups I and II, but has a higher iron content in both the fabric and temper, which causes it to fire to a more reddish color when not reduced. Some, but not all, of the sherds in this group were grog tempered, but the sherds used as temper are not distinctive from the new vessels, indicating the reuse of ceramics from the same production source. This group includes both plainwares and a range of local decorated types. The local decorated types contain more B-types (local redwares)

and less E-types (local Red-on-Natural) than would be expected from the sample as a whole. This petrographic group also includes all of the comal sherds that were not matched to a clearly imported group. I tentatively consider this group to have been produced within the Toluca Valley, but most likely not at Calixtlahuaca itself due to the somewhat unusual combination of otherwise local types in the group.

Group VI contains sherds which generally fall within the range of variation encompassed by the previous local groups but which were not a specific match to a particular group (n=3). These sherds show both similar mineral inclusions and production techniques to the local groups in general.

Aztec Petrographic Groups. In addition to the local petrographic groups described above, there are also nine petrographic groups associated primarily with non-local decorative types or INAA groups. Of these, four are associated with ceramics from the Basin of Mexico, four are associated with types more commonly found to the south or southwest of the Toluca Valley, and one consists of sherds not matching any of the known groups. All of the groups include relatively small numbers of samples, many of which come from the non-random samples selected for INAA/petrography correlations.

Group XI (n=11) consists almost exclusively of Aztec III or III/IV Black-on-Orange ceramics. The single exception is one plain jar sherd. This group is characterized by highly processed, likely levigated, clay. The total volume of inclusions is much lower than in the local types described previously, though the types of minerals are similar, as expected based on the similar volcanic geologies of the Basin of Mexico and the Toluca Valley. This group shows evidence of firing at a high temperature. All of the Aztec

orangewares in the group were originally typed as either probably imported (project types 21 and 114) or imported status unknown (Local B Aztec variants), though not all sherds in these types were assigned to this petrographic group. This petrographic group is strongly, though not perfectly, associated with INAA Group 5. This group is considered Aztec-affiliated for purposes of further analysis.

Group XII (n=9) consists of Aztec III or III/IV Black-on-Orange and a mix of plainware vessel forms. This group is characterized by high firing temperatures. Tempering is variable; most sherds show a coarse temper similar to that seen in the local groups, but a few examples show some evidence for the deliberate removal of inclusions, followed by the addition of sand temper. The Aztec Black-on-Orange assigned to this group consists mostly of sherds originally assigned as locally produced imitations ("Local A" types). The plainwares assigned to the group include both plain bowls and comals. This group is strongly associated with INAA Group 5. This group is considered Aztec-affiliated for purposes of further analysis.

Group XIII (n=7) consists of four pieces of Basin of Mexico style Black-on-Red ceramics ("Guinda"), one piece of Aztec Black-on-Orange, one eroded bowl and one local sahumador fragment. Guinda ceramics are typically not useful for petrographic purposes because they are made of very fine clay with organic temper, providing almost no mineral fraction for identification. The clay matrix is slightly optically active, and most examples have a dark core and voids consistent with the use of organic temper. Only one of these sherds was also sampled for INAA, and it was assigned to the Group 6 (the guinda INAA group). This group is considered Aztec-affiliated for purposes of further analysis.

		Local								Basin of Mexico				S/SW St. Mex.				Unk.	
	Type	I-A	I-B	I-C	I-D	II	III	VI	XI	XII	XIII	XIV	VII	VIII	IX	X	XV	N.	
<i>Aztec¹</i>																			
Aztec III	21								4	1								5	
Aztec III/IV	114								3									3	
Aztec III, local B	181								1			1					1	3	
Aztec III/IV, loc. B	182								1	2	1							4	
Aztec III, local A	271					3			1	1								5	
Aztec III/IV, loc. A	274									2								2	
Guinda	208										2	1						3	
Guinda, fine line	192										2							2	
Miniature vessel	71											1						1	
Texcoco Salt Ves.	68																3	3	
<i>Other Imported¹</i>																			
B-5	207												1	3			1	5	
B-11	137	1											2		1			4	
B-7	209															1		1	
C-2	214												1					1	
D-0	215																1	1	
D-3 or 4	188							1										1	
Coyotlatelco	166												1					1	
Other Dec. Jar	38															1		1	
Unkn. Ves. Frag.	60															1		1	
<i>Plain and Eroded</i>																			
Bowl, Eroded	10		1			1	3				1					1	1	8	
Bowl, Plain	11	4	9	2	1	5	5	1		1		4				1	2	35	
Jar, Eroded	30		2	2			4					1				2	1	12	
Jar, Plain	31	16	4	10	3	2	9					1			2	3		50	
Jar, Thick Rim	167	6		5	2	1	1									1	1	17	
Comal	45/46	3					4			2		1					2	12	
Spoon	100	1																1	
<i>Decorated Bowls</i>																			
B/E frag.	264			1		1	1					1						4	
Red Rim	200			1			1											2	
B-0	202			1		1										1		3	
B-1	203						1											1	
C-1	213			2	1	1							1			1		6	
E-0	221/269						1								1			2	
E-1	222	1		1			2											4	
E-5	225	1	3	1	1		1				1							8	
E-6	226																		
E-9	277			1	1													2	
E-10	132	1	1	1	1													4	
E-11	133						1											1	
E-12	173						1											1	
E-14	185		1															1	
G-0	230						2											2	

Table 4.5 Ceramic petrographic sourcing group to project ceramic type correlations

		Local						Basin of Mexico				S/SW St. Mex.				Unk.		
	Type	I-A	I-B	I-C	I-D	II	III	VI	XI	XII	XIII	XIV	VII	VIII	IX	X	XV	N.
<i>Decorated Jars</i>																		
B/E frag.	266					1												1
B-0	253	1																1
E-2	256		2		1		2											5
<i>Ritual</i>																		
Biconical Censer	267	6	2	2		1	2											13
Scored Censer	101/180	1	2	2			1											6
Sahum., Local	262		1									1						2
Censer, Other	170			1			1											2
Crude Unfinished	134	1	2	2		1	3	1							1		1	12
Handle/Support	169		1		1	1												3
<i>Total</i>																		
		43	31	35	12	19	46	3	10	9	7	12	6	3	5	13	14	268

¹Bowls unless otherwise noted

Table 4.5 (continued) Ceramic petrographic sourcing group to project ceramic type correlations

Group XIV (n=12) includes sherds generally falling within the range of variation seen in the Basin of Mexico associated groups, but which could not be matched to a specific group.

S/SW State of Mexico Petrographic Groups. Group VII consists of six decorated sherds from low-frequency types: three incised redware pieces, one sherd each of C-1 and C-2 polychromes, and one piece coded as Coyolatelco, which should probably more accurately be identified simply as sloppy red-on-white. This group is characterized by a relatively low level of inclusions, and inhomogenous (poorly mixed), optically active, fabric. The sherds in this group show evidence of the addition of both deliberately sorted sand temper, and grog temper from both local and non-local vessels. The petrographic group has a strong correlation with INAA Group 7. All sherds in this petrographic group

are assigned to INAA Group 7, though there are also three Group 7 sherds not in this petrographic group. This group is considered to be associated with regions to the south or southwest of the Toluca Valley for purposes of further analysis.

Group VIII Group consists of three pieces of incised redware. This group is generally similar to the preceding Mixed Imports group, but shows a larger fraction of grog, somewhat less optical activity, and a mineral mix characteristic of a more felsic source region. The inclusions in this group are bimodal, indicating deliberate tempering. All three sherds in this group were assigned to INAA Group 8. This group is considered to be associated with regions to the south or southwest of the Toluca Valley for purposes of further analysis.

Group IX consists of one piece of incised redware, one E-0 Red-on-Buff bowl, one crude unfinished bowl and two plain jar sherds. The sherds in this group are generally similar to those in the Mixed Imports and Grog-Tempered groups, but show a much higher degree of optical activity. Due to differences among the sherds in this group, Dr. Meanwell believes it is unlikely that they were produced in the same location. The samples show evidence for deliberate tempering, and an unusual (more felsic) mineralogy when compared to the main local groups. Both sherds in this group were assigned to INAA Group 8. This group is considered to be associated with regions to the south or southwest of the Toluca Valley for purposes of further analysis.

Group X (n=13) consists of sherds which fell into the general range of paste, temper, and production techniques characteristic of the S/SW State of Mexico groups, but which could not be matched to a specific group. The group consists primarily of plain or eroded types. Dr. Meanwell considers the S/SW State of Mexico groups provisional at

the individual group level and feels that some of them might combine into a single group if a larger set of samples were examined.

Type Based Analysis

Because the Calixtlahuaca Archaeological Project coded all analyzed ceramics into type categories, it is these types that ultimately need to be associated with probable source regions for reasons of sample size. For both INAA and petrography, the random ceramic samples by household can be used to directly evaluate the frequency of imported ceramics in each household component. However, for both methods, these samples include only a fraction of the total ceramics from the component. In addition, neither method covers all of the households included in the final DS-1 sample. One household component was defined after samples were selected for INAA (327-Ph6), and the random household sample for petrography only covered the two households that were continuously occupied through all three phases of the site's history, 307 and 316. In both cases, the relatively small number of samples per household ($n=30$ for INAA and $N=22$ for petrography) also creates a higher degree of random error. As a result, the data produced by these specialized methods of analysis become more useful when they can be extrapolated to the ceramic assemblage as a whole, bolstering regional identifications based on type distributions from different areas.

The Calixtlahuaca Archaeological Project's ceramic type classification system is described in more detail in the preceding chapter on methods. I assigned types to one of six regional proveniences (or as unknown) based on a combination of factors. For types for which INAA or petrographic data are available, the type is assigned to the region

which dominated the sourcing samples (Table 4.2, Table 4.5), supported by regional type affiliations in the published literature. For types for which no sourcing data are available, or where only two samples were run and they divided between source regions, types are assigned to a source region based on published descriptions of ceramics in the relevant literature. This numbers of INAA and petrography samples run, relative to the frequencies of types in the assemblage, can be seen in Table 4.6. Due to the strong association between type frequencies in the overall assemblage and the dual sampling strategy used, most types occurring in more than trace frequencies are well represented among the samples selected for technical analysis. Excluding types with less than four successfully sourced (INAA and/or petrography) samples only results in a 4-8% reduction in total and/or rim sherds count per phase and the patterning of source regions by phase remains consistent. This demonstrates that the minor types assigned to source regions primarily (or exclusively) on the basis of the regional literature are likely generally accurate and that the overall quantities of such types are not likely to have a large effect on the type based analysis as a whole. Specific regional references are listed in the subsequent sections on each region. While projects in adjacent regions have not always published complete artifact catalogs, ceramic typologies are commonly included in reports and can be used for comparative purposes. A complete list of ceramic types and their regional assignments can be found in Appendix A. I present the general list of source regions below, followed by a discussion of several special cases, where regional assignment was more difficult. Due to the much higher sample size, the results of chi-square tests of phase and source region are highly significant for both rims and total sherds (Rims - $\chi^2=470.64$, $df=6$, $p<.000$; All Sherds - $\chi^2=1662.57$, $df=6$, $p<.000$).

General Ceramic Source Regions. Source Unknown/Not Applicable. The type is either not a vessel, or not from the Postclassic. For non-vessel items, function overrides potential source in the classification system used by the project, so types may contain both local and imported items (e.g., all figurines, including those likely of Aztec manufacture, are classified under a single type code in the general ceramic database). Vessels were generally assigned to “non-Postclassic” types on the basis of pan-regional traits, and thus also contain an unknown mix of local and imported pieces. Non-Postclassic types are quite rare.

Local. This regional group includes types manufactured in the general area the Central Toluca Valley surrounding Calixtlahuaca, though not necessarily at the site itself. This is the “default” geographic source region for all types, unless there is a good reason to place them elsewhere. These types fall primarily (and often exclusively) into INAA groups 1, 2 or 3, or petrographic groups I-III and VI. Types in this group are comparable to those reported from the historic García Payón excavations at Calixtlahuaca (García Payón 1936, 1979, 1981), and more recent projects at the Toluca Valley sites of Teotenango (Tommasi de Magrelli 1978; Vargas Pacheco 1975), Metepec (Carbajal Correa and González Miranda 2003), and Cerro Toloche (Jaramillo Lunque and De la Peña Virches 2012, 2014).

Basin of Mexico. This regional group includes types associated with the Basin of Mexico. Types in this group were assigned primarily to INAA groups 4, 5, or 6 and the petrographic groups XI-XIV. It also includes types not sampled for technical analyses which are stylistically characteristic of the Basin of Mexico. Types assigned to this group are comparable to those described for the Middle and Late Postclassic Basin of Mexico

by Parsons (1966) and illustrated by Séjourné (1970, 1983). Common decorated wares characteristic of the Basin of Mexico have been subject to extensive INAA sourcing across multiple projects, both in and outside of the Basin (Garraty 2013; Hodge and Minc 1991; Minc 2009; Nichols, et al. 2009). While provincial copies of Aztec Black-on-Orange and Texcoco molded *sahumadores* are fairly common, they can also be reliably visually distinguished from pieces produced in the Basin of Mexico. Additionally, some Aztec Black-on-Red was produced in Morelos, but it does not appear to have circulated widely – outside of Morelos, it has only been identified on a low frequency basis in the immediately adjacent southern Basin of Mexico. None of the sourced Aztec Black-on-Red samples at Calixtlahuaca were from Morelos. Additionally, Chalco-Cholula polychromes cannot always be distinguished between the two titular source cities, one within the Basin and one in Puebla. However, as none of this type was recovered at Calixtlahuaca, this does not create any potential for regional misattribution.

Split Local/Basin of Mexico type. This group includes types that split approximately evenly between local and Basin of Mexico source groups in INAA or petrographic analyses, or where there was a discrepancy between the expected regional attribution and the results of a small number of sourcing samples. (Ladles are the exception – of three INAA samples two are local and one is unknown. They are placed in this category based on paste colors in the type collection, which are approximately evenly divided between the buff-brown shades characteristic of local plainwares and the finer orange-tinted shades characteristic of the Basin of Mexico.) For purposes of estimating the frequency of imports, types in this group are assigned as 50% local, 50% Basin of Mexico.

Type Code	Type Description	N. Sherds	N. Rims	INAA N. Run	INAA N. Known	Petrog N. Run	Petrog N. Known
<i>Local</i>							
168	Asymmetrical bowl	5	3	2	2		
70	Copa, fragment	6	4	1	1		
60	Unknown Vessel Frag.	38	8			1	1
72	Pitcher, other dec	46	10	2	1		
184	E-16 Bowl	11	10	1	1		
206	B-4 Bowl	15	11				
228	E-8 Bowl	21	11				
185	E-14 Bowl	20	11	2	0	1	1
173	E-12 Bowl	23	12	1	1	1	1
223	E-3 Bowl	26	16				
169	Hollow support/handle	439	18			3	3
224	E-4 Bowl	44	21				
0	Eroded uncertain	3,280	33				
101/180	Scored Censer	228	38	7	4	6	6
71	Miniature vessel	89	39	1	1	1	1
253	B-0 Jar	503	41	2	2	1	1
170	Other censer	127	43	5	3	2	2
266	B / E fragment, Jar	552	45	1	1	1	1
204	B-2 Bowl	89	47	9	8		
203	B-1 Bowl	83	71	2	2		
256	E-2 Jar	1,906	75	22	20	5	5
222	E-1 Bowl	98	76	19	15	4	4
226	E-6 Bowl	128	78	4	4		0
133	E-11 Bowl	318	102	5	5	1	1
277	E-9 Bowl	267	104	27	19	2	2
225	E-5 Bowl	248	106	21	17	8	8
262	Sahum, Tol Valley form	256	123	11	9	2	2
255	E-0 fragment, Jar	961	149	10	6		
213	C-1 Bowl	245	157	19	18		
134	Crude unfinished	498	227	21	10	12	11
264	B/E fragment, Jar	959	332	14	10	4	4
221	E-0 Bowl	1,384	357	7	5		
267	Hourglass censer	1,828	441	20	15	13	13
132	E-10 Bowl	1,360	483	22	20	4	4
200	Red rim frag, Bowl	487	487	21	17	2	2
167	Thick-rim Jar	679	660	28	23	17	16
202	B-0, Jar	1,975	862	26	25	3	3
30	Eroded Jar	40,923	1,515	59	42	12	11
10	Eroded Bowl	3,097	1,676	47	36	8	7
31	Plain Jar	53,183	1,923	88	70	50	50
11	Plain Bowl	5,090	2,050	84	59	35	33

Table 4.6 Number of samples sourced by type, with DS-1 total and rim sherd counts, and INAA and petrography samples submitted and successfully sourced. Excludes types with less than ten DS-1 rim sherds unless examples were sourced.

Type Code	Type Description	N. Sherds	N. Rims	INAA N. Run	INAA N. Known	Petrog N. Run	Petrog N. Known
<i>Basin of Mexico</i>							
68	Texcoco fabric marked	258				3	0
1	Aztec orange, untyped	1	1	1	1		
42	Thin-walled Basin	38	11	3	2		
67	Spinning bowl, Az. Or.	20	13	2	1		
192	Guinda, variant B	29	19	4	4	2	2
114	Aztec III/IV	21	21	7	5	3	3
64	Sahumador, Texcoco	51	24	2	1		
182	Aztec III/IV, Local B Bowl	34	26	6	5	4	4
113	Guinda goblet	41	29	1	1		
21	Aztec III Bowl	106	35	14	13	5	5
181	Aztec III, Local B Bowl	147	60	16	12	3	2
208	B-6 Bowl	212	63	7	7	3	3
<i>Morelos</i>							
(3 Total Sherds, None Sourced)							
<i>South/Southwest State of Mexico</i>							
209	B-7 Bowl	1	1			1	1
166	Coyotlatelco? Bowl	1	1	1	1	1	1
38	Other decorated, Jar	58	3	1	0	1	1
188	D-3 or 4 Bowl	5	4	3	3	1	1
214	C-2 Bowl	16	7	1	1	1	1
207	B-5 Bowl	25	11	7	4	5	4
137	B-11 Bowl	26	13	7	4	4	4
215	D-0 Bowl	31	18	7	5	1	0
230-232	G Bowls	54	30	2	1	2	2
<i>Mixed Local/Basin of Mexico</i>							
274	Aztec III/IV, Local A Bowl	18	12	4	2	2	2
100	Ladle	25	23	3	2	1	1
271	Aztec III, Local A Bowl	177	35	14	10	5	5
45/46	Comal	593	173	16	8	12	10
<i>Other Non-Local Regions</i>							
122	Otros tipos decorados	44	16	1	1		

Table 4.6 (continued) Number of samples sourced by type, with DS-1 total and rim sherd counts, and INAA and petrography samples submitted and successfully sourced. Excludes types with less than ten DS-1 rim sherds unless examples were sourced.

South or Southwest State of Mexico. This group includes types assigned primarily to INAA groups 7 and 8, or petrographic groups VII-X. These are generally minor decorated types at Calixtlahuaca, particularly Red-on-White, complex Polychrome-on-

White, and incised redwares. In addition, types without INAA data that occur in higher frequencies in museum collections from Malinalco and Ixtapan de la Sal (Smith 2003b), historic excavations in the Valle de Bravo (Reinhold 1981), and/or regional survey near the Mexico/Morelos/ Guerrero border (Arana 1990) are placed here.

Morelos. All of the types assigned to this group are stylistically characteristic of Morelos. Stylistic descriptions of decorative types characteristic of Morelos are based on Smith (Smith 2006a, 2006c), and have been supported by prior INAA sourcing work of pieces recovered within Morelos. (While Guinda types were produced in both the Basin and Morelos (Smith 2006c), the examples at Calixtlahuaca form a single INAA group more likely matching the Basin of Mexico and are placed there.) INAA assigned seven sherds from Calixtlahuaca to Eastern Morelos and one to Western Morelos (all from group 7), but of the six of these that are decorated, none are stylistically consistent with material from Morelos. Because Morelos is one of the only regions immediately south of the Central Mexican Plateau with INAA reference samples, the samples in this study are probably matching here by default rather than true association, and the associated types are not placed in this general geographic region.

Other, more distant source regions. This group includes all other source regions, including the Huasteca, the Balsas, and the Tarascan Empire. This group also includes sherds coded as “other decorated type” during analysis, as these were pieces that did not match any known type in the classification system and were therefore presumably not from a local or immediately adjacent region. Assignments are based on decorative styles. All of the potential types in this category are either extremely rare, or did not occur at Calixtlahuaca.

Special Cases – Aztec Black-on-Orange. The correlation between the ceramic classification type divisions for Aztec Black-on-Orange and the associated INAA and petrographic results for these same types are a special case. At Calixtlahuaca, Aztec Black-on-Orange occurs almost exclusively in the form of tripod bowls, most of which are molcajetes. These vessels are distinguished from local-style molcajetes by their vessel body shapes, support forms, rim forms, and pattern of incising on the interior. As a result, they can be identified even in eroded and fragmentary states. However, “imitation” Aztec Black-on-Orange was sometimes produced for local use in provincial parts of the Empire. The Toluca Valley may have been one of these regions, as previous INAA samples from the site of Tlacotepec from the Field Museum’s Starr collection showed two distinct chemical groups of Aztec Black-on-Orange ware (McVicker, et al. n.d.). Unfortunately, something about the sample preparation for these pieces left their results incompatible with the Calixtlahuaca samples (See MURR report in Appendix D), so it is unknown whether the two groups at Tlacotepec correspond to the Aztec INAA groups 4 and 5 identified at Calixtlahuaca.

It was recognized in the field that the Aztec Black-on-Orange ceramics recovered at Calixtlahuaca had a continuum of pastes. The finer of the pastes were a good match for traditional examples of the type from the Basin of Mexico. In addition, we also recovered a range of coarser pastes, some of which fired to the traditional orangeish hue, and others which were cream colored. These were sorted into three paste based categories: Basin of Mexico (types 21 and 114) which visually matched pieces from the Basin of Mexico on the basis of paste color and texture, Provisionally Local A (types 271 and 274) which was made from a coarse, usually cream colored paste, and Provisionally Local B (types 181

and 182) which was orange colored, but coarser than would be expected from pieces produced in the Basin.

These three type based classifications only broadly parallel the results of the INAA and petrography groups. Aztec Black-on-Orange sherds were also assigned to three INAA source groups: the primary local Group 1, the Basin of Mexico Group 5, and the geographically unknown Aztec Group 4. Sherds assigned to the Basin of Mexico source group 5 are almost exclusively from the “Basin of Mexico” paste types. Aztec B/O sherds assigned to the primary local group are exclusively from the “Local Aztec A” paste types, and are all from the cream-firing portion of this group. However, the third INAA group, Unknown Aztec Group 4 includes Aztec Black-on-Orange sherds assigned to all three paste groups. Despite the visual variation in these INAA Group 4 Aztec sherds, petrography did place most of them into a distinctive grouping, Group XII.

The ware also exhibits temporal variation, including both Aztec III and the later Aztec III/IV decorative variants. Both decorative variants occur in all three macropaste categories. However, within the INAA source groups, there is a definite temporal bias, with later decorative variants being more likely to be assigned to Group 4. Aztec III/IV variants were identified conservatively, with ambiguous or eroded sherds coded as Aztec III. As a result, the apparent temporal bias in the INAA groups may be overestimating the degree of the shift because some of the Aztec III sherds are decoratively ambiguous. The temporal bias in INAA groups is less pronounced, but still present when Aztec B/O is considered by the phase of the context where each piece was recovered. Approximately the same number of sherds from each paste group were selected for analysis from each phase.

As a result of this ambiguity, the finer two categories of Aztec Black-on-Orange, those originally coded as imported and uncertain (Local B), are considered to be imported types in this analysis, while the types originally coded as local (Local A) are considered a split type and divided between the local and Basin of Mexico source regions.

Special Cases – Comals Due to a combination of cultural and compositional factors, comals are a special case at Calixtlahuaca. As a type, their distribution generally parallels other stylistically Aztec types; they are almost completely absent during the Dongu phase and increase steadily after that. They also never reach the frequencies seen in the Basin of Mexico and Morelos, where comal sherds account for 15-30% of rim sherds in household assemblages. (See Chapter 8 for a more extensive discussion of comals in a regional context.) This would suggest that comals are certainly a non-local idea, whether or not they are locally produced.

The compositional data for comals are ambiguous. Of the sixteen samples submitted for INAA, five are local (in groups 1 and 2), and three are Aztec (in group 4), and the remaining eight are unassigned. There are no other types represented by more than four sherds that have this high an unknown assignment rate. Petrography was more successful at assigning the samples to known groups. All petrographic samples were assigned; six were local and two were imported. However, four of the six local assignments were to group III, an otherwise relatively rare local group. Ethnohistorically, the Florentine Codex separates comal production from that of other ceramics; for both types of artisans and types of clay, comals are one of the only types of ceramics given a separate entry (Sahagún 1950-82:Book 10: p. 83; Book 11: p. 256-257). If this means that

comals were produced by specialized potters, then it is not unexpected that they have paste recipes outside of the norm. Due to the general regional evidence that comals are a non-local type, and the mixed but local-trending compositional evidence, comals are assigned to the Split Basin of Mexico/Local group.

Ceramic Exchange: Results

All three methods – INAA, petrography, and type-based source attributions – show a pattern of increasing ceramic imports over time. This is accompanied by a regional shift in the source of imports, with ceramics from the Basin of Mexico accounting for a larger proportion of total imports over time. Imports from all regions other than the Basin of Mexico and the South-Southwest State of Mexico are very rare during all phases (Figure 4.4). The average number of non-local source regions per household increases between the Dongu and Ninupi phases before decreasing to its lowest level during the Yata phase. This is accompanied by a more uneven distribution of access to ceramics from all sources during the Yata phase.

Because the INAA and petrography samples were stratified random samples divided into bowls, jars, and other vessels, each of these categories must be weighted by the frequency of the vessel form category within a component's original ceramic assemblage in order to estimate the actual frequency of different source groups. This allows differences in vessel form frequency among components and time periods to be accounted for in the analyses. The results of this weighting procedure for the INAA and petrography samples can be seen in Tables 4.6 and 4.7.

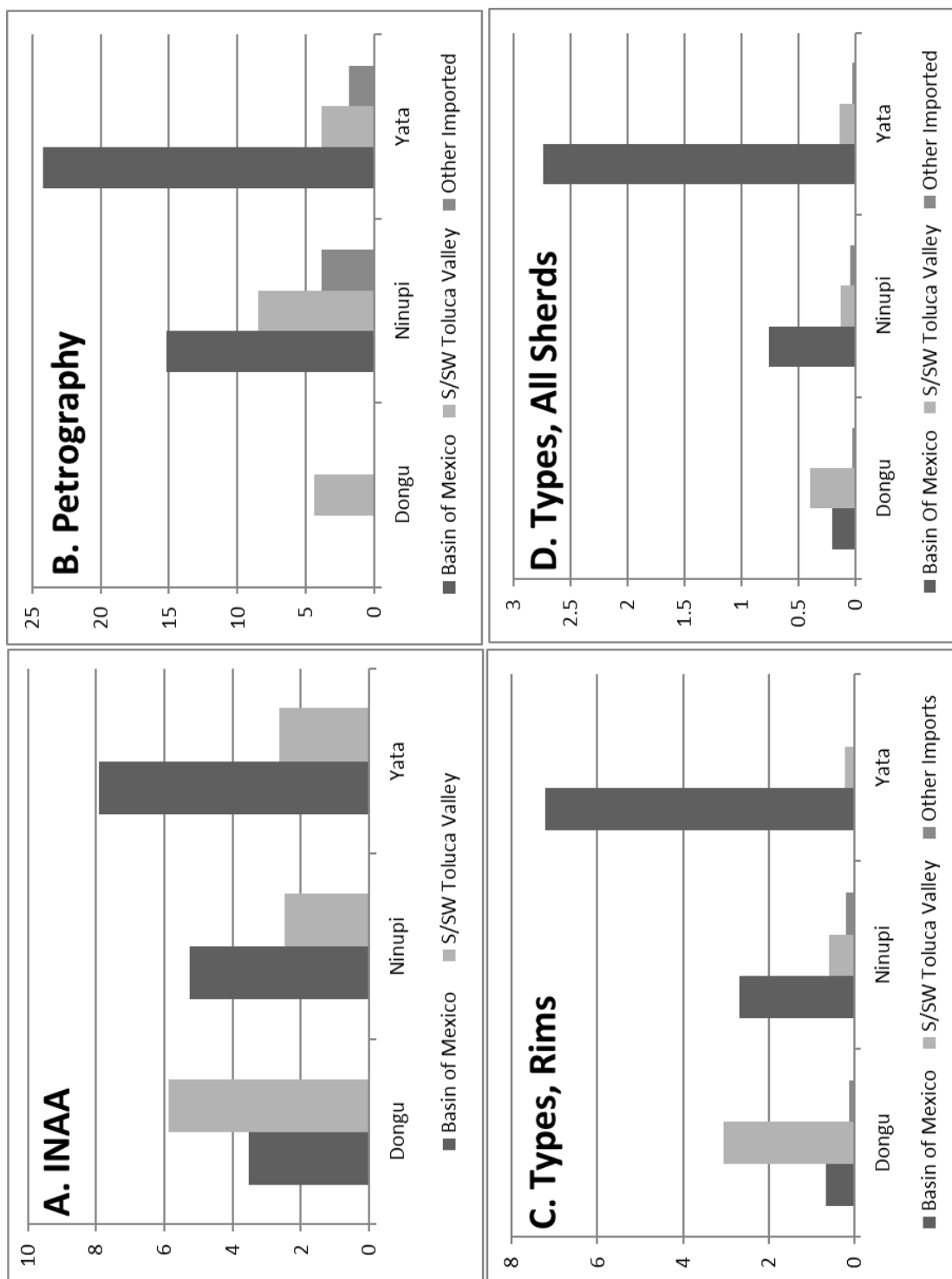


Figure 4.4 Summary of imported ceramics by macroregion by phase, based on INAA (A), petrography (B), types, rim sherds only (C), and types, all sherds (D).

		Vessel		Basin of		S/SW St.	
Unit	Phase	Form	% Form	Local	Mexico	Mex.	Other
307	Dongu	Bowl	54.99	54.99	0.00	0.00	0.00
		Jar	33.33	33.33	0.00	0.00	0.00
		Other	11.68	11.68	0.00	0.00	0.00
		Total		100.00	0.00	0.00	0.00
316	Dongu	Bowl	53.63	53.63	0.00	0.00	0.00
		Jar	34.95	26.21	0.00	8.74	0.00
		Other	11.42	11.42	0.00	0.00	0.00
		Total		91.26	0.00	8.74	0.00
307	Ninupi	Bowl	62.39	31.20	7.80	15.60	7.80
		Jar	29.72	29.72	0.00	0.00	0.00
		Other	7.88	6.57	0.00	1.31	0.00
		Total		67.49	7.80	16.91	7.80
316	Ninupi	Bowl	52.96	39.72	13.24	0.00	0.00
		Jar	37.26	27.95	9.32	0.00	0.00
		Other	9.78	9.78	0.00	0.00	0.00
		Total		77.44	22.56	0.00	0.00
307	Yata	Bowl	60.46	45.35	15.12	0.00	0.00
		Jar	27.52	24.08	0.00	3.44	0.00
		Other	12.02	6.01	4.01	0.00	2.00
		Total		75.43	19.12	3.44	2.00
316	Yata	Bowl	54.95	27.48	27.48	0.00	0.00
		Jar	34.39	30.09	0.00	4.30	0.00
		Other	10.66	7.11	1.78	0.00	1.78
		Total		64.67	29.25	4.30	1.78
Dongu Mean				95.63	0.00	4.37	0.00
Ninupi Mean				72.47	15.18	8.46	3.90
Yata Mean				70.05	24.19	3.87	1.89

Table 4.7 Ceramic petrography results by macroregion for each of six sampled household components, with weighting corrections for vessel form frequencies for the original component

Unit	Phase	1	2	3	4	5	6	7	8	Local	BoM	S-SW
307	Dongu	95.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	95.00	5.00	0.00
315	Dongu	63.83	0.00	36.17	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
316	Dongu	91.06	0.00	8.94	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
320	Dongu	91.76	4.12	0.00	0.00	0.00	0.00	4.12	0.00	95.88	0.00	4.12
323	Dongu	53.14	22.41	0.00	4.65	0.00	0.00	4.65	15.15	75.54	4.65	19.80
324	Dongu	17.14	45.71	0.00	11.43	0.00	0.00	11.43	0.00	62.86	11.43	11.43
303	Ninupi	83.67	5.45	0.00	1.38	4.75	0.00	4.75	0.00	89.11	6.13	4.75
307	Ninupi	85.55	0.00	12.48	1.97	0.00	0.00	0.00	0.00	98.03	1.97	0.00
308	Ninupi	80.15	0.00	8.40	8.40	3.06	0.00	0.00	0.00	88.54	11.46	0.00
311	Ninupi	90.51	1.81	4.75	2.94	0.00	0.00	0.00	0.00	97.06	2.94	0.00
316	Ninupi	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
322	Ninupi	80.77	0.00	0.00	4.62	0.00	4.51	10.10	0.00	80.77	9.13	10.10
307	Yata	63.92	10.08	5.04	7.45	5.04	0.00	5.04	3.44	79.04	12.49	8.48
309	Yata	77.81	0.00	8.88	4.44	4.44	4.44	0.00	0.00	86.68	13.32	0.00
316	Yata	82.71	3.55	4.58	4.58	0.00	4.58	0.00	0.00	90.84	9.16	0.00
317	Yata	86.40	4.33	0.00	4.64	0.00	0.00	0.00	4.64	90.72	4.64	4.64
324	Yata	89.10	10.90	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Dongu Mean		68.66	12.04	7.52	2.68	0.83	0.00	3.37	2.52	88.21	3.51	5.89
Ninupi Mean		86.77	1.21	4.27	3.22	1.30	0.75	2.48	0.00	92.25	5.27	2.48
Yata Mean		79.99	5.77	3.70	4.22	1.90	1.80	1.01	1.62	89.46	7.92	2.62
Dongu StD		30.49	18.65	14.48	4.67	2.04	0.00	4.50	6.18	15.40	4.54	8.14
Ninupi StD		7.48	2.20	5.28	2.97	2.09	1.84	4.19	0.00	7.37	4.43	4.19
Yata StD		9.93	4.61	3.77	2.67	2.60	2.47	2.25	2.25	7.60	5.59	3.84
Dongu CoV		0.44	1.55	1.93	1.74	2.45		1.34	2.45	0.17	1.29	1.38
Ninupi CoV		0.09	1.82	1.24	0.92	1.60	2.45	1.69		0.08	0.84	1.69
Yata CoV		0.12	0.80	1.02	0.63	1.37	1.37	2.24	1.39	0.08	0.71	1.46

Table 4.8 INAA ceramic group frequencies by household component, after weighting by vessel form frequencies in the total original assemblages to account for stratification by form in the original sample. Excludes unassigned samples.

Both specialized samples include a percentage of sherds that did not match one of the groups described above. These are treated differently for the INAA and petrography samples. The unidentified INAA samples likely contain a mixture of imported sherds from areas with too small a sample to form an identifiable group, and local ceramics with somewhat anomalous paste recipes. This is supported by MURR's description of the unidentified sherds, the varied petrographic placements of the INAA-unknown sherds submitted for both techniques, and the diversity of types included in the category. Attempts to use discriminant analysis to assign these sherds to existing groups were not successful; unassigned sherds from types that generally otherwise showed a strong association with groups from one particular region were not consistently assigned to that region. As a result, the unknown INAA samples are excluded from further calculations. This matches the usual treatment of unassigned samples in INAA studies of Aztec ceramics (Garraty 2006:Tables 6.1, 7.1).

In contrast, the much smaller fraction of petrographically unknown sherds are generally either plainwares or types that would reasonably have been expected to have been imported. Because the petrography included macrogroup level categories for sherds that could be matched only at the regional level, rather than the group level, any sherds remaining outside of these categories are highly likely to be from a region outside of those represented in the numbered groups. The presence of plainwares in this unknown category does not negate their foreign status; both INAA and petrography placed substantial numbers of plainware sherds in the Basin of Mexico and S/SW State of Mexico categories, demonstrating long distance trade in plainwares as well as in

decorated types. As a result, the petrographically unassigned sherds are treated as imports of uncertain provenience.

Import Quantities and Sources

All three ceramic analysis methods, INAA, petrography, and type classification, show similar patterning in the quantity and sources of imported ceramics at Calixtlahuaca over time. However, there is some variation in the specific quantities and timing of changes between methods.

The INAA data show only minor fluctuations in the frequency of local ceramic production, which is addressed further in the next chapter. This method shows a steadily increasing frequency of sherds in Aztec-associated groups, more than doubling over the course of the site's occupation. This is accompanied by an initial decrease in ceramic imports from areas in the south or southwest of the State of Mexico between the Dongu and Ninupi phases, followed by a relatively stable level of imports between the Ninupi and Yata phases. In the INAA sample, the total percentage of imported ceramics is highest during the final Yata phase, after the Aztec conquest of the site. However, as noted previously, the chi-square tests of the original sample count results do not show that the trends in the INAA data are strongly significant, and the calibration by vessel form does not change the percentages of the overall assemblage attributed to each source enough to change this.

The similarly weighted petrographic data show a sharp increase in the overall ceramic imports between the Dongu phase and the two following time periods, from about 5% non-local ceramics to 28% in Ninupi and Yata phases. This is much higher than

the total imported group frequency in the INAA samples, suggesting that either the local petrographic groups represent a smaller geographic area around Calixtlahuaca than the corresponding INAA groups, or that a majority of the INAA-unassigned samples are non-local. Aztec imports increase from each phase to the next, starting at completely absent during the Dongu phase and reaching a high of 22% by the Yata phase. Imports from the S/SW of the Toluca Valley rise from 4 to 8% from the Dongu to Ninupi phases before dropping to less than 2% during the Yata phase. This latter pattern of imports contrasts with those produced by other methods, but is consistent with the INAA results for households 307 and 316 only, suggesting that it is due to the particular households selected for petrography. Imported sherds of unknown origin show the same pattern as those from the S/SW of the Toluca Valley, increasing from the Dongu to Ninupi phases, before decreasing to an intermediate level during the Yata phase. In this case, the calibration by vessel form makes the changes in import frequencies over time more pronounced than they were in the original data set, suggesting that the already significant chi-square results for the raw counts of petrographic samples underestimate the significance of the calibrated results.

Import patterns based on the general ceramic classification were calculated for both rim sherds and all sherds (Table 4.9). The two show similar patterns, though the absolute percentage of imports is about 60% lower for the all sherd count calculations. Because jars, which are mostly local, add more body sherds per vessel than bowls, which account for most of the imports, this is not an unexpected pattern. Types associated with the Basin of Mexico increase from each period to the next, with a particularly large increase between the Ninupi and Yata phases. In both samples, imports from the S/SW of

State of Mexico drop between the Dongu and Ninupi phases. In the rim-based sample, imports from this region continue dropping during the Yata phase, while in the all sherd calculations, the frequency of imports from the S/SW is about the same between the Ninupi and Yata phases. Imports from any other region are very rare during all phases, but reach their highest level during the Ninupi phase. Based on two-tailed t-tests of means of the percentages of each source group by household component, the increases in imports from the Basin of Mexico are statistically significant between all pairs of phases (Rims - $p > .90$, All Sherds - $p > .95$). In contrast, none of the between-phase changes for imports from the S/SW region were statistically significant at the .90 level, mainly due to the high degree of variability among households within each phase.

Unit	Phase	Rim Sherds				All Sherds			
		Local	BoM	S/SW	Other Import	Local	BoM	S/SW	Other Import
307	Dongu	98.54	0.97	0.24	0.24	99.54	0.30	0.15	0.02
315	Dongu	98.80	0.33	0.58	0.29	99.77	0.06	0.11	0.06
316	Dongu	98.62	0.00	1.38	0.00	99.45	0.32	0.23	0.00
320	Dongu	98.10	0.89	1.01	0.00	99.58	0.29	0.13	0.00
323	Dongu	95.92	0.48	3.48	0.12	99.22	0.08	0.61	0.09
324	Dongu	87.01	1.30	11.69	0.00	98.70	0.17	1.13	0.00
303	Ninupi	97.92	0.49	1.47	0.12	99.51	0.20	0.25	0.04
307	Ninupi	98.75	0.73	0.47	0.05	99.52	0.33	0.13	0.02
308	Ninupi	97.87	1.83	0.30	0.00	99.07	0.84	0.08	0.00
311	Ninupi	96.23	2.89	0.70	0.18	99.00	0.80	0.14	0.06
316	Ninupi	96.97	2.60	0.16	0.27	98.93	0.96	0.08	0.04
322	Ninupi	91.55	7.49	0.48	0.48	98.39	1.43	0.06	0.12
307	Yata	91.62	7.93	0.44	0.00	96.11	3.80	0.09	0.00
309	Yata	84.34	15.66	0.00	0.00	94.19	5.75	0.07	0.00
316	Yata	91.47	8.53	0.00	0.00	97.11	2.85	0.04	0.00
317	Yata	91.07	8.57	0.27	0.09	96.20	3.13	0.53	0.14
324	Yata	96.76	2.68	0.56	0.00	99.31	0.60	0.09	0.00
327	Yata	100.00	0.00	0.00	0.00	99.68	0.32	0.00	0.00
Dongu Mean		96.17	0.66	3.06	0.11	99.38	0.20	0.39	0.03
Ninupi Mean		96.55	2.67	0.60	0.18	99.07	0.76	0.12	0.05
Yata Mean		92.54	7.23	0.21	0.01	97.10	2.74	0.14	0.02
Dongu StD		4.61	0.48	4.38	0.13	0.38	0.12	0.41	0.04
Ninupi StD		2.60	2.55	0.46	0.18	0.42	0.45	0.07	0.04
Yata StD		5.38	5.44	0.25	0.04	2.09	2.04	0.20	0.06
Dongu CoV		0.05	0.72	1.43	1.21	0.00	0.57	1.04	1.34
Ninupi CoV		0.03	0.95	0.77	0.96	0.00	0.59	0.55	0.88
Yata CoV		0.06	0.75	1.18	2.45	0.02	0.74	1.46	2.45

Table 4.9 Ceramic type classification based import frequencies by household component and source macroregion (Local,Basin of Mexico, South-Southwest State of Mexico, Other Region), with rim sherd and total sherd based values.

The total quantity of imports also increases over time in all four samples, though there are variations in the timing of the change. The INAA and rim sherd type analyses show similar total imports during the Dongu and Ninupi phases, followed by a sharp increase during the Yata phase. In contrast, the petrography shows the sharp increase occurring between the Dongu and Ninupi phases, and the total sherd-type analysis shows a steady progression in increasing imports from each phase to the next. I consider the first pattern to be the most accurate, given the broader sample compared to the petrography and the lower influence of differential fragmentation rates based on vessel size when compared to the total sherd sample.

Inter-Household Variation in Ceramic Exchange

In addition to the site-level patterns of ceramic exchange over time, the household components within each phase also vary in their quantities and sources of non-local ceramics (Figure 4.5, Figure 4.6). Component level data are available for six components based on petrography (Units 307 and 316 for each phase), all components except 327-P6 for INAA, and all components for type-based analysis. This discussion draws primarily on the INAA and type-based datasets due to their more extensive coverage, with reference to the petrographic sample where appropriate. (Table 4.7, Table 4.8, Table 4.9)

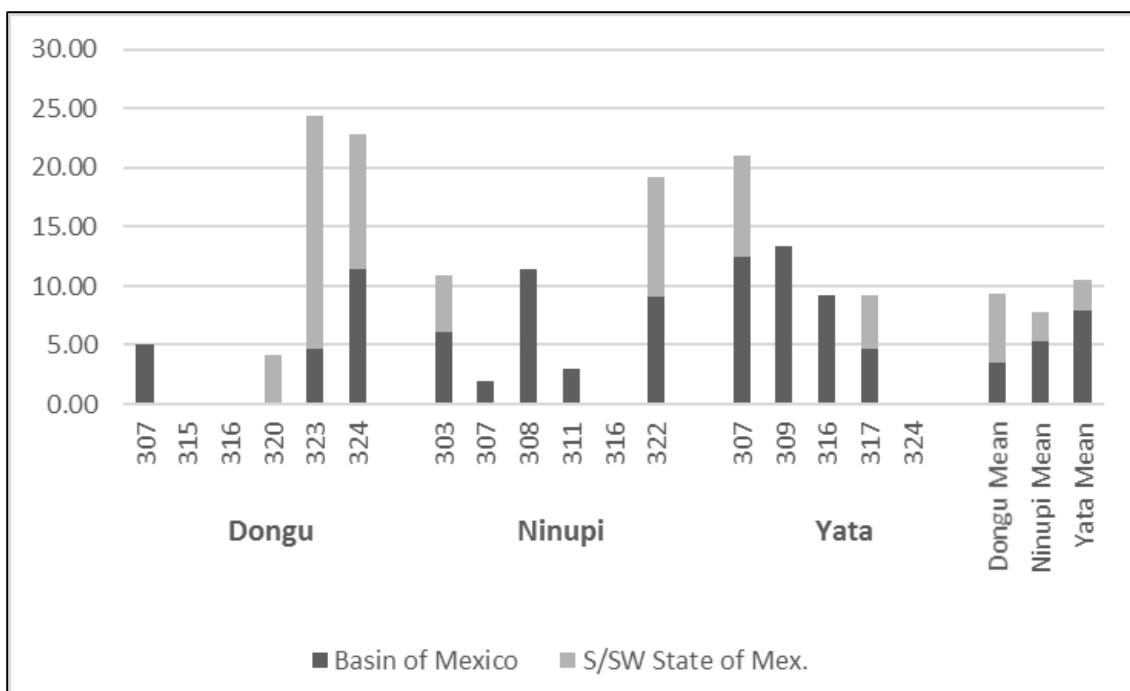


Figure 4.5 INAA ceramic imports by household component. Values from Table 4.6.

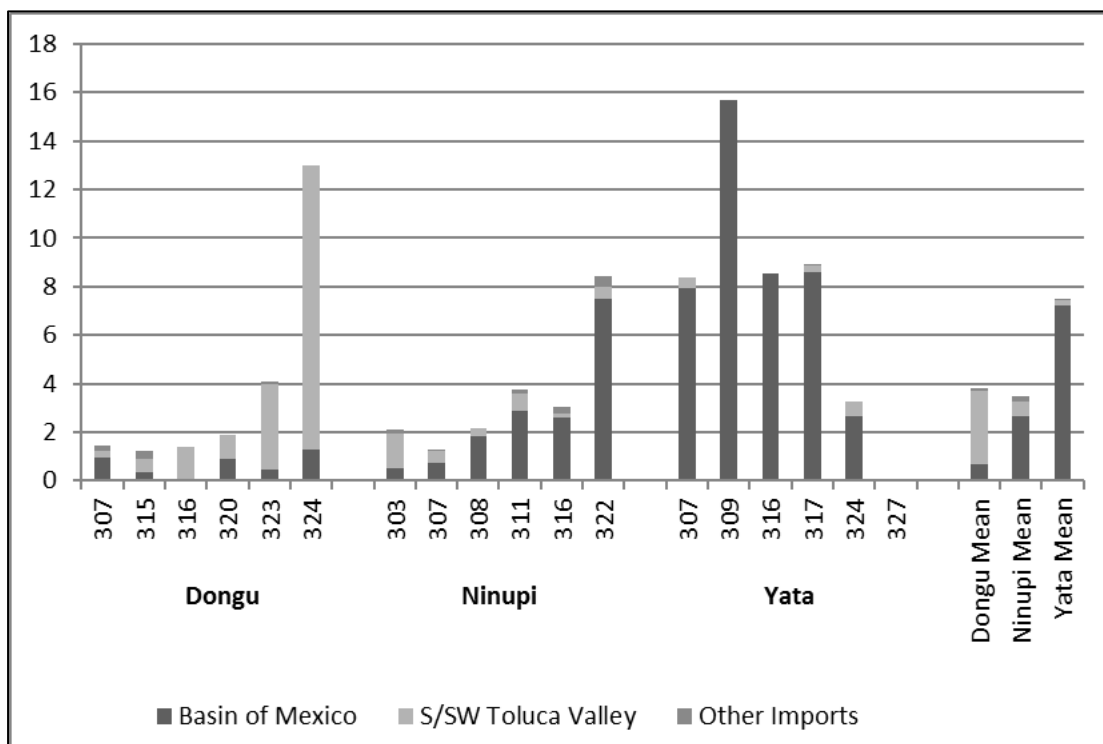


Figure 4.6 Rim sherd type-based ceramic imports by household component. Values from Table 4.9.

Not unexpectedly, the INAA samples have a higher proportion of household components in which imports from one or both non-local source regions are completely absent when compared to the type-based data. Given the average frequency of imported ceramics, where each source region accounts for an average of 2-6% of the ceramics for a given household component, and a sample size of thirty sherds, each source region would only be expected to be represented by one or two sherds in the INAA sample, making it reasonable that sampling would occasionally miss a region completely. Despite this, there is a high level of agreement at the household component level between the INAA sample and the type based ceramic analysis. There is a pattern of increasing within-phase differentiation over time. Both datasets have steadily increasing coefficients of variation for the total quantity of imported ceramics over time. This suggests that access to imported ceramics was becoming increasingly differentiated over time. The two datasets also tend to identify many of the same households as having relatively high or relatively low frequencies of imported ceramics, as well as ceramics from specific source regions.

At the same, the diversity of sources per household increases between the Dongu and Ninupi phases, before decreasing to the lowest overall level during the Yata phase. Based on the typological analysis of all rim sherds, during the Dongu phase, all but one household had ceramics from more than one of the three primary import sources (Basin of Mexico, S/SW of the Toluca Valley, and Other Regions) and three had imported ceramics from all three groups. During the Ninupi phase, five out of six household components had imported ceramics from all three import sources, and the sixth had imports from two. However, despite the higher overall levels of imported ceramics during the final Yata phase, one household component has no imported ceramics, two have

imports exclusively from the Basin of Mexico, and only one has ceramics from a region other than the Basin of Mexico or S/SW of the Toluca Valley. When this is calculated as the average number of source regions per phase, Dongu phase components have an average of 2.3 sources per component, Ninupi components have 2.8, and Yata phase components have only 1.5. The typological analysis of all sherds, which is more likely to identify rare categories of imports due to the larger sample size, shows a similar (though higher overall) pattern, with the average number of import source regions per household going from 2.5 to 2.8 to 2.0 over the three phases. Collectively, these data show that the occupants of Calixtlahuaca saw a widespread increase in the diversity of ceramic exchange between the Dongu and Ninupi phases. This was followed a reduction in the diversity of sources present during the Yata phase, as well as a much more uneven distribution of imported ceramics. This is consistent with the site's increasing integration into broader regional exchange networks prior to Aztec rule, followed by an interruption of such trade under Aztec rule with a potential shift toward more network-oriented provisioning strategies as households relied on personal, rather than market connections for non-local goods.

Obsidian Exchange

A sample of obsidian was submitted to Dr. Adrian Burke at the University of Montreal for experimental high-resolution sourcing using XRF. As a result of the technical limitations of the size of samples that the facility's equipment could use and the smaller database of reference samples, a significant portion of the samples either could

not be processed or could not be matched to a source. The remaining samples, as well as a few successfully sourced samples from each source were then analyzed via XRF at MURR. The overall sources and source frequencies are very similar to those from the more systemically random sample survey obsidian samples processed at MURR (Glascock 2012; Novic 2015), when phase length is taken into consideration (Table 4.9). (Due to the much longer length of the Dongu phase, it presumably contributed a larger proportion of the surface material at the site than the shorter Ninupi and Yata phases.)

Context	Pachuca	Otumba	Ucareo	Other
Dongu	15.54	34.11	45.57	4.77
Ninupi	34.88	21.66	35.25	8.21
Yata	47.49	22.97	28.08	1.45
All excavated, weighted by phase	25.32	29.70	40.27	4.71
Survey	20.05	31.30	45.80	2.90

Table 4.10 INAA-based obsidian source percentages for excavated phases and survey at Calixtlahuaca

Sampling Calibration

Due to the sampling issues described in the methods section, the sourced obsidian does not provide a representative sample of individual households. It does, however, include enough artifacts to estimate overall source frequencies for each phase. While the phase-wide samples are not as unbiased as might be hoped for under an ideal sampling strategy, they do represent a wide range of artifact types within each technological category, as well artifacts from multiple households during each phase. Corrections to account for sampling bias by tool type are described below.

Technology	Otumba	Ucareo	Zacual- tipan	Paredon	Cruz Negra	Zina- pecuario	El Paraiso	Enchisi	Santa Teresa
<i>Dongu</i>									
Blade-Core	1	34				1			
Bifacial	10								
Bipolar	2	1							
Flake-Core	1								
Unidentified	4	4				1			
<i>Ninupi</i>									
Blade-Core	5	34		1	1				
Bifacial	9	2	1				1	1	1
Bipolar									
Flake-Core								1	
Unidentified	3	3						1	
<i>Yata</i>									
Blade-Core	4	12					1		
Bifacial	4	2							
Bipolar	1								
Flake-Core									
Unidentified	2	2							

Table 4.11 Grey obsidian sourcing results with sample results divided by phase and lithic production technology. Includes both Burke and MURR sample results.

Calculating obsidian source frequencies from the original sample results requires two data transformations. The first corrects the relative frequencies of grey obsidian sources for the effects of correlation between sources and production technologies (Table 4.11). This problem occurred because particular technologies were strongly correlated with particular sources, the frequencies of particular technologies varied by phase, and because lithic production technologies had not been sampled proportionally to their occurrence within each phase. I calculated grey source frequencies individually for each lithic technology and then weighted them by the average household percentage of that

lithic technology within all of the DS-1 grey obsidian for the phase. This is the same procedure used to correct for the presence of stratification by vessel form within the ceramic INAA and petrography samples. It produces a matrix of values, in this case unique combinations of technologies and sources, which collectively add up to 100%. Once this matrix is created, the values for all technologies for each source can be summed to give a corrected source frequency out of the total grey obsidian. The results of this calibration step can be seen in Table 4.12.

Second, the sampled artifacts only included a few pieces of green obsidian, because such pieces can be reliably identified visually and in Central Mexican contexts almost always source to Pachuca, Hidalgo. As a result, I use the visually identified percentage of green obsidian as the frequency of the Pachuca source in the assemblage. Because the proportions of the grey sources can only be calculated at the phase, rather than household component, level, I use the average percentage of green obsidian in DS-1 household components as the frequency of Pachuca material for that phase. The grey obsidian source frequencies produced by the previous step are then each proportionally reduced to express only the non-green percentage of all the obsidian, rather than a full 100% of grey obsidian produced by the previous step. This second step produces the fully calibrated values for each source for each phase previously seen in Table 4.10.

Technology	Average % Hh Grey	% of Tech. Sourced Samples			Calibrated % of Grey		
	Obs, DS-1	Otumba	Ucareo	Other	Otumba	Ucareo	Other
<i>Dongu</i>							
Blade-Core	36.01	2.78	94.44	2.78	1.00	34.01	1.00
Bifacial	17.92	100.00	0.00	0.00	17.92	0.00	0.00
Bipolar	4.02	66.67	33.33	0.00	2.68	1.34	0.00
Flake-Core	0.17	100.00	0.00	0.00	0.17	0.00	0.00
Unidentified	41.87	44.44	44.44	11.11	18.61	18.61	4.65
<i>Total</i>					<i>40.38</i>	<i>53.96</i>	<i>5.65</i>
<i>Ninupi</i>							
Blade-Core	41.03	12.20	82.93	4.88	5.00	34.02	2.00
Bifacial	17.47	60.00	13.33	26.67	10.48	2.33	4.66
Bipolar	1.26	50.00	50.00	0.00	0.63	0.63	0.00
Flake-Core	0.24	0.00	0.00	100.00	0.00	0.00	0.24
Unidentified	40.00	42.86	42.86	14.29	17.14	17.14	5.71
<i>Total</i>					<i>33.26</i>	<i>54.13</i>	<i>12.61</i>
<i>Yata</i>							
Blade-Core	46.97	23.53	70.59	5.88	11.05	33.16	2.76
Bifacial	10.61	66.67	33.33	0.00	7.07	3.54	0.00
Bipolar	8.84	100.00	0.00	0.00	8.84	0.00	0.00
Flake-Core	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unidentified	33.59	50.00	50.00	0.00	16.79	16.79	0.00
<i>Total</i>					<i>43.75</i>	<i>53.48</i>	<i>2.76</i>

Table 4.12 Primary obsidian sources by phase, showing correction procedure based on production technology frequencies by phase to adjust for lithic production technology related bias in original sample selection.

Obsidian Exchange: Results

The results of the analyses of obsidian show three patterns over time at Calixtlahuaca, related to major sources, minor sources, and the total volume of obsidian. First, there is a shift in the relative frequencies among the major sources of Ucareo,

Otumba, and Pachuca at the site (Table 4.10). The Ucareo, and to a lesser extent Otumba, sources decrease over time. Pachuca increases over time. Ucareo and Pachuca are both high quality sources that can be used to make prismatic blades, so the replacement of Ucareo by Pachuca is a technologically reasonable substitution. In contrast, Otumba is a medium quality source used primarily for biface production (Cobean 2002; Hirth 2006a). The shift from Tarascan-controlled Ucareo to Aztec-controlled Pachuca was likely a result of shifting political conditions in the Toluca Valley, though it should be noted that the shift begins prior to the Aztec conquest of the Toluca Valley.

The second pattern concerns the diversity of sources over time. Calixtlahuaca is an unusual site for Postclassic Central Mexico in that no single obsidian source ever accounts for the majority of the assemblage, despite the chronological shifts in source frequency. Most Middle and Late Postclassic sites in the Basin of Mexico and Morelos are heavily dominated (80+%) by green obsidian (Table 4.13) (Smith 1990), and the rare exceptions are usually dominated by Otumba. The grey fraction of the assemblage is usually dominated by either the Otumba or Paredon source areas (Braswell 2003). In contrast, sites within the Tarascan area rarely have more than an occasional 1-2% of obsidian from the Pachuca source.

Site	Period	Total Obsidian	% Pachuca	Obs/1000 Sherds	Obs/100 Rims	Source
<i>Toluca Valley</i>						
Calixtlahuaca ¹	MPC	1,249	15.5	39.3	43.50	
Calixtlahuaca ¹	LPC-A	1,622	34.9	41.4	37.73	
Calixtlahuaca ¹	LPC-B	707	47.5	24.6	22.54	
Santa Cruz Atizapan	LC	4,453	9.2			Kabata 2009, Figure 4
Santa Cruz Atizapan	EPI	7,974	6.5			
<i>Basin of Mexico</i>						
Cihuatecpán ²	LPC	11,319	30.7	100.4		Evans 1988, Table 1.2
Chalco	MPC		72.0			Elam et al, 2008
Chalco	LPC		66.7			
Chiconautla	M-LPC	365	82.7			Elson 1999, Table 5
Xaltocan	EPC		68.9			184 Millhauser 2005,
Xaltocan	MPC		89.4			170 Table 12.8
Xaltocan	LPC		93.2			54
<i>Puebla-Tlaxcalla</i>						
Tlaxcallan	LPC	1,556	14.0			Millhauser et al 2015, Table 1
<i>Morelos</i>						
Yautepec	MPC	2,108	93.4	31.9		Smith 2006c, Tables C4-1 to C4-5
Yautepec	LPC-A	4,952	93.2	26.8		
Yautepec	LPC-B	20,126	94.0	25.3		
Yautepec	COL	161	90.7	18.6		
Cuexcomate	LPC-A		91.0	34.0		Earle and Smith 2012, Table 10.6
Cuexcomate	LPC-B		92.8	32.0		
Capilco	LPC-A		95.8	18.0		
Capilco	LPC-B		95.2	19.0		
<i>Michoacan</i>						
Erongarícuaro	LPC		0.7			Rebnegger 2013, Table 5.17
Urichu	LPC		8.6			
Tzintzuntzan	LPC		0.3			
Apatzingan	PC	836	0 ³	33.4		Kelly 1947, Tables 1, 18.
<i>Oaxaca</i>						
Tututepec, House A	MPC	838		13.8		Levine 2011, Table 3
Tututepec, House B	LPC	281		16.4		
Tututepec, House C	M-LPC	71		12.2		
Nicayuhu, House 1	LPC-B	27		0.7		Perez Rodriguez 2003
Nicayuhu, House 2	PC	15		2.3		Tables 4.5, 5.3-4

¹ Calix Values are for DS-1

² Average of Structures/Operations excluding Op 8, Surface collection

³ Described as "all black obsidian". This contrasts with Hester et al 1973 (cited in Braswell 2003), which sourced 7 of 17 pieces(41%) from the site to Pachuca.

Table 4.13 Comparative total and green obsidian frequencies for Late Classic to Early Colonial sites in Central Mexico

In addition, the diversity of minor sources at Calixtlahuaca is also chronologically sensitive. The Ninupi phase shows the highest diversity of sources, with 1-3 pieces from each of six additional sources beyond the major sources noted above. These include at least one newly located source within the Toluca Valley (Palomas), and one geographically unknown source group that has only appeared at sites in the Toluca Valley (San Antonio Enchisi) and is thus likely an additional local source. Both the preceding Dongu and subsequent Yata phases have one minor source represented among their samples. Because the Yata phase sample of grey obsidian is only about half the size of that for the preceding phases, the disappearance of minor sources may not be quite as severe as it appears, but it is certainly still present. In a metanalysis of Mesoamerican obsidian sourcing, Golitko and Feinman (2015), showed that Late Postclassic sites (n=61) have obsidian from an average of 3.74 (± 1.98) sources. If this is used as a general point of comparison, the Dongu and Yata phases fall very close to the macroregional average, with four sources each. In contrast, the Ninupi phase features a diversity of obsidian sources far above the macroregional average. The same analysis, which did not include data from Calixtlahuaca, showed that Late Postclassic sites in West Mexico (i.e., Tarascan sites) generally form an almost completely independent obsidian exchange network from the rest of Mesoamerica. The presence of substantial amounts of Ucareo obsidian at Calixtlahuaca suggests that this conclusion may need to be reconsidered.

Unit	Phase	Lithic		Total		N. Green	%	Obs./	Green/
		Total	Weight	Lithic	N. Total			1000	1000
		Sherds	(g)	Count	Obsidian	Obsidian	Green	Sherds	Sherds
307	Dongu	4,770	357	295	276	29	10.51	57.86	6.08
315	Dongu	13,890	115	101	97	26	26.80	6.98	1.87
316	Dongu	3,050	147	31	30	2	6.67	9.84	0.66
320	Dongu	3,840	149	98	94	15	15.96	24.48	3.91
323	Dongu	8,915	550	719	699	59	8.44	78.41	6.62
324	Dongu	914	354	63	53	6	11.32	57.99	6.56
303	Ninupi	8,951	232	240	211	38	18.01	23.57	4.25
307	Ninupi	20,280	787	610	584	235	40.24	28.80	11.59
308	Ninupi	3,729	114	124	109	40	36.70	29.23	10.73
311	Ninupi	5,030	373	436	427	40	9.37	84.89	7.95
316	Ninupi	15,800	245	174	173	64	36.99	10.95	4.05
322	Ninupi	1,668	126	124	118	79	66.95	70.74	47.36
307	Yata	10,200	562	272	260	131	50.38	25.49	12.84
309	Yata	3,094	129	73	70	41	58.57	22.62	13.25
316	Yata	7,451	154	94	92	44	47.83	12.35	5.91
317	Yata	9,638	208	82	76	48	63.16	7.89	4.98
324	Yata	3,438	218	188	185	36	19.46	53.81	10.47
327	Yata	948	36	26	24	13	54.17	25.32	13.71
Dongu							13.28	39.26	4.28
Ninupi							34.71	41.36	14.32
Yata							48.93	24.58	10.19

Table 4.14 Green and total obsidian quantities by household component, with obsidian weights, counts, and standardizations by rim sherd and total sherd counts. DS-1 sample.

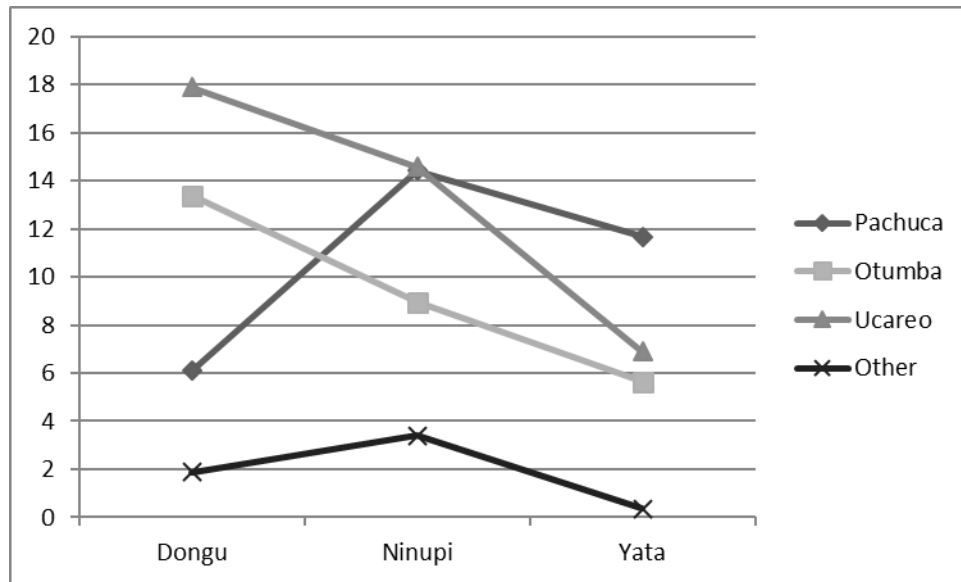


Figure 4.7 Obsidian source frequencies per 1000 sherds by phase

Third, the quantity of obsidian arriving at Calixtlahuaca can also be addressed on a more absolute basis by calculating the frequency of obsidian artifacts per 1000 ceramic sherds (Table 4.14, Figure 4.7). As a primarily locally produced artifact class, the absolute quantity of ceramics used by a household would have been mostly independent of the volume of extra-polity trade in any given time period. In addition, ceramics should have a relatively consistent average breakage rate (though different vessel types may have different use lives), providing a reasonably consistent rate of accumulation. Given the high degree of variation in artifact densities among deposits at Calixtlahuaca, sherd counts are a better standardization factor than excavated volume. When obsidian counts are standardized in this manner, they show a small increase in the absolute quantity of obsidian entering the site between the Dongu and Ninupi phases, followed by a sharp decrease from the Ninupi to Yata phases. When broken down by source, between the

Dongu and Ninupi phases, the absolute quantity of obsidian entering the site from Pachuca and minor sources increases, while the amount arriving from both Otumba and Ucareo decreases. Between the Ninupi and Yata phases, the absolute quantity of obsidian arriving from all sources decreases. This final decrease includes even the Pachuca source, despite the fact that it comes to represent a much higher percentage of the obsidian assemblage during this phase, indicating that the apparent increase in the frequency of green obsidian at the site is due more to a decrease in grey obsidian than an actual increase in green obsidian.

Discussion

Some aspects of the trade patterns seen at Calixtlahuaca parallel those seen in other provinces of the Aztec Empire, while others stand out as distinctive. First, the pattern of substantial trade with the Basin of Mexico prior to Calixtlahuaca's political incorporation into the Aztec Empire parallels other cases in Central Mexico. For both ceramics and obsidian, trade with the Basin of Mexico begins to increase during the Ninupi phase, prior to the Aztec conquest of the Toluca Valley. In addition, while I generally interpret the Yata phase as the period during which the site was under Aztec rule, the phase actually begins two decades prior to the historically recorded date of conquest. In a general sense, the discrepancy in timing between the evidence for changes in trade and the historical dates for political control demonstrates the relative reach of the Aztec economic and political nets (Hall 1997). It also demonstrates the ability of exchange networks to reach beyond the political unit(s) at their cores. This accords well

with the historic and archaeological understanding of Postclassic Mesoamerica as a commercial economy (Berdan 2003; Blanton, et al. 2005).

On the other hand, the specifics of the exchange patterns observed at Calixtlahuaca also stand out as distinctive in some regards, namely for the volume of trade (Table 4.15). The overall percentage of imported ceramics is much lower than that observed at contemporaneous sites in Morelos. In addition, in Morelos, the period under Aztec rule usually shows a small decrease in the frequency of imported ceramics when compared to the preceding phase. The opposite occurs at Calixtlahuaca, where the frequency of imported ceramics continues to rise after the Aztec conquest of the region. At the same time, the frequency of extraregional imported ceramics is much higher than at contemporary Aztec sites in the Basin of Mexico. Obsidian does show the more stereotypical pattern, with a reduction in the absolute quantity of material entering the site under Aztec rule, as is seen at a number of other sites in both the Basin of Mexico and Morelos (See obsidian/sherd ratio data for Xaltocan, Yautepec, and Cuextomate in Table 4.13).

Both ceramics and obsidian reach their greatest diversity of sources during the Ninupi phase, prior to Calixtlahuaca's conquest by the Aztec Empire. As a result, the increase in goods from the Basin of Mexico during the Yata phase was a mixed benefit that came at the expense of the further development of trade connections in other regions.

Site	Period	Total Sherds	% Total Imported	Total Rims	% Total Imported	Source
<i>Toluca Valley</i>						
Calixtlahuaca	MPC		0.62		3.83	
Calixtlahuaca	LPC-A		0.93		3.45	
Calixtlahuaca	LPC-B		2.90		7.46	
Cerro Toloche	M-LPC	6,204	1.98			Jaramillo & De la
<i>Basin of Mexico</i>						
Chalco	EPI			455	0?	Hodge 2008, Chap. 9
Chalco	PC			1,442	0?	
Chalco	MPC			2,288	0?	
Chalco	LPC			2,101	0?	
Tlatelolco	LPC	12,303	0.11			Gonzalez Rul 1988a
Xaltocan	EPC			867	4.04	Brumfiel 2005a,
Xaltocan	MPC			3,731	2.22	phases per
Xaltocan	LPC			2,335	0.64	Overholtzer 2014
Cihuateopan ¹	LPC	96,881	0.13			Evans 1988, Table 1.2
Oxtotipac	MPC			1,007	2.48	Parsons 1966, Table
Tepexpan	LPC			1,961	0.97	28
Maquixco	LPC			4,000	0.53	
Teacalco	LPC			1,856	0.81	
Xometla	LPC			562	0.36	
<i>Puebla</i>						
Cholula, UA-1, Midden	EPC	3,858	0.96			McCafferty 2001,
Cholula, UA-1, Well 3	EPC	262	0.38			Tables 3.1, 5.2
Cholula, UA-1, Well 1	LPC	445	2.25			
<i>Morelos</i>						
Yautepec	LPC-A		5.6 (+3.4% Guinda) ²			Earle and Smith
Yautepec	LPC-B		3.3 (+2.5% Guinda)			2012, Table 10.8
Cuexcomate	LPC-A		3.4 (+3.9% Guinda)			
Cuexcomate	LPC-B		2.6 (+2.8% Guinda)			
Capilco	LPC-A		3.3 (+2.2% Guinda)			
Capilco	LPC-B		2.3 (+1.7% Guinda)			

¹ Average of all excavations, excluding Operation 8, which is a specialized lithic dump

² Guinda B/R or B&W/R are produced in both the Basin and Morelos, and cannot be visually distinguished between the two regions. Chemical sourcing shows approximately a 50/50 split in sources at these sites.

Table 4.15 Comparative frequencies of imported ceramics at Postclassic Central Mexican Sites

Conclusions

The finer chronological control at Calixtlahuaca allows for a nuanced discussion of the interplay between the political and economic control exerted by the Basin of Mexico, with implications for the understanding of Aztec rulership strategies. The Dongu to Ninupi phase trajectory of change in long distance trade establishes a baseline that can be compared to subsequent, Yata phase, changes.

The pre-Aztec baseline for macroregional interaction at Calixtlahuaca begins at a lower level than in most surrounding areas of Central Highland Mexico. During the Middle Postclassic, the occupants of Calixtlahuaca participated in relatively low levels of exchange with adjacent areas. While the Basin of Mexico is one of these areas, it is not particularly more culturally similar to the Toluca Valley than any of the site's other trading partner regions. The low level of initial interaction differs from the pattern seen in most of the regions that would become the inner provinces of the Aztec Empire, many of which did have a higher degree of both intra-regional trade and general cultural similarity. As a result, the degree of change in trade at Calixtlahuaca should be measured from the site's lower baseline, rather than by absolute volume.

The occupants of the Basin of Mexico exerted an increasing level of economic dominance over Calixtlahuaca over the course of the Late Postclassic. This increasing influence, is visible as an increased "market share" of the non-local goods reaching Calixtlahuaca, starting during the Ninupi phase. Given that the earlier portion of this phase predates the establishment of the Triple Alliance, let alone the conquest of the Toluca Valley, the data indicate that the increasing dominance of the Basin of Mexico in

regional trade networks was not solely the result of imperial actions. The Ninupi phase also sees the greatest diversity of sources for imported goods at Calixtlahuaca. Based on this evidence of long distance trade at Calixtlahuaca, the pre-Aztec trajectory at the site was one of increasing integration into broader Postclassic Central Mexico, with an increasing diversity (and for lithics, increasing quantity) of goods reaching the site. This increasing integration was relatively evenly distributed among households, indicating that commoners were likely acquiring foreign goods primarily through markets, rather than personal connections. The relatively even distribution of non-local goods is consistent with a relatively collective form of rulership at the site prior to its incorporation into the Aztec Empire.

The political influence on economic activity becomes visible later, during the Yata phase. The quantity of imported ceramics continues to rise, but the absolute quantity of obsidian arriving at the site drops. For both types of imports, the proportion of non-local goods coming from the Basin of Mexico rises. The changes in trade patterns indicate that incorporation into the Aztec Empire partially disrupted the prior trend toward increased interregional connection, redirecting it from an expanding multilateral web of regional connections to one where all further increases in trade were strongly centered on the Basin. This indicates that Aztec rule was sufficiently direct to cause some reorganization of trade in directions favorable to the imperial core. However, imperial rule was not sufficiently direct to completely sever prior lateral trade connections, even those reaching across the Tarascan border.

The Yata phase also saw a reduction in the evenness of access to non-local goods from particular sources, suggesting a breakdown in the prior market system and a higher

degree of reliance on patronage or personal ties for access to non-local goods. This interpretation would be consistent with a relatively non-collective rulership strategy by the Aztec Empire, with a lower dependence on market revenues and a greater dependence on patron/client relationships. The reduction in long distance trade at Calixtlahuaca could also be a side effect of the Aztec relocation of the primary regional market, though this would still indicate a primary focus on controlling local elites rather than providing benefits to commoners.

The results of the analyses of long distance trade at Calixtlahuaca support the first of the two hypotheses presented at the beginning of this chapter. That is, the data support an interpretation of relatively indirect imperial rule. There is a dampening - but not a complete negation - in the prior pattern of economic growth, and a reduction - but not a complete disappearance - of goods from regions other than the Basin of Mexico. In contrast, the increase in the dominance of goods from the Basin of Mexico and the increased inequality of access to such goods, are not consistent with relatively collective imperial rulership of the Toluca Valley.

CHAPTER 5. “THE GRIDDLE MAKER IS ONE WHO MOISTENS CLAY”⁵:

LOCAL CRAFT PRODUCTION

Integration into larger economic systems is a two-way process and this chapter’s discussion of local production at Calixtlahuaca is the flip side to the previous chapter’s discussion of exchange networks and imported goods. As such, changes in local craft production at Calixtlahuaca over time can be used to examine the degree and form of Aztec control over the local economy as a product of particular imperial strategies of rule. Some items produced locally at Calixtlahuaca would have exited the local economy via medium or long distance trade, while the majority would have been used locally. Despite this chapter’s focus on the production of objects, the relatively low density of occupation at Calixtlahuaca and the generally low levels of craft production at the site suggest that the majority of the site’s occupants were either full or part-time farmers. This contrasts with the idea that Aztec cities were centers of craft production (Charlton, et al. 1993; Fargher 2009). This chapter presents the evidence for the production of ceramic vessels, small molded ceramic items, obsidian artifacts, textiles and activities associated with projectile points and scrapers at Calixtlahuaca over time.

I find that craft production at Calixtlahuaca was low throughout the site’s history, with production occurring primarily for household use and little variation among households. This indicates that while Calixtlahuaca was becoming increasingly integrated

⁵ General History of the Things of New Spain. Book 10: The People. Chapter 23.

into broader networks of interaction, market integration had not yet reached the level where it could drive specialized production. Following the Aztec conquest of the site, there is a modest increase in textile production, likely related to tax (tribute) requirements, and modest reduction in lithic production, likely related to the increasing scarcity of material noted in the previous chapter.

Empire and Economic Development

The economics of peasant households – such as Aztec commoners – sit at the intersection of two major debates in the social sciences. The first is how pre-modern world-systems were organized, and the degree to which various aspects of modern international economic relationships can be applied to ancient cases. The second is the degree to which factors other than economic self-interest influence economic behavior, which might result in pronounced cultural differences in economic behaviors. Both questions echo the long-running formalist-substantivist debate about the degree to which economic behaviors are explained by generalizable laws versus culturally specific logics. In more recent applications, these two questions pertain to the general question of whether there was substantial economic growth and/or increases in the standard of living in antiquity (Morris 2004a; Scheidel 2010; Stark, et al. 2016). If the potential for such growth can be demonstrated, what political conditions support or impede it?

In the post-1492 world, political and territorial control have been intrinsically linked to economic control. Colonies or provinces have been used as sources of raw materials, and as controlled markets for manufactured goods produced in the home

country (Wallerstein 1976; Wolf 1982). Under this paradigm, manufacturing activities are actively suppressed in provincial areas. However, Schortman and Urban (1994) argue that this type of peripheral economic underdevelopment is only likely to occur in cases where the core state controls trade within the boundaries of other trading partners, has an ability to project military force into peripheral areas, and has more advanced technologies of trade and/or transport. Only the first and second of these conditions are even weakly met for the provinces of the Aztec Empire, including Calixtlahuaca. The Aztec Empire could control trade with other areas to some extent, as was demonstrated by the shifting patterns of imported goods in the previous chapter. However, there is clear archaeological evidence that even the most supposedly antagonistic boundaries of the Aztec Empire let goods through in both directions. Aztec sites feature goods from outside the empire, such as “contraband” Tarascan obsidian and metal items, and sites in the Tarascan heartland include low, but certainly more than insignificant percentages of Aztec Pachuca obsidian (Pollard 2000). Cross boundary trade was not limited to the Tarascan frontier. Aztec goods, including Black-on-Orange ceramics and Pachuca obsidian, also appear at sites in Tlaxcala (Xiuhtecutli 2014). Militarily, the Aztec Empire did have the ability to mobilize larger forces than the rulers of Calixtlahuaca, and the influx of Aztec settlers into the Toluca Valley would have provided a check on independent local military action. However, the regular occurrence of provincial revolts, possibly including in the Toluca Valley, demonstrates that Aztec military power was also far from all-controlling. In terms of technological or transportation advantages, the Basin of Mexico did not differ notably from other parts of Central Highland Mexico. (The lake system in the Basin provides an internal transportation advantage, but not one that can be applied to transporting goods

outside of the Basin.) There is a potential association between the strength of rulership and the development of more modern-patterns of world systems-based economic exploitation. As a result, establishing the directness and social organization of power of rulership have broader implications for clarifying the validity and time depth of this relationship.

There is a similar debate as to the degree to which extra-economic factors influence the rationality of economic choices. In anthropology, this debate has historically been framed as the argument between moral and political economy perspectives, where the former perspectives argues that households (or individuals) are primarily motivated by maintaining appropriate social relationships, while the latter argues that households are primarily motivated by the rational pursuit of their own self-interest (Cheal 1989; Wilk and Cliggett 2007). In the social sciences more broadly, arguments concerning the influence of other factors on economic self-interest make up part of the debate around rational choice theory (Eriksson 2011; Tucker 2014). This latter body of work has found that what options are seen as viable and/or appropriate are at least partially culturally determined (e.g. cultures vary widely in the average offers made and rejected in the ultimatum game (Henrich, et al. 2004)), but that all human groups cooperate at higher levels than would be expected from purely self-interested strategies (Bowles and Gintis 2006). However, cooperation and group-benefitting behaviors are not particularly inherently irrational, if one considers that humans live in social groups and often reap collective benefits from the overall wellbeing of their group. On a more applied level, the fundamental (maximizable) goal of most peasant households is the continued existence of the household itself. In most premodern cultures (and most non-

first world modern states), insuring that your neighbors are doing reasonably well is a form of self-interest, because one's neighbors are one's social safety net. This same focus on the perpetuation of the household unit will also likely produce a relatively risk-averse attitude toward economic choices (Kuznar 2001; Winterhalder, et al. 1999). However, risk-averse does not mean unchanging, and modern peasant households often shift among multiple strategies, including subsistence farming, cash crops, wage labor, and crafting, based on nuanced understandings of risk and potential gain (Cashdan 1990; Wilk 1989). In addition, risk-averse does not mean that households seek to directly supply all of their own needs. At a minimum, the differential distribution of natural resources means that most households have to trade for some necessary items not available locally, such as salt or obsidian. The degree to which households seek to self-provision is likely related to the reliability of alternate means of acquiring basic necessities (Hirth 2009a). This means that household decisions concerning specialization can be used to provide information about the reliability of alternate means of access to other goods, both at local and regional scales, under particular political regimes.

Fargher's (2009) argument for peasants as rational actors provides a set of testable expectations related to both of the debates presented above. In this hypothesis, under conditions of high agricultural demand, people in areas amenable to agricultural intensification will specialize in agricultural activities (usually of staple crops) at the expense of other types of production. People in agriculturally marginal areas, or areas not amenable to agricultural intensification, then specialize in producing other types of craft goods. These craft goods are then purchased by the agricultural specialists to replace those that they no longer make for themselves. At this basic level, this type of

interregional interdependence occurs in both state and relatively high population density non-state societies (Earle 1987; McGuire 1993; Sanders 1956; Stark 1991). In more complex societies, both of the preceding groups supply urban areas, which focus on the political/religious activities, and craft production. The Middle and Late Postclassic Basin of Mexico conforms well to the predictions of this model, with agricultural intensification in productive areas, and variable specializations in less productive zones (Charlton, et al. 1991; Fargher 2009). However, the Basin is a much smaller area than the other test cases from which the model was derived. This has two possible implications. The lack of draft animals in Mesoamerica may have limited the spatial zones over which the trade of staple goods resulting from agricultural specialization occurred. Alternatively, the pattern of subregional occupational specialization observed in the Basin of Mexico may also extend to adjacent regions, such as the Toluca Valley. Integration over a larger geographic area would correspond to Sanders' (1956) idea of a Central Mexican Symbiotic Region.

Aztec rule over the Basin of Mexico was both more direct and more collective than over most provincial areas, with the ability to cause changes in economic organization (e.g. founding and moving market locations, and elite sponsorship of luxury craft production), and the ability to maintain regular and reliable market access to allow for specialization. If Calixtlahuaca does fall within a broader Central Mexican core area, I expect the pattern of craft production at Calixtlahuaca to parallel those seen in the Basin of Mexico. In this case, I would expect Calixtlahuaca to gain importance as an urban center from the Dongu to Ninupi phases, which would be accompanied by an increase in craft production. The reduction of administrative functions at the site between the Ninupi and Yata phases, resulting from the reorganization of local power under Aztec rule,

would have required the occupants of Calixtlahuaca to focus on other productive activities. Given that Calixtlahuaca is marginally located for maize agriculture, this would likely have meant an intensification in the production of other goods.

In contrast, if Calixtlahuaca falls outside of the more highly integrated core of the Aztec Empire, it would likely be under more indirect and, at the imperial level, less collective rule. There is a potential issue of conflation between relatively collective forms of local social organization, and relatively collective imperial rule. As a result, the pre-Aztec pattern may be one of stable market access at the local level resulting in the development of specialized craft production, especially given general regional trends toward economic integration over the course of the Postclassic. However, given the somewhat lower population density of the Toluca Valley relative to the Basin of Mexico, I expect an overall lower level of specialization. Subsequently, under a relatively indirect, network-oriented Aztec rulership strategy, I would expect to see relatively minor changes to the preexisting pattern of craft specialization at the site.

The Economics of the Aztec Empire

Patterns of craft production over time are highly variable at Postclassic Central Mexican sites. Archaeologists' interpretations of changes in local craft production resulting from the expansion of the Aztec Empire fall into two groups. These interpretations largely reflect the degree to which researchers interpret the development of the Basin of Mexico market system as resulting from primarily political as opposed to primarily economic processes (Nichols, et al. 2009). Unfortunately, two of the sites with

the clearest evidence for specialization in particular activities, Otumba and Cihuatecpan, do not have sufficient chronological refinement to discuss changes over time.

The first group interprets changes in craft production and market development as heavily influenced by political processes (Brumfiel 1980; Garraty 2007), and often interprets changes in a negative light. If local production rates drop, it is because the economy is being swamped by foreign goods, or access to raw materials is being limited or taxed. If the evidence shows increased craft production, it is a result of imperial taxation either directly or indirectly extracting wealth out of the provincial community. At Xaltocan, reductions in local lithic production (Millhauser 2005; Rodríguez-Alegría 2008), and increases in the frequency of spinning tools (Brumfiel 2005a) are both interpreted as responses to imperial rule that were negative for local communities.

In contrast, the second group of interpretations sees most changes in craft production after imperial conquest as the result of positive changes resulting from increased economic opportunities (Charlton, et al. 2000; Hirth 2013; Smith 2003c). If the evidence for the production of certain crafts increases, then it is a result of greater opportunities to sell items in an expanded market network. Decreasing evidence for particular crafts is also seen as a result of greater market dependence. Case studies falling into this mode of interpretation include Smith's interpretations of the increase in textile production tools at the Morelos sites of Cuexcomate and Capilco (Smith and Heath-Smith 1993), and explanations for decreases in bark-beaters and molds for small ceramic items at various sites in Morelos (Smith 2003c).

As a result, changes in the intensity and diversity of craft production must be contextualized against broader changes in the standard of living. The patterns of craft

production explored in this chapter are compared against changes in household wealth in the following chapter.

Mesoamerican Craft Production

Craft production in Mesoamerica was generally a part-time occupation for a large portion of the population, rather than a full-time means of making a living (Brumfiel 1980; Hirth 2009a). This is especially true for the production of commonly used goods, such as pottery or grinding stones. In contrast, very high value goods, such as metal items or stone jewelry were often produced by more specialized, urbanized producers (Smith 2003a). As a result, changes in the distribution or intensity of the production of widely used items are likely to be visible in consumption-based household contexts, while the study of rarer items depends on encountering the primary contexts of production.

Mesoamerican studies of craft production can be framed around the concepts of specialization and multicrafting. Specialization addresses the organization of production of a single craft and can be broken down into multiple variables, as characterized in Costin (1991). Her dimensions of specialization are context, concentration, scale, and intensity. Context ranges from independent to attached and describes the independence of the craftsperson relative to the consumer. Concentration describes the spatial patterning of specialization, from dispersed to nucleated. Scale describes the size of the production group, from small family-based groups to factories. Finally, intensity describes whether crafting is a part time or full-time activity for the producer. The variables can theoretically be combined in any set of combinations, but certain combinations seem to

be more common. In general, state-level social organization is accompanied by at least intermediate levels of specialization, but this ranges from primarily family-based workshops to factory/manufactory levels of organization, and from primarily private enterprise to heavy state involvement in the production of goods.

Most Mesoamerican crafting falls into the independent, dispersed, kin-based, part-time end of Costin's spectrums of variation, with occasional forays toward attached specialization for higher-value crafts. This produces an appearance of homogeneity, masking important variations in the organization of Mesoamerican craft production. As a result, Hirth (Hirth 2006b, 2009a) and Shimada (2007) proposed two dimensions, the periodicity of crafting and the number of crafts practiced, that better characterize the variability of Mesoamerican craft production. The first of these two dimensions distinguishes between craft activities that a household or individual may perform discontinuously (such as seasonally, in years with bad harvests, or for an occasional commission) from those that occur on a fairly continuous basis. The second distinguishes between households or workshops where there is evidence for a single craft, and locations where the craftspeople created multiple classes of objects. Multicrafting is sometimes used to refer to any context with evidence for the production of multiple crafts, but should more accurately be reserved for cases where there is evidence for the production of multiple crafts *above the level needed for use within the household*. Multicrafting is easier than periodicity to identify archaeologically.

At Calixtlahuaca, I consider Costin's dimensions of specialization at both the household and site level, with a particular focus on intensity. At the household level, I seek to identify whether there is any evidence for a particular craft activity, and whether

there is sufficient evidence to consider a particular household as producing for more than their own needs. The evaluation of the intensity of production is based on both relative comparisons among households at Calixtlahuaca and comparisons with other Aztec sites. Inter-site comparisons are also used to evaluate the overall intensity of production for particular crafts at Calixtlahuaca from a regional perspective, as a level of craft production that looks high at a local scale may not be unusual at a regional scale. Due to the limitations of the data both from Calixtlahuaca and comparative sites, not all of the comparisons described here can be used for all of the crafts under consideration. Following the discussion of production and specialization by household, I discuss the evidence for multicrafting.

Ceramic Vessel Production

Ceramic production occurred widely, usually as a part-time specialization in Mesoamerica. Ceramic vessel production may be identified by direct evidence of production, such as molds, kilns, or waste sherds, or via indirect methods based on the frequency of artifact types and/or the characteristics of the produced artifacts themselves. The production of non-vessel ceramic items is discussed separately in the following section.

Direct Evidence for Ceramic Production

Direct evidence for ceramic production consists of the raw materials, tools and/or facilities used to make ceramics or the debris resulting from production. Examples of raw

materials include deposits of raw clay, tempering material or pigments to be used for decorative purposes. These are rarely recovered archaeologically, and even when found can be difficult to link to ceramic production. In Mesoamerica, ceramic production tools were simple, consisting of one-piece molds (in some time periods and regions), burnishing stones (possibly including worked sherd disks), and small grinding stones for pigments. The only facilities recovered in Mesoamerica are kilns, the use of which was very rare (for exceptions, see Balkansky, et al. 1997; Castanzo 2004; Healan 1989: Appendix 2; Santley, et al. 1989). Theoretically, settling basins for clay preparation could also be identified archaeologically, as they have been in the Southwest (e.g., Abbott 2006). Direct evidence for ceramic production also includes the by-products of production in the form of improperly fired sherds. These may take the form of highly vitrified or warped sherds, or simply as unusual concentrations of sherds from a single type of vessel (Arnold 1991; Curet 1993; Stark and Garraty 2004; Sullivan 2006).

There is no direct evidence for ceramic production at Calixtlahuaca. This is not unusual in Mesoamerican contexts. Most ceramics were formed by hand or over simple one-piece molds and then open fired at relatively low temperatures. Ethnographic work has demonstrated that very small scale producers may fire ceramics in their household cooking hearth, leaving no specific evidence of firing (Deal 1998). Larger firing areas are also often located some distance from houses (Arnold 1991), and the Calixtlahuaca house excavations may not have extended far enough to reach the appropriate locations. A few heavily vitrified sherds were recovered from a number of excavations (Table 5.1), but given all four of the excavation units where these sherds were recovered also included quantities of burned daub, it is unclear whether the sherds were exposed to extremely

high temperatures during firing or at some later point in their use-life. According to Levine, et al. (2015), a strong “local” sourcing signature, but poor correlation among local INAA groups, local petrographic groups, and macroscopic ceramic characteristics can be reasonably interpreted evidence of widespread, low-level local ceramic production. Given the lack of one-to-one correlations between local INAA groups, local petrographic groups, and specific decorative types at Calixtlahuaca this argument provides additional support for widespread, low-intensity ceramic production at the site.

Provenience	Phase	DS-1	DS-3	N. Sherds	Type(s)
315-12-8	Dongu		X	1	Not recorded
323-13-1	Dongu		X	1	Not recorded
323-13-6	Dongu		X	1	Not recorded
316-16-2	Ninupi	X	X	1	Not recorded
316-17-2	Ninupi	X	X	1	Not recorded
316-20-1	Ninupi		X	1	Not recorded
316-22-2	Ninupi	X	X	1	Not recorded
316-6-1	Yata	X	X	1	Bowl
316-14-2	Yata		X	1	Jar, decoration unknown
316-15-2	Yata	X	X	4	Not recorded
317-12-4	Yata		X	1	Unidentifiable
317-14-4	Yata	X	X	1	Plain Jar
317-14-7	Yata		X	1	Not recorded
317-35-5	Yata	X	X	2	Not recorded

Table 5.1 Excavated contexts at Calixtlahuaca with overfired sherds. Includes phase and project DS-1 and DS-3 sample assignments (See Chapter 3 for a description of samples of contexts used for analysis)

Indirect Evidence for Ceramic Production

Changes in ceramic production can also be inferred from macro- or microscopic characteristics of the finished pots themselves. Such characteristics provide information

about the general organization of producers at a site, rather than the specifics of production by a particular household. I look at INAA for general sitewide patterns of local production and attribute data for more detailed information on the production of specific types.

Phase	Vessel Form	N. Samples	% of DS-1 Rims	Local	Aztec Imports	S/SW Mex. St. Imports
Dongu						
	Bowls	72	54.57	47.93	2.95	3.69
	Jars	45	34.44	32.87	0.00	1.57
	Other	16	10.99	10.99	0.00	0.00
	<i>Total</i>			<i>91.80</i>	<i>2.95</i>	<i>5.25</i>
Ninupi						
	Bowls	84	57.53	54.92	1.96	0.65
	Jars	57	34.39	32.06	1.17	1.17
	Other	21	8.07	6.24	1.47	0.37
	<i>Total</i>			<i>93.21</i>	<i>4.59</i>	<i>2.19</i>
Yata						
	Bowls	63	56.65	48.56	6.29	1.80
	Jars	42	33.16	31.58	0.79	0.79
	Other	17	10.2	9.60	0.60	0.00
	<i>Total</i>			<i>89.74</i>	<i>7.68</i>	<i>2.59</i>

Table 5.2 INAA based frequencies of local and imported ceramics by macroregion (Local, Basin of Mexico, South-Southwest State of Mexico), showing adjustment for vessel form frequencies during the phase.

INAA. The general frequency of local ceramic production can be addressed using INAA data, which were described in more detail in the preceding chapter. The primary local source group, Group 1, and its variants Group 2 and Group 3, make up the majority of the sourced ceramics from all three phases of the site's occupation. While this cannot be taken as a precise measure of direct ceramic production at Calixtlahuaca, as some

ceramics in these groups likely came from communities in the surrounding area, it is a broad-brush measure of local production. When the INAA data are adjusted by the assemblage frequency of each major vessel type (bowls, jars and other vessels) to account for the effects of the original sampling strategy, the local source groups show very little change in assemblage dominance over time (Table 5.2). Excluding unattributed sherds, the local groups account for 91.8% in Phase 2, 93.2% in Phase 4, and 89.7% in Phase 6.

Because most Mesoamerican INAA studies are focused on particular decorative types, there is little comparative data as to whether the levels of local production at Calixtlahuaca are particularly high or low. Of the cases that exist, Garraty (2007) shows that approximately 73-83% of plainwares in the Basin of Mexico were produced in the same major third of the Basin where they were used. When this figure is combined with sourcing studies that show that 70-80% of Late Postclassic Black-on-Orange wares (Nichols, et al. 2002) and 81-97% of Late Postclassic redwares (Minc 2009) were remaining within similar geographic regions, the net use of locally produced ceramics appears to be somewhat lower than what is seen at Calixtlahuaca.

Attribute Analysis. Increases in the scale or intensity of production may be visible as a greater level of standardization among vessels of a given type. This may be a result of a shift from a larger number of smaller producers to a few larger producers, an increase in consistency due to increased skill/repetition, or due to the adoption of new technologies to facilitate rapid production, such as molds (Rice 1987:201-204). However, comparisons of pottery standardization in different ethnographic contexts have

demonstrated that only relatively large changes in production intensity are likely to be visible in the standardization of the finished products (Roux 2003).

I examine the standardization of three ceramic attributes – the rim form, the rim diameter, and the vessel wall thickness. These three attributes could be consistently recorded for almost the entire attribute sample. In addition, all three are likely subject to reduced variation as a result of production intensification. For rim diameter and vessel wall thickness, increased standardization would likely be an unintentional product of increased repetition, while a decreased variety of rim forms might relate to a decreasing number of producers. I examine these variables in three ceramic types - plain bowls, plain jars, and biconical censers - using the attribute sample of more intensively recorded sherds from each household component. These types occur in all households during all phases. The first two are very common types with large sample sizes. The latter is a relatively less common but still ubiquitous type, potentially offering a contrasting pattern of production, both because demand could have been met by a smaller number of producers, and because the plaster and appliqué decoration of the censers is unique among ceramic types at the site.

These three ceramic types generally do not show changes in the organization of ceramic production over time (Table 5.3). The metric variables, rim diameter and vessel wall thickness, are unimodally distributed for all three vessel types and their distributions are evaluated using the coefficient of variation. The coefficient of variation measures the distribution of variation relative to the mean. Because, in the absence of measuring devices, humans psychologically perceive variation as relative to the total, this measure provides an appropriate means of assessing changes in the degree of variation, even in the

presence of changing mean values (Eerkens and Bettinger 2001). Rim form is a categorical variable, and is evaluated using the scaled version of Simpson's C. Simpson's C is a diversity measure, and in the version used here, scores assemblages from 0 for complete dominance by a single type, to 1 for a completely even distribution of types among categories.

For jars, I include both plain and eroded jars in the analyses. Because most jars are plain, most eroded jar sherds are likely to originally have been plain. The use of both types results in a larger sample size. Jars do not show increasing or decreasing standardization over time. The standard deviation for jar diameters decreases from the Dongu to Ninupi and Yata phases, but this is accompanied by a general reduction in the mean vessel diameter. As a result, the coefficient of variation decreases from the Dongu to Ninupi phases, and then rises to an intermediate level in the Yata phase. For vessel thickness, the coefficients of variation are very similar across all three phases, suggesting either consistent production methods, or that thickness is a technological constraint that is not affected by changes in the organization of production. The distribution of different rim forms over time shows consistently increasing standardized Simpson's C values, indicating that the assemblages are less dominated by one or two rim forms over time. This may indicate increased diversity of producers over time.

For bowls, I only included plain bowls in the analyses. As a high percentage of the total bowls are decorated, the original nature of eroded pieces is much harder to predict. Bowl diameters show a decrease in the coefficient of variation from the Dongu to the Ninupi phases, followed by an increase to an intermediate level during the Yata phase. Conversely, the coefficients of variation for bowl thickness show a near-opposite

pattern, increasing from the Dongu to Ninupi phases before returning to their original levels during the Yata phase. The diversity of rim forms remains even during the Dongu and Ninupi phases, followed by a small increase in heterogeneity during the Yata phases. The relatively small changes in the amount of variation among phases, as well as the highly inconsistent patterning among the three variables lead me to conclude that there was no systematic change in the organization of bowl production over time.

Phase	Diameter				Thickness				Rim Forms	
	N.	Mean	Std. Dev.	Co. Var.	N.	Mean	Std. Dev.	Co. Var.	N.	Simpson's C, Stand.
Jars										
Dongu	278	21.07	6.04	0.29	344	8.68	1.54	0.18	344	0.67
Ninupi	355	20.47	5.04	0.25	416	8.81	1.53	0.17	415	0.74
Yata	208	19.37	5.05	0.26	230	8.38	1.58	0.19	231	0.78
Bowls										
Dongu	188	17.69	4.98	0.28	202	6.46	1.35	0.21	203	0.79
Ninupi	248	17.73	4.48	0.25	253	6.15	1.43	0.23	253	0.79
Yata	79	17.24	5.64	0.33	88	6.12	1.28	0.21	88	0.77
Censers										
Dongu	36	23.36	6.89	0.30	39	7.54	1.29	0.17	39	0.78
Ninupi	41	26.90	7.62	0.28	43	8.19	1.74	0.21	45	0.79
Yata	20	24.10	5.67	0.24	22	8.14	1.39	0.17	22	0.79

Table 5.3 Standardization measure values for ceramic bowls, jars, and hourglass censers, by phase. Diameter means in cm, thickness means in mm.

Biconical “hourglass” censers are a much less frequently recovered type than bowls or jars, though the type does have a high ubiquity among excavated contexts. The rim diameters for this type show a decrease in the coefficient of variation from each phase to the next. The coefficient of variation for vessel thickness, however, increases

from the Dongu to Ninupi phases, followed by a return to approximately its starting level during the Yata phase. The Standardized Simpson's C statistic for the diversity of rim forms is almost identical in all three phases. For biconical censers, the relatively small degrees of change in the variables examined for standardization, and the inconsistent temporal patterning among variables suggests that there were no systematic changes over time in how censer production was organized.

Molded Ceramic Items

Small non-vessel ceramic items, particularly spindle whorls and figurines, were produced independently of ceramic vessels. The production of such items can be identified either through the same markers of direct production used for vessels (prepared clay, misfired pieces, etc.), or through the identification of the ceramic molds used to produce the items in question. At other Aztec sites, particularly Otumba (Charlton, et al. 1993; Nichols, et al. 2000), there is clear evidence that the production of these artifact types was conducted in workshops, and that the two artifact types were likely made by the same producers. At the same time, molds only occur as a very low frequency item at Middle and Late Postclassic Yautepec (.07-.19 molds per 1000 sherds) (Smith 2006c: Table C3-2), and are completely absent at the rural sites of Cuexcomate and Capilco for the same periods (Smith 2006a:Table B3-2). The only Postclassic site in the Toluca Valley where molds are reported is Teotenango, with four whorl molds (Velázquez V. 1975). However, given that molds are a very low-frequency item, and most projects in the Toluca Valley have featured either relatively low-intensity test-pitting or a

concentration on the excavation of monumental architecture, the general absence of molds should not be taken as evidence for a lack of production. Mold-produced items, especially spindle whorls, are common at sites across the Valley. Toluca Valley maguey whorls are stylistically distinct enough from those produced in surrounding regions that it is unlikely that they were being produced outside of the region and imported in bulk.

At Calixtlahuaca, there is little evidence for the production of small molded items on-site. The excavations recovered four fragments of figurine molds (M-263, 264, 265, 567) and four unspecified mold fragments that may have been part of maguey whorl molds (M-272, 504, 576, 582) (Figure 5.1). The molds are scattered among household components and phases, occurring in six excavation units and all three phases (Table 5.4). At .02 molds per 1000 sherds in the DS-1 sample, the overall frequency of molds falls below those noted above for the site of Yautepec. The sitewide survey located two figurine molds in addition to those described above, a frequency which also does not support intensive production of molded artifacts in non-excavated portions of the site.

Piece #	Mold Type	Provenience	Context	DS-1	DS-3	Phase
M-576	Other/Unknown	314-5-1	Excavation		X	Dongu
M-264	Figurine	315-17-2	Excavation		X	Dongu
M-265	Figurine	315-22-10	Excavation	X	X	Dongu
M-272	Other/Unknown	303-1-7	Excavation	X	X	Ninupi
M-567	Figurine	311-5-1	Excavation		X	Ninupi
M-263	Figurine	307-14-1	Excavation		X	Yata
M-504	Other/Unknown	317-13-4	Excavation	X	X	Yata
M-582	Other/Unknown	317-18-3	Excavation		X	Yata
M-262	Figurine	302-4-1	Survey			-
M-451	Figurine	300-831-2	Survey			-

Table 5.4 Molds for small ceramic items at Calixtlahuaca by type and provenience. See Chapter 3 for a description of DS-1 and DS-3 samples of contexts.



Figure 5.1 Examples of figurine molds and spindle whorl molds excavated at Calixtlahuaca

The frequency principle also fails to support the notion of specialized production of these artifact types in any of the excavated households. None of the excavated households have truly exceptional frequencies of either finished artifact class, which might suggest on-site production (See Table 5.7 for whorl frequencies by household component, and Figure 7.2 for figurine frequencies by phase.) Additionally, the molded figurines and spindle whorls are very diverse. No duplicates from the same mold were identified among the figurines. There is only a single case of two maguey whorls with tops that appear to have come from the same mold, but their sides differ. The diversity of

finished artifacts suggests that there may have been a correspondingly high number of intermittent producers, either at the site or elsewhere.

Due to recent changes in INAH policy, examples of spindle whorls and figurines could not be exported for INAA as originally planned. As a result, I can only say that figurines appear to include examples made from Basin of Mexico clays, locally produced variants of Basin-style fine clays, and several groups of brown pastes that broadly overlap those seen in vessels produced within the Toluca Valley. Figurines are discussed in more detail in Chapter 7. Of the spindle whorls, some of the cotton whorls show the orange shifted paste colors more characteristic of the Basin of Mexico, while the remainder are consistent with local paste colors. On grounds of macropaste alone, none of the maguey whorls are inconsistent with a production location within the Toluca Valley, though stylistic traits suggest that at least some of them are likely imported from the Basin of Mexico.

Lithic Production

Stone tools, especially those made from obsidian, make up the second most common artifact class in Postclassic Mesoamerica households. Stone tool production was often differently organized than other craft activities (Hirth 2006a), generally featuring a higher degree of specialization than ceramic production. This is likely due to the more limited spatial distribution of appropriate raw materials and relatively lower annual consumption rates (Sanders and Santley 1983; Sheets 1992). The higher relative degree of necessary training may also play a role. Despite this general trend toward more

specialized production, the organization of Mesoamerican lithic production was highly variable over time and space (Cobean 2002: Chapter 5). On one end of the production spectrum are workshops, such as those found at Epiclassic Xochicalco (Hirth 2008, 2009b), Early Postclassic Tula (Healan, et al. 1983) or Postclassic Otumba and the surrounding Teotihuacan Valley (Parry 2001). Workshop-level production can usually be identified even during survey, due to the very high concentrations of debitage that it leaves behind. In addition, the lithic assemblage from a workshop is likely to show relatively little evidence of use-wear (Hirth and Castanzo 2006). Based on reported data from Middle Postclassic Xaltocan, obsidian to rim sherd ratios were approximately seven times higher in a workshop dump context than in other contexts (1135 vs. 170 obsidian fragments per 100 rims) (Millhauser 2005). Similarly, a deposit at Late Postclassic Cihuatecpan interpreted as an obsidian workshop dump had an obsidian to total sherd ratio approximately 18.5 times higher than the average of other excavated contexts (1868 vs. 100 obsidian pieces per 1000 total sherds) (Evans 1988). Below the workshop level, lithic production can also take place as one of several household crafts in multicrafting situations, such as at Classic period El Palmillo (Haines, et al. 2004), or Postclassic Erongaricuro (Rebnegger 2010). In such cases, there is a reasonable amount of evidence for lithic production, such as artifacts from several stages of a production sequence, but it is generally lower in density than what is found in workshop contexts and may be mixed with a higher proportion of domestic refuse. In addition, in multicrafting situations, lithic production may be oriented toward producing tools for use in another craft, such as scrapers for producing xerophytic plant products (Evans 1988) or gourd working (Hay 1978). At the most basic level, most Postclassic households show some evidence for the

occasional production or modification of tools for household use, and the mere presence of production-related lithic forms should not be taken as evidence of specialization.

The degree of specialization in lithic production also varies by the type of artifact being produced. Prismatic blade production tends to be a more specialized industry than biface production, even at the same site. This is likely a product of the specialized skills required to produce prismatic blades, as well as the fact that they require higher quality raw material than bifacial artifacts (Clark 1987; Parry 1994).

Because lithic production is a reductive technology, the production of stone tools leaves behind direct evidence in the form of the debitage produced by the knapping process. In some cases, tools associated with lithic production, such as hammerstones, can also be identified, but functional assignments often suffer from issues of equifinality. As a result, the Calixtlahuaca Archaeological project did not separate lithic production tools from other similar artifacts, and I focus only on the chipped stone material itself in the following discussion.

Lithics found in archaeological contexts represent both the remains of the production of stone tools, and tools discarded after use. Evidence of local production must be distinguished from other potential causes for a concentration of lithic material, such as another craft that required the use of large numbers of stone tools, or the opportunistic exchange of production byproducts with novel but functionally valuable forms, such as core rejuvenation artifacts or plunging blades.

Evidence for Lithic Production at Calixtlahuaca

Lithic production may be identified by very high concentrations of lithic material, particularly production debitage. At Calixtlahuaca, Dr. Bradford Andrews classified artifacts both by technology, and by the functional stage of lithic production or consumption that they likely represented. The assignment of lithic artifact types to “production” or “consumption” categories is a rough approximation, as many of the artifact types created as production byproducts may be repurposed as cutting edges and used. In order to be considered evidence of intensive, specialized lithic production, I require that a household have both a high percentage of production-related lithics (evidence of production), and a relatively high lithic-to-sherd ratio (evidence of intensification relatively to other households activities). The full list of lithic artifact codes, and their technologies and production/consumption codes can be found in Appendix E. The discussion of lithic craft production included here draws heavily on Andrews’ work, which will be available in more detail in the upcoming final project report to INAH.

The stone tools used at Calixtlahuaca fall into three technological categories: core-blade, bifacial, and bipolar (Andrews 2013). In the DS-1 sample, 66% of the lithic artifacts are technologically diagnostic. Of these, 76% are core-blade, 19% are bifacial, and 5% are bipolar. There was no evidence for lapidary production in the DS-1 sample. However, of the lithic artifacts directly related to production, the proportions are different, with the majority of the technologically identifiable production-related pieces pertaining to bifacial production, followed by core-blade, and finally bipolar production (Table 5.5). Part of the difference between the production-related and the total lithic

percentages is due to differences in the quantity of identifiable production-related pieces each technology produces. However, the discrepancies here are high enough to suggest differences in how various types of lithic artifacts were reaching consumers at Calixtlahuaca.

For all three production technologies, the quantities of production-related artifacts are low enough to raise questions of sample size, especially in the smaller components. As a result, I require that household components fall more than two standard deviations from the mean before being considered unusual, for both the frequency of percentage of production related lithics for a given technology, and for the obsidian to sherd ratio. I also generally interpret outlier households conservatively, with a focus on the broader, sitewide pattern over time.

Unit	Phase	Total Lithics	Core-Blade Production				All Core-Blade %				Biface Production				All Biface %				Bipolar Production				All Bipolar %	
			N. % Lithics	/1000 sherds	Lithics	Blade %	N. Lithics	% Lithics	/1000 sherds	Lithics	N. % Lithics	/1000 sherds	Lithics	N. % Lithics	/1000 sherds	Lithics	N. % Lithics	/1000 sherds	Lithics	N. % Lithics	/1000 sherds	Lithics	N. % Lithics	/1000 sherds
307	Dongu	279	10	1.79	1.05	38.35	38	13.62	7.99	14.70	2	0.72	0.42	0.72										
315	Dongu	108	6	4.63	0.36	57.41	6	5.56	0.44	7.41	7	6.48	0.51	6.48										
316	Dongu	30	3	3.33	0.37	46.67	7	23.33	2.61	26.67	0	0.00	0.00	0.00										
320	Dongu	93	52	2.15	0.51	37.63	10	10.75	2.53	11.83	4	4.30	1.01	4.30										
323	Dongu	715	53	7.13	5.78	37.62	122	17.06	13.59	18.74	36	5.03	4.08	5.31										
324	Dongu	55	11	5.45	3.36	54.55	5	9.09	5.61	9.09	2	3.64	2.24	3.64										
303	Ninupi	351	25	2.56	1.00	48.72	43	12.25	4.78	13.96	5	1.42	0.56	1.42										
307	Ninupi	602	19	2.66	0.79	54.82	60	9.97	2.96	11.63	0	0.00	0.00	0.00										
308	Ninupi	87	16	3.45	0.81	48.28	6	6.90	1.34	6.90	9	10.34	2.42	10.34										
311	Ninupi	429	26	3.96	3.41	47.32	79	18.41	15.24	19.58	0	0.00	0.00	0.23										
316	Ninupi	183	10	5.46	0.63	57.92	21	11.48	1.20	14.21	1	0.55	0.06	0.55										
322	Ninupi	103	10	0.97	0.60	74.76	0	0.00	0.00	0.97	7	6.80	4.20	6.80										
307	Yata	289	15	3.81	1.08	62.28	21	7.27	2.05	9.69	1	0.35	0.10	0.35										
309	Yata	71	5	5.63	1.29	66.20	3	4.23	0.97	7.04	0	0.00	0.00	0.00										
316	Yata	90	2	1.11	0.13	56.67	9	10.00	1.20	12.22	4	4.44	0.53	4.44										
317	Yata	77	10	2.60	0.21	74.03	2	2.60	0.21	2.60	4	5.19	0.42	5.19										
324	Yata	175	11	4.57	2.32	51.43	3	1.71	0.87	2.29	33	18.86	9.55	18.86										
327	Yata	18	3	16.67	3.17	88.89	0	0.00	0.00	0.00	0	0.00	0.00	0.00										
Dongu, Mean			4.08				13.24				5.46				14.74				3.36				1.38	
Ninupi, Mean			3.18				9.83				4.26				11.21				3.19				1.21	
Yata, Mean			5.73				4.30				0.88				5.64				4.81				1.77	
All Phases, Mean			4.33				9.12				3.53				10.53				3.78				1.45	
Dongu, Std Dev			2.05				6.31				4.79				7.11				2.52				1.53	
Ninupi, Std Dev			1.51				6.12				5.63				6.48				4.35				1.73	
Yata, Std Dev			5.58				3.72				0.74				4.77				7.26				3.82	
All Phases, Std Dev			3.50				6.42				4.49				6.98				4.85				2.44	

Table 5.5 Total and production related lithic frequencies for core-blade, biface and bipolar lithic production artifacts by house and phase. DS-1 sample.

Core-Blade Production. Potential evidence for production of core-blade artifacts consists of artifacts relating to core shaping, rejuvenation and recycling, as well as initial series pressure blades and flakes or blades resulting from production errors. Most artifacts in this category relate to the production of prismatic blades. One or more of these artifact classes are present in all of the excavated household components, but the frequencies are generally extremely low. With two exceptions, artifacts related to core-blade production account for 1-6% of the total lithics in a household component, and at a relative frequency of less than three and a half pieces per 1000 ceramic sherds. The first exception to this pattern is household component 327-Ph6, which is a very small sample (n=18 obsidian artifacts), of which the identifiable artifacts consist exclusively of core shaping artifacts (n=3) and prismatic blades. The relatively low obsidian to sherd ratio in this component, however, suggests that the lack of artifact type diversity is due to sample size rather than actual craft production. The second exception to the general pattern is 323-Ph2. In this component, artifacts related to core-blade production account for both an unusually high percentage of the lithics and the highest frequency relative to the ceramic count of any component. This component includes artifacts from a wide range of stages of production, with all categories noted above except core recycling present. However, while this household component does have higher frequencies than any other household, they are not outside of the two-standard deviation range for all components at the site, nor are they the order of magnitude higher characteristic of specialized lithic production.

The general pattern of core-blade artifact provisioning is one in which the overwhelming majority of prismatic blades entered circulation in the city as completed artifacts. This is supported by the much higher frequency of consumed blades relative to

the frequency of artifacts related to blade production. Given the technical skill necessary for prismatic blade production, the very low but widespread presence of production related artifacts is more consistent with their sale and secondary use as cutting edges, rather than widespread household blade production. The evidence for blade production is reasonably constant over time. If the outlier households are excluded, evidence for core-blade production accounts for an average of 3-3.5% of the total lithic assemblages over time. Similarly, it accounts for 1-1.5 obsidian artifacts per 1000 sherds in all three periods. This suggests little change in the organization or intensity of prismatic blade production (or, rather, the absence thereof) at Calixtlahuaca over time.

Biface Production. Potential evidence for bifacial artifact production includes debitage from the production of bifacial, unifacial, and flake-core artifacts, and at Calixtlahuaca primarily includes material in the former two categories. Finished tools are not included as evidence of production. Bifacial artifact production requires less technical skill than core-blade production, and produces less useful byproducts. As a result, relatively lower total quantities of production related artifacts are required to argue for bifacial production than for blade production. At Calixtlahuaca, the evidence for bifacial artifact production shows a higher level of intercomponent variability than the evidence for prismatic blade production, ranging from 0-23% of the total lithic assemblage and frequencies of 0-15 artifacts per 1000 sherds. However, no household component falls outside of the two standard deviation range for both the percentage of biface production artifacts and their frequency per 1000 sherds. (Interestingly, the two households which completely lack evidence for bifacial production – 322-Ph4 and 327-Ph6 - are the only

two components located on the smaller hill to the east of the main site. This may be an area with lower than average biface production, but the sample sizes are too small to evaluate this conclusively.) As a result, I do not consider the excavated sample of households to have included any cases of specialized biface production.

Based on this patterning, the production of bifacial artifacts likely occurred in most households (except those on the east edge of the site) during all time periods. Some households produced more than others, but none reach a level of production that could be considered a workshop. Bifacial tool production decreases consistently over time, both as a percentage of the total lithic assemblage and as a relative frequency per 1000 sherds. While the exact magnitude of the drop depends on whether cases falling between one and two standard deviations are included, the inclusion or omission of these components does not change the overall pattern.

Bipolar Production. The third major category of lithic artifacts found at Calixtlahuaca was produced using bipolar techniques. These are produced by supporting the piece of obsidian on an anvil while striking it, allowing force to be transmitted from both ends (Flenniken 1981). It is an efficient way to use small fragments of stone that might otherwise not be knappable, or a means of recycling tools that had lost their edge, particularly blade sections. (This reuse of blade sections at Calixtlahuaca is unusual for Mesoamerica.) Because this technology represents a final effort to get a usable edge from a small fragment of stone, the act of bipolar production presumably took place within the site. Evidence for bipolar production includes almost all artifacts produced using the technique, and as a result, this category may include a higher degree of equifinality

between evidence of production and evidence of consumption. The average evidence for bipolar production is similar to that for core-blade production, accounting for a phase average of 3-5% of the total lithics. However, the evidence for bipolar production is much more variable among households, ranging from 0-18% of the total lithics, and 0-9 pieces per 1000 sherds. There are five components with no evidence for bipolar production, spread across all three phases, meaning that this was not an activity that all households participated in. There is also one component, 324-Ph6, which shows an unusually high level of bipolar production, with both the percentage of bipolar artifacts and their frequency per 1000 sherds falling outside of the two standard deviation range, both as a percentage of the lithic assemblage and as a frequency per 1000 sherds.

Bipolar production was most likely an occasional activity performed by some households at Calixtlahuaca, primarily to recycle/produce tools for their own use. The much patchier distribution of evidence for bipolar production (which is almost coterminous with any evidence for the production or consumption of bipolar artifacts), may be partially due to sample size and the relative rarity of bipolar artifacts overall. However, it does suggest that bipolar artifacts were produced within the household on an as-needed basis, rather than bought and sold in the marketplace. 324-Ph6, with its more intensive bipolar production, may have been a poorer household with more need to conserve obsidian. The overall level of bipolar production is approximately stable during the Dongu and Ninupi phases, followed by an increase during the Yata phase. Given that the absolute quantity of obsidian entering the site drops during this final period, an increase in bipolar production, which “recycles” previously used obsidian, is expected. However, at an individual household level, there is little correlation between the quantity

of bipolar production and the obsidian/sherd ratio. As noted in the previous chapter (Table 4.13), the overall obsidian to sherd ratios at Calixtlahuaca are low relative to those seen in the Basin of Mexico, but comparable to those in Morelos or Oaxaca.

In general, a low degree of lithic production occurred at Calixtlahuaca, but the details of production vary by technology. Prismatic blades were widely utilized, but there is next to no evidence for the preparation of cores or the abandonment of exhausted cores. This suggests that most blades were produced by itinerant specialists, who arrived, produced blades, and then moved on, taking their partially used cores with them, rather than local individuals. In contrast, most households show some evidence for biface production, and a few cases may have been producing for use in other crafts. Similarly, many, but not all, households show evidence of occasional bipolar production, with one possible case of more intensive production. Evidence for blade production remains fairly constant over time, while biface production drops, and bipolar production slightly increases.

Cloth Production

The evidence for the production of textiles at Aztec sites often patterns differently than that for other crafts at the same sites. This is most likely due to the use of textiles as a form of currency, for both tax payments and independent trading purposes. As a result, the Aztec Empire could conceivably promote local textile production even as it suppressed the production of other crafts in order to create more demand for products from the imperial core. With the technology – drop-spun thread, and backstrap looms -

available in Postclassic Mesoamerica, textile production is not particularly amenable to economies of scale. Female members of a household could invest more time in textile production, or engage more members of the household in various stages of fiber processing, but the net output per work hour would probably not have gone up substantially (Hicks 1994). (The same problem confronted textile producers in England immediately prior to the industrial revolution, leading to the “putting-out” system (e.g. Millward 1981)).

Mesoamerican textile production involved a series of stages and a variety of fibers. The stages of production include fiber extraction, spinning, weaving, sewing, dyeing, and embroidering. The two primary fibers were cotton and maguey (agave), with an additional variety of less well documented fibers such as rabbit fur, palm, and metallic threads (McCafferty and McCafferty 2000). Cotton and maguey have different technological constraints in their production, resulting in different types of associated production artifacts. The archaeological evidence for maguey fiber production consists of tabular “desfibrador” scrapers, usually made of basalt, and larger spindle whorls (>10g) (Parsons and Parsons 1990). The evidence for cotton fiber production consists of smaller spindle whorls (<10g) and the small bowls used to support them (Parsons 1972; Smith and Hirth 1988). The weight division between cotton and maguey whorls shows some regional variation, but Parson’s original values remain valid for central highland Mexico. Additional tools, such as copper or bone needles, bone awls, bone or greenstone weaving battens, and stamps for decorating cloth are rare enough that they cannot usually be evaluated in a systematic manner.

The easiest way to compare the intensity of textile production among sites is to standardize cloth production artifacts by some factor. Due to the variability of archaeological reporting, different researchers have used excavated volume, surface area, rim sherd count, and total sherd count (King 2011). I use spindle whorls per 1000 sherds, as these are the most commonly reported (Table 5.6). I also include sites reporting whorls and rim sherds, applying a conversion factor of ten total sherds per rim unless an estimate of the rim sherd/total sherd ratio was included. Based on the forty-one Postclassic and Early Colonial site components for which I could find data (Table 5.6), the frequency of spindle whorls relative to total sherd count forms a strongly right-tailed distribution (Figure 5.2). About two thirds of the sites fall between a complete absence of whorls and about 1.5 whorls per 1000 sherds. Then there are a smaller number of sites with frequencies up to just over four whorls per 1000 sherds. I interpret sites in the first range as those producing primarily for domestic use, with a possible low degree of specialization for market sale toward the higher end of the range. I interpret sites in the higher cluster as those specializing in cotton production. All but one of them are located in known cotton cultivating areas, and the exception (the Late Postclassic portion of O'Neill's excavations at Chalco) is quite close to cotton producing regions and features exclusively cotton whorls. Other than Calixtlahuaca itself, none of the sites has more than about 60% maguey, as opposed to cotton whorls, making it difficult to assess what a specialization in maguey fiber would look like. The best candidate is Cihuatecpan, which both falls at the upper end of the proposed "non-specialized" range, and is one of the few sites with more maguey than cotton whorls.

		Per 1000				Source	
		Sherds	Cotton	Maguey	Total	Total	Total
Site	Period	(Rim=10	Whorls	Whorls	Whorls	Rims	Sherds
<i>Toluca Valley</i>							
Calixtlahuaca	MPC	0.16	2	9	11	6,382	67,345
	LPC-A	0.34	5	18	23	7,317	67,988
	LPC-B	0.87	13	22	35	4,585	40,129
Huamango	EPI-EPC	1.20			20		16,689 Pina Chan 1981, p. 92,118
Cerro Toloche	LPC	0.48	3		3		6,204 Jaramillo & De la Peña
<i>Morelos</i>							
Capilco	MPC	1.43	2	3	5		3,496 Smith 2006 Table B3-2
	LPC-A	1.90	42	2	44		23,115
	LPC-B	2.99	86	2	88		29,444
Cuexcomate	LPC-A	1.53	31	0	31		20,286 Smith 2006 Table B3-2
	LPC-B	2.35	210	25	235		99,828
Xochicalco &	MPC	2.08	2	3	5		2,402 Smith & Hirth 1988, Table
Coatetelco	LPC-A	2.63	7	2	9		3,417 2
	LPC-B	3.15	5	0	5		1,589
Yautepec	MPC	0.97	29	1	30		30,795 Smith 2006, Table C3-2
	LPC-A	1.17	143	9	152		130,206
	LPC-B	1.16	227	10	237		204,243
	COL	1.47	13	0	13		8,866
<i>Basin of Mexico</i>							
Chalco	MPC	0.48	8	3	11	2,288	Hodge 2008, Chap 9,13;
	LPC	1.05	20	2	22	2,101	Table B-4
Chalco	MPC	1.20	6	2	8		O'Neill 1962, cited in
	LPC	4.10	13	0	13		Smith & Hirth 1988
Tlatelolco	LPC	0.73			9		12,284 Gonzalez Rul 1988a, p.186
Cihuatecpan	LPC	1.21	53	65	118		97,252 Evans 1988
Huexotla*	MPC	0.59	10	11	21	3,582	Brumfiel 1991, Table 8.1
	LPC	0.29	37	44	81	27,720	
Xaltocan	EPC	0.31	2	1	3	965	Brumfiel 2005, Tbls 4.2-3,
(Testing)	MPC	0.20	6	7	13	6,661	14.1-2, Phases per
	LPC	0.14	7	2	9	6,418	Overholtzer 2014
Xaltocan	EPC	0.42	4	17	21		DeLucia and Overholtzer
(Houses)	MPC	0.46	7	6	13		2014, Tables 1, 2
	LPC	0.81	10	2	12		
Xaltocan*	MPC	0.35	6	7	13	3,740	Brumfiel 1991, Table 8.1
	LPC	0.91	17	4	21	2,298	
Xico*	MPC	0.12	5	1	6	5,062	
	LPC	0.04	1	0	1	2,247	
Coatlan Viejo*	LPC	2.26	119	13	122	5,408	Brumfiel 1991, Table 8.1(citing Mason 1980)

Table 5.6 Cotton and maguey spindle whorl frequencies at Calixtlahuaca and other comparative sites

		Per 1000			Source		
Site	Period	Sherds (Rim=10	Cotton Whorls	Maguey Whorls	Total Whorls	Total Rims	Total Sherds
<i>Oaxaca</i>							
Nicayuju	PC	0.00	0	0	0	46,719	Perez Rodriguez 2006
Rio Viejo	EPC	0.31	86	0	86	36,677	276,300 King 2011, Table 2
Tutuepec, ResA	MPC	1.30	79	0	79	6,297	60,816 Levine 2007, Table 7.01
Tutuepec, ResB	LPC	2.34	39	1	40	1,740	17,090
Tutuepec, ResC	LPC	2.72	16	0	16	639	5,883
<i>Other</i>							
Tepetitlan	EPC	0.23			13	55,730	Cobean & Alva Mastache 1999, Figures 2.1, 8.39a
Cholula, UA-1	PC	0.79			129	16,396	McCafferty 2001, McCafferty & McCafferty, 2000

*Survey Project

Table 5.6 (continued) Cotton and Maguey spindle whorl frequencies at Calixtlahuaca and other comparative sites

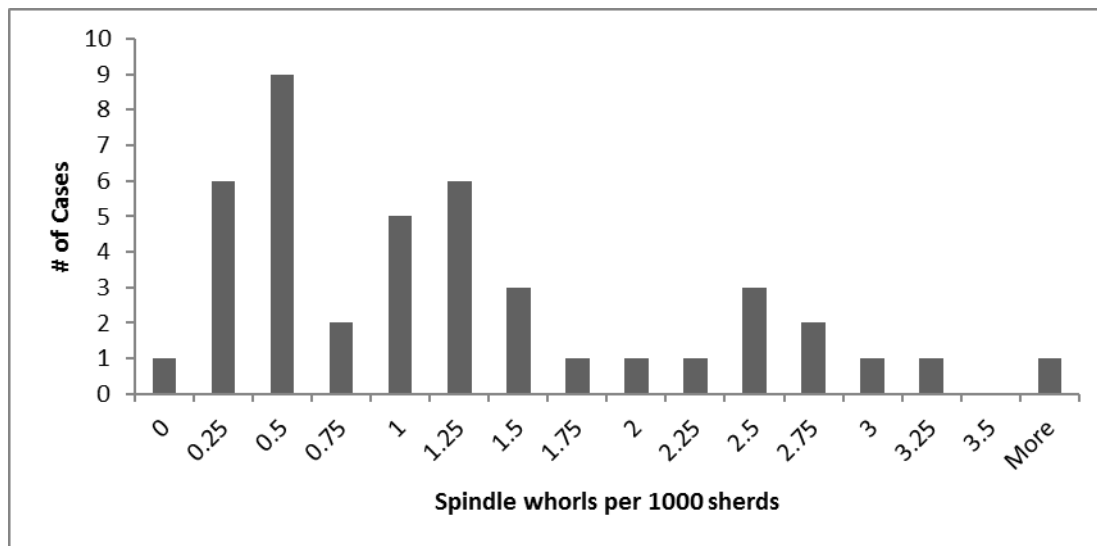


Figure 5.2 Histogram of spindle whorl frequencies per 1000 sherds at Postclassic and Early Colonial sites

Cotton Textile Production

The return per land unit on cotton cultivation may have been higher than that for food production, making it more economically logical to specialize in cotton cultivation rather than the intensified production of food crops, in regions where cotton cultivation was possible. However, after cotton is picked, the remaining highly labor intensive cleaning, carding, spinning, and weaving may take place elsewhere. Cotton could not be grown in the Toluca Valley for climatic reasons, and would have had to be imported from warmer regions, such as Morelos or the Balsas drainage. Thus, the presence of cotton spinning artifacts is only evidence for the textile production stages from spinning onward. The float samples from Calixtlahuaca recovered a small number ($n=14$) of plant fragments from Family Malvaceae, but none of those that could be identified to genus level ($n=3$) were *Gossypium* (cotton). This lack of identifiable cotton seeds in the macrobotanical samples from Calixtlahuaca suggests that cotton was imported pre-cleaned. In addition, many of the tools used to spin cotton at the site may also have been imported. As noted in the preceding section of this chapter on figurine and whorl production, some of the cotton whorls show orange-toned pastes more consistent with manufacture in the Basin of Mexico, and very few have definitively local pastes. Spinning bowls are also disproportionately imported; approximately 2/3 of the examples in the DS-2 sample were coded as imported Black-on-Orange, and all but one of the remainder were identified as locally produced imitations of the same. Given that spinning bowls imported during the Dongu phase predate the widespread importation of Aztec Black-on-Orange serving vessels at the site, it is likely that they were imported as part of

a new craft technology, rather than for stylistic appeal. A sample of cotton spindle whorls from Calixtlahuaca can be seen in Figure 5.3.

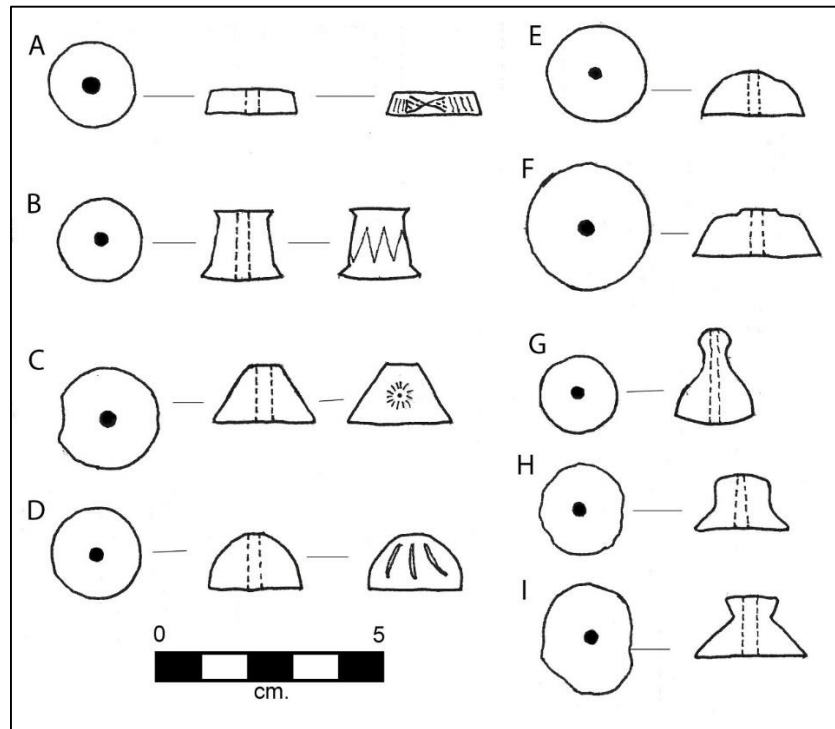


Figure 5.3 Decorated (A-D) and plain (E-I) cotton spindle whorls from Calixtlahuaca, showing the range of variation in shapes.

Evidence for cotton production at Calixtlahuaca increases steadily over time, from .13 cotton spinning artifacts (small whorls or spinning bowl fragments) per 1000 sherds during the Dongu phase, to approximately .66 cotton spinning artifacts per 1000 sherds by the Yata phase (Table 5.7). The increasing frequency is driven primarily by a rising frequency of spinning tools within particular households, rather than a rise in the ubiquity of spinning among households. There are three Dongu phase households with cotton spinning tools, as compared to four households in each of the subsequent phases,

indicating little change in the ubiquity of cotton production. Despite this, only one household component, 307-Ph2, is an extreme outlier when compared to others within its phase. The artifact assemblage for this household is unusual in a number of ways, which are discussed more extensively in the next chapter. While the internal evidence for an increase in cotton production is strong, comparisons with spinning tool frequencies at other sites show that even at its highest, cotton textile production at Calixtlahuaca remained on the low end for Postclassic Mesoamerica.

Unit	Phase	Total Sherds	Cotton Whorls	Maguey Whorls	Spin. Bowls	Maguey Scrapers	Freq C Whorls	Freq M Whorls	Freq SpnBwl	Freq MS	Cotton Tools	Maguey Tools
307	Dongu	5,810	1	1	3		0.17	0.17	0.52	0.00	0.69	0.17
315	Dongu	16,775		3		2	0.00	0.18	0.00	0.12	0.00	0.30
316	Dongu	4,710					0.00	0.00	0.00	0.00	0.00	0.00
320	Dongu	12,189		2	1	2	0.00	0.16	0.08	0.16	0.08	0.33
323	Dongu	26,947	1	3		1	0.04	0.11	0.00	0.04	0.04	0.15
324	Dongu	914					0.00	0.00	0.00	0.00	0.00	0.00
303	Ninupi	9,043		1			0.00	0.11	0.00	0.00	0.00	0.11
307	Ninupi	22,330	2	4		2	0.09	0.18	0.00	0.09	0.09	0.27
308	Ninupi	4,359	2		1		0.46	0.00	0.23	0.00	0.69	0.00
311	Ninupi	7,838	1	5	2		0.13	0.64	0.26	0.00	0.38	0.64
316	Ninupi	22,563		8	6		0.00	0.35	0.27	0.00	0.27	0.35
322	Ninupi	1,855					0.00	0.00	0.00	0.00	0.00	0.00
307	Yata	10,257	9	6	9	4	0.88	0.58	0.88	0.39	1.75	0.97
309	Yata	4,217	2	2	3	1	0.47	0.47	0.71	0.24	1.19	0.71
316	Yata	10,091		6	3		0.00	0.59	0.30	0.00	0.30	0.59
317	Yata	10,860	2	4	6	1	0.18	0.37	0.55	0.09	0.74	0.46
324	Yata	3,438		3			0.00	0.87	0.00	0.00	0.00	0.87
327	Yata	1,266		1		1	0.00	0.79	0.00	0.79	0.00	1.58
Dongu							0.03	0.10	0.10	0.05	0.13	0.16
Ninupi							0.11	0.21	0.13	0.01	0.24	0.23
Yata							0.26	0.61	0.41	0.25	0.66	0.87

Table 5.7 Cotton (cotton-weight whorls and spinning bowls) and maguey (maguey-weight whorls and tabular basalt scrapers) textile production tool frequencies per 1000 total sherds by household component

Maguey Textile Production

In contrast to cotton, maguey is climactically suited to the Toluca Valley and was widely cultivated there in antiquity. In addition to the fiber-related tools discussed below, the daub wall fragments excavated at Calixtlahuaca show frequent impressions of split maguey stalks (Karabowicz 2009). Maguey plants are commonly mentioned in Colonial-Period Nahua language wills from the surrounding area (García Castro 2000; Pizzigoni 2013), and even today much of the hill where the site is located is planted in magueys to support terraces and prevent erosion. Due to the wide range of products that can be made from maguey, including foods, medicines, building materials, and textiles, not all the maguey cultivated at the site was probably used for textile or cordage production, but there would have been no shortage of raw plant material, either.

As might be expected, evidence for maguey textile production at Calixtlahuaca is higher than that for cotton production, with 2-3 times more maguey whorls than cotton whorls (Table 5.7). Maguey textile production also increased over time, showing approximately the same degree of increase as cotton production. This increase is particularly dramatic by the Yata phase, for which the maguey processing artifact frequencies do not overlap either of the preceding periods at one standard deviation. There are no extreme outlier households during any phase.

The increase in maguey processing tools occurs for both basalt scrapers and large spindle whorls (Figure 5.4, Figure 5.5). Ethnographically, the scraping stage of maguey fiber processing often occurs near a water source, which is not necessarily near the house (Camposeco M. 1994; Mendoza Cerón and Canger 1993; Parsons and Parsons 1990). As a result, this household-focused sample likely under represents this artifact class. Large

spindle whorls, which represent the thread-spinning phase of production, increase about sixfold, to about .61 whorls per 1000 sherds by the Yata phase. When compared to frequencies at other sites (Table 5.6), this suggests a move from below-expected levels of maguey textile production to slightly above-expected. However, even at its highest, the frequency of maguey whorls at Calixtlahuaca is only half as high as that observed at Cihuatecpan (Evans 1988), a Basin of Mexico site which has been proposed to have specialized in maguey products.

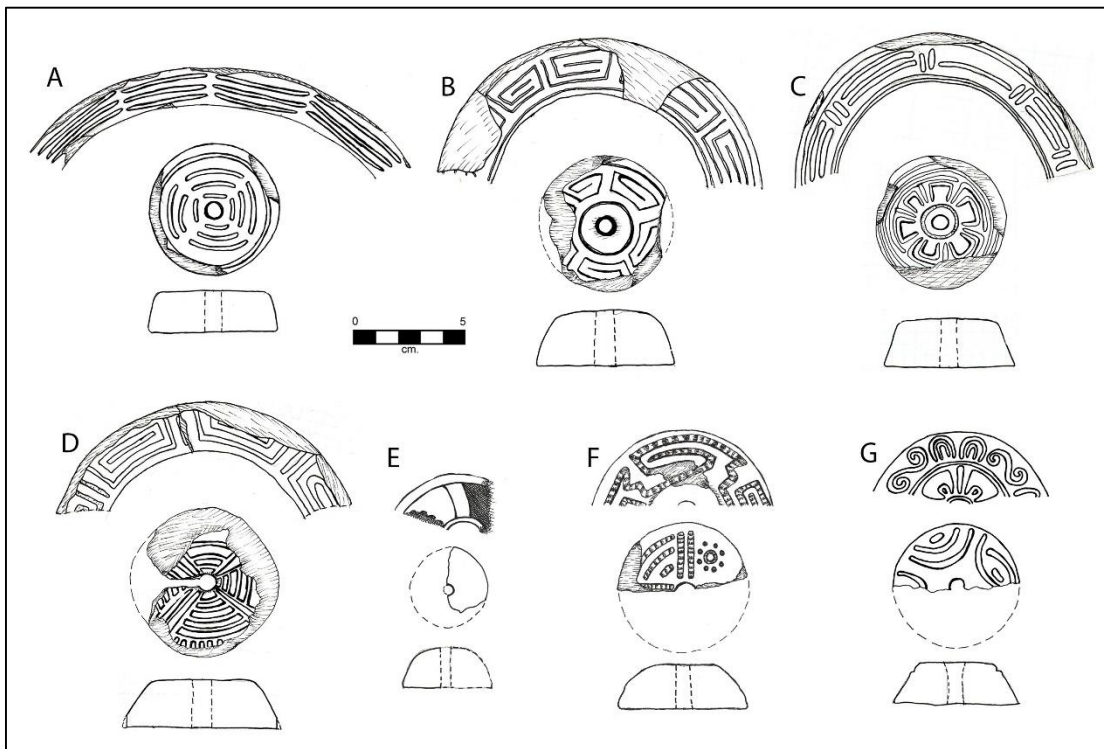


Figure 5.4 Examples of maguey spindle whorls from Calixtlahuaca. A-D, F and G are stylistically typical of the Toluca Valley. E stylistically matches the Basin of Mexico.



Figure 5.5 Tabular basalt maguey scrapers (“desfibradores”) from Calixtlahuaca

Discussion

Calixtlahuaca shows relatively little evidence for specialized craft production compared to most contemporaneous sites in Central Mexico. With the exception of biface production, there is little variation among households in the number of crafts practiced or the intensity of craft production, when the size of the excavation is taken into account (Figure 5.6, Table 5.8). Excavation size and the number of crafts represented are correlated at .52. The three smallest excavations account for three out of four lowest numbers of crafts represented. When cases with unexpectedly high levels of evidence for particular crafts are considered, they are, with one exception, all in the smaller half of the components. The pattern of smaller components having evidence for fewer crafts, but higher

frequencies for the ones that do appear suggests that both patterns are a product of sample size. There is one possible exception to this general pattern of low frequency, widely distributed production. Component 323-Ph2 is the largest excavation, but also has higher than average values for both core-blade and bifacial artifact production.

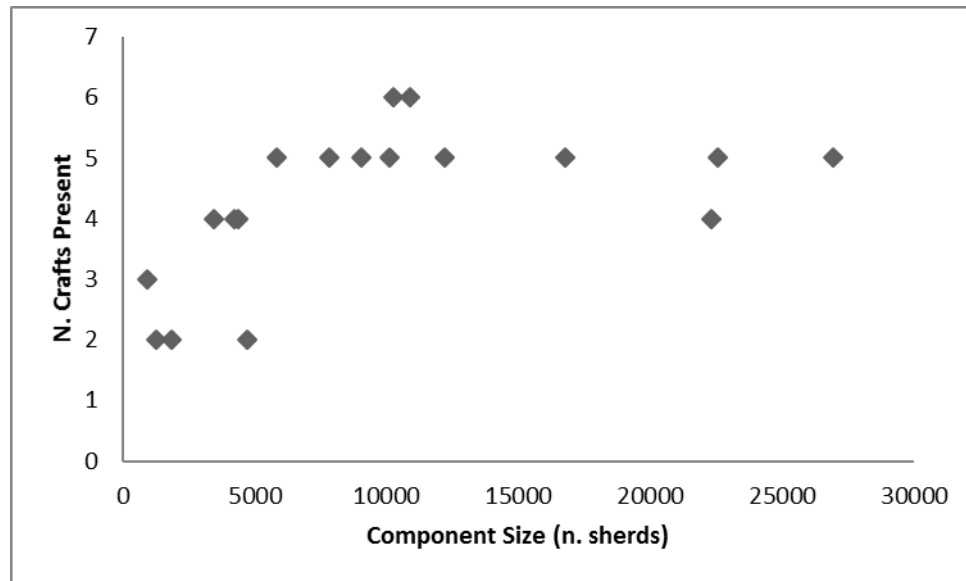


Figure 5.6 Relationship between component size (sherd count) and the number of craft activities present. Each point is a household component.

The total average household evidence for craft production decreases steadily over time (

Table 5.8). However, this is a very rough proxy measure for total craft production, as different crafts leave very differing amounts of archaeological evidence at the same level of specialization. The observed decrease is also heavily driven by the two components with higher evidence for biface production, and averages calculated without these components or excluding all biface production produce alternate patterns. There is also a

high degree of variability in the patterning of individual crafts over time (Figure 5.7).

Local ceramic vessel production shows little variation across time. Textiles – both cotton and maguey – increase from one period to the next. In contrast, the three lithic production technologies – core-blade, bifacial, and bipolar lithic production – produce three different patterns of relative rankings across the three phases. This variability is likely a matter of changes in the relative importance of the three production technologies, though the net effect is of decreasing evidence for lithic production over time.

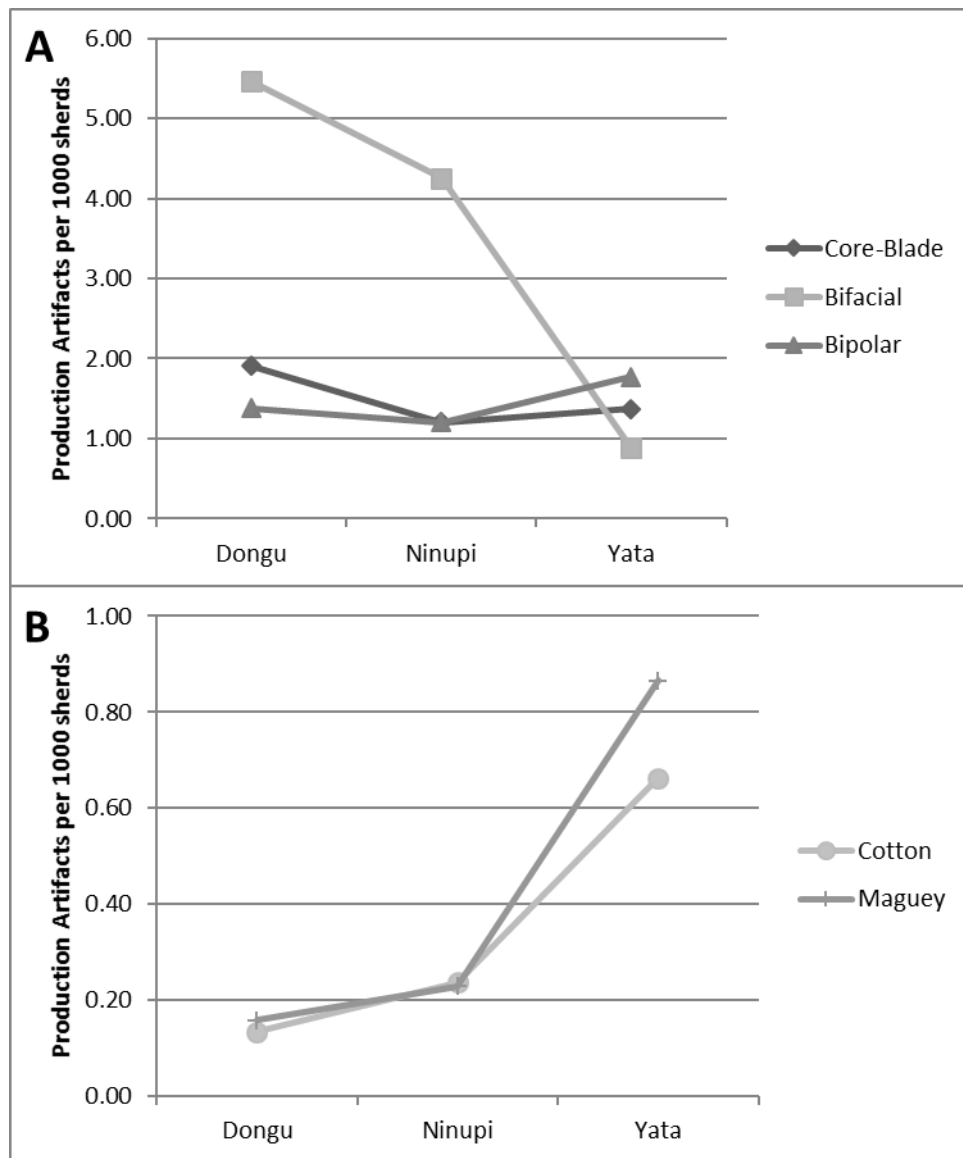


Figure 5.7 Temporal trends in craft production at Calixtlahuaca, by craft. (A) Lithics (B) Textiles

Unit	Phase	Ceramics			Lithics			Textiles		Total Crafts Present	"Highs" Evidence	Total Craft Evidence
		Total Sherds	Molds	Core-Blade	Bifacial	Bipolar	Cotton Maguey					
307	Dongu	5,810		1.05	7.99	0.42	0.69	0.17	5	0.5		10.32
315	Dongu	16,775	Y	0.36	0.44	0.51	0.00	0.30	5	0		1.61
316	Dongu	4,710		0.37	2.61	0.00	0.00	0.00	2	0		2.98
320	Dongu	12,189		0.51	2.53	1.01	0.08	0.33	5	0		4.46
323	Dongu	26,947		5.78	13.59	4.08	0.04	0.15	5	2		23.64
324	Dongu	914		3.36	5.61	2.24	0.00	0.00	3	0		11.21
303	Ninupi	9,043	Y	1.00	4.78	0.56	0.00	0.11	5	0		6.45
307	Ninupi	22,330		0.79	2.96	0.00	0.09	0.27	4	0		4.11
308	Ninupi	4,359		0.81	1.34	2.42	0.69	0.00	4	0		5.25
311	Ninupi	7,838	Y	3.41	15.24	0.00	0.38	0.64	5	1.5		19.67
316	Ninupi	22,563		0.63	1.20	0.06	0.27	0.35	5	0		2.52
322	Ninupi	1,855		0.60	0.00	4.20	0.00	0.00	2	0		4.80
307	Yata	10,257	Y	1.08	2.05	0.10	1.75	0.97	6	1		5.96
309	Yata	4,217		1.29	0.97	0.00	1.19	0.71	4	0		4.16
316	Yata	10,091		0.13	1.20	0.53	0.30	0.59	5	0		2.76
317	Yata	10,860	Y	0.21	0.21	0.42	0.74	0.46	6	0		2.03
324	Yata	3,438		2.32	0.87	9.55	0.00	0.87	4	1		13.61
327	Yata	1,266		3.17	0.00	0.00	0.00	1.58	2	1.5		4.75
Dongu				1.91	5.46	1.38	0.13	0.16	4.17	0.42		9.04
Ninupi				1.21	4.26	1.21	0.24	0.23	4.17	0.25		7.13
Yata				1.37	0.88	1.77	0.66	0.87	4.50	0.58		5.55

Table 5.8 Summary of craft production artifact frequencies by household component. Dark grey cells are two standard deviations outside mean for all components. Light grey cells are borderline anomalous.

Possible Alternatives

Prior to considering the broader implications of craft specialization at Calixtlahuaca, I touch briefly on several ways in which the preceding patterns might be misleading relative to the actual pattern of activity specialization at the site. I do not consider any of these alternatives particularly probable, but good scientific data evaluation requires the consideration of potentially confounding factors (Smith 2015c).

A first hypothesis is that the occupants of Calixtlahuaca specialized in some activity that does not preserve archaeologically. The Toluca Valley is known for the production of marsh-related plant and animal products both prehistorically (Sugiura Yamamoto 2009) and historically (García Sánchez 2008), a form of specialization which would not be directly apparent in the lines of evidence discussed in this chapter. However, a specialization in marsh-related products would be at least indirectly visible as net weights, blowgun pellets, patterned faunal remains, salt vessels for preserving, or ground stone for cane-working. As none of these artifact classes occur as more than occasional background pieces, an unrecognized specialization in marsh products is unlikely. In addition, Calixtlahuaca is not located particularly close to the marshy portions of the Upper Lerma drainage.

A second hypothesis is that worked sherd disks (*tejos*) are the byproduct of a sitewide specialization in an unknown craft. Sherd disks occur in all household contexts during all phases at Calixtlahuaca, in far higher frequencies than at contemporaneous sites in the Basin of Mexico or Morelos (Warren 2015). Regionally specific artifact types – such as bark beaters for making amate paper in Morelos – are good candidates for markers of regional craft activities. However, the patterning of disks at Calixtlahuaca does not correspond to any of the four currently proposed uses for sherd disks: spinning

weights, net weights, gaming pieces (Phillips 2002), or exchange tokens (Manzanilla 2011). Only a handful of the approximately 3000 disks recovered at Calixtlahuaca have the central perforations or edge notching required for use as spinning or net weights. The disks are found in both household and non-household contexts, which is not particularly consistent with use as gaming pieces. They also lack the clear division into standardized fractions (halves, quarters) that Manzanilla argues may indicate use as a standardized medium of exchange. With the majority of pieces under 5cm in diameter, the disks are too small to have been used as plates or lids. As a result, until a reasonable use can be proposed, sherd disks remain unlikely evidence of craft specialization.

A third hypothesis is that the occupants of Calixtlahuaca were agricultural specialists. The extensive terraces at the site were a substantial investment in agriculturally oriented infrastructure. This investment occurred despite the presence of a wide surrounding alluvial plain, where maize is widely cultivated today. Based on the number of test pits and terrace trenches excavated by the CAP that did not encounter house remains, there was substantial open space within the city. In addition, the terrace soils had been heavily modified to improve drainage and soil quality (Smith, et al. 2013). This combination of factors suggests the widespread presence of kitchen gardens, if not full-fledged milpas, within the site. Because farming leaves little evidence, it is difficult to quantify directly. However, the intensity of agricultural production would have been fairly consistent over time, as no major reduction in most other craft activities occurred. (Previous research at the urban site of Huexotla showed that decreased craft production did accompany increased agricultural specialization at that site (Brumfiel 1980)). At a

minimum, this suggests that Aztec rule did not result in a dramatic increase in agricultural activity at Calixtlahuaca.

Conclusions

Calixtlahuaca is, in many ways, an example of a city made up of stereotypical autonomous peasant households. Craft production at Calixtlahuaca was generally low intensity, with only occasional production for use above the household level. Evidence of production is also widespread; most crafts for which there is any production evidence occur in most excavated household components (Table 5.8). This generalized pattern parallels the evidence produced by the sitewide survey, which did not locate workshops or other zones of intensive production (Smith 2006b).

The lack of specialization at Calixtlahuaca stands in direct opposition to Fargher's (2009) model's predictions of cities as hubs of craft specialization, and contrasts with most contemporaneous sites in Central Mexico. This suggests two things. First, prior to the Aztec conquest of the Toluca Valley, either the internal population levels and/or the degree of local market integration was too low to produce a strong internally-driven specialization of labor in the region. While precise population estimates are not available for the Postclassic Toluca Valley, Sugiura's survey of the Toluca Valley (Sugiura Yamamoto 2011) shows a notably lower Postclassic site density than the Basin of Mexico surveys (Sanders, et al. 1979). When paired with the evidence for increasing market development seen in the previous chapter, the lack of craft specialization at

Calixtlahuaca suggests that markets were present and increasing in reliability over the Middle and Late Postclassic-A periods, but that they had not reached the level of intra-regional reliability seen in the Basin of Mexico. The lack of market development does not provide strong evidence for either a network or corporate orientation among the pre-Aztec rulers of the Toluca Valley. In the crafts considered in this chapter, there are neither the independent specialists that would be expected under strongly collective, market-dependent social organization, nor the attached specialists that might be expected under less collective regimes.

Second, the continued lack of specialization in the Toluca Valley under Aztec rule suggests that it falls outside of the area directly affected by the consumption demands in the Basin of Mexico, either due to geographic distance or cultural boundaries. If Calixtlahuaca had fallen within this zone throughout the periods under consideration, the degree and organization of craft production should have paralleled the pattern of increasing sub-regional specialization seen at contemporaneous sites in the Basin. Alternatively, if Calixtlahuaca had become fully integrated into the Basin market system after its conquest, the Yata phase should show a marked increase in the intensity of production of one or more crafts. The continued lack of specialization at the site during the Yata phase supports relatively indirect rule by the Aztec Empire. The changes in craft production which do occur are relatively minor (a small increase in textile production, and a small decrease in lithic production, likely driven by material scarcity). Aztec economic exploitation was neither pronounced enough to produce regional specialization in reaction, nor Aztec rule penetrating enough to enforce such specialization by fiat.

CHAPTER 6. “MECÍA TEICUH BOUGHT AN OLD JÍCARA FOR 15 CACAO BEANS⁶”: MEASURING WEALTH

One of the most central questions in discussions of imperialism, both Aztec and otherwise, is the effect that incorporation into a state or empire had on the quality of life of conquered peoples. On the one hand, becoming part of a larger state offered greater opportunities for trade, geographic mobility, and social connections with distant areas. On the other hand, foreign rule was often accompanied by increased taxation, imported goods that undercut local markets, and the imposition of foreign customs. As the debates in each of the previous two chapters demonstrate, the same change in trade or craft production can be interpreted in both positive and negative lights. While wealth and quality of life are not synonymous (discussed in more detail below), wealth is the most easily measured dimension of quality of life in many archaeological contexts. This chapter provides a context for the relatively small changes in long distance exchange and local craft production observed at Calixtlahuaca. It measures the degree to which the overall level and distribution of household wealth changed over time, the implications that this had for quality of life, and how this relates to larger questions of rulership strategies.

At Calixtlahuaca, the Dongu to Ninupi periods represent a time during which the site was politically independent. As a result, changes in household wealth between these

⁶ Cline, S. L. and Miguel León-Portilla
1993 *The Testaments of Culhuacan (modified first edition)*. UCLA Latin American Center Nahuatl Studies Series, No. 1: Document 13/f. 35r

two phases were most likely the result of greater integration into the network of markets in Postclassic Central Mexico (Berdan 2003). This integration is visible as the widespread but modest increase in non-local goods at Calixtlahuaca between these two periods. While it is unclear what goods Calixtlahuaca may have provided in exchange, agricultural products remain a strong possibility. In contrast, Ninupi to Yata phase changes are likely due to a combination of market integration and political factors. As a result, the contrast between the two patterns can be used to separate the results of Aztec imperial control from broader regional changes in economic activity. The differences among time periods can also be used to differentiate the effects of local and Aztec imperial rulership strategies.

Under relatively collective forms of rulership, commoners have a greater ability to negotiate for the provision of public services and these services are available to the majority of the population (Blanton and Fargher 2008:133-136). Relatively collective rulership is also likely to promote economic growth (Blanton and Fargher 2008:280-282). Due to these two factors, this form of rulership should promote an increasing standard of living for the majority of the population. In contrast, relatively non-collective rulership should provide a more limited range of public goods and fewer opportunities for economic growth through market participation. Changes in the standard of living should also be more unevenly distributed, since opportunities are distributed on a patronage basis. At Calixtlahuaca, I evaluate the shift in collectivity of rule between the periods under local and Aztec rule, based on changes in the average household wealth per phase and in the interhousehold variation in wealth.

The question of the directness of rule applies primarily to the rulership strategies of the Aztec Empire. More direct rule will produce greater changes in provincial areas, but the direction of change will primarily be a result of the collectiveness of imperial rulership. As a result, I expect indirect rule to produce few changes in the standard of living at the site, while more direct rule has the potential to produce more significant changes, in either positive or negative directions. I evaluate the directness of rule using the differences in the absolute wealth levels at the site among phases, as well as Yata phase shifts away from the prior trajectory of change.

My analyses in this chapter show that at Calixtlahuaca, most average measures of wealth increase dramatically between the Dongu and Ninupi phases. This is followed by approximately even wealth levels between the Ninupi and Yata phases, though these results are sharply divided between slightly decreasing non-local items (obsidian, bronze), and neutral to increasing primarily local items (ceramics, ground stone). At the same time, the interhousehold variation in wealth values increases from each phase to the next. Based on the combination of these two dimensions of household wealth, I argue that the pre-Aztec rulership of Calixtlahuaca was relatively collective, but that Aztec rule was both relatively indirect and non-collective.

Quality of Life, Wealth, and Status

Quality of life, wealth, and status are three related, but non-identical concepts (Smith 2015d). Quality of life/wealth and wealth/status are often conflated, particularly in archaeological discussions. Quality of life is a broad measure of an individual's material,

physical and psychological wellbeing. Wealth, in contrast, measures the resources (including both material and non-material resources) controlled by an individual or larger unit. Status is a measure of social prestige or membership in ranked social groups. The latter two concepts have a relatively long history of archaeological investigation, while the former is just beginning to be considered (For exceptions, see many of the pieces in the November 2013 issue of the SAA Archaeological Record).

Quality of Life

Quality of life is a difficult concept to quantify. For modern populations, most formulations are based on Sen (1993), who proposes that quality of life be seen as a combination of economic and social factors. An individual's quality of life is based on the portion of the culturally relevant possible "bundles" they are able to acquire. This perspective has not been widely considered archaeologically and archaeological correlates for Sen's factors are generally undeveloped (However, see Smith 2015d for a recent exception).

Archaeological correlates for the economic factors are quite similar to those used to measure wealth, described in more detail below. Due to the material nature of archaeological data, both the proportion of possible bundles and total number of bundles for a given artifact class or classes can be relatively easily quantified. The bundle perspective also provides a strong argument for looking at the degree of variation present in any given measure, in addition to measures of central tendency, as cultural perspectives on how well off one is are heavily influenced by how much room an individual sees for improvement. In addition to looking at households, broader measures

of economic standing should also take into account investment and access at levels above the household, such as neighborhood-constructed terraces, district temples, or city ball-courts. Economic investment above the household level has been less considered archaeologically, though Pérez Rodríguez's (2006) study of suprahousehold terrace construction in the Mixteca provides an exception.

It is more difficult to develop archaeological correlates for social factors. On the household level, social connectivity can be estimated from the number of local and foreign sources of goods a household had access to (Smith 2015d). This aspect of quality of life is primarily discussed in the preceding chapter on trade, but is also integrated into the discussion at the end of this chapter. At the suprahousehold level, the presence of community facilities, such as plazas, markets, and temples can be used as indicators of interaction within a community. Archaeological work in this area has focused on analyses of accessibility and visibility (e.g. Stockett 2005). However, because the first three out of four construction phases for the monumental architecture at Calixtlahuaca cannot be firmly dated (Sergheraert 2011), I am not able to consider superhousehold level economic investment or social connectivity in this chapter.

Bioarchaeological research has also generated a large body of data on measuring quality of life, focusing primarily on an individual's physical condition. Physical quality of life incorporates aspects of genetics, as well as the economic and social aspects of quality of life. Measures of physical well-being can provide a complement to several of the levels of analysis described above by providing information on health, nutrition, and mortality. Examples of such studies at the general level include Steckel (2008) and Steckel and Rose (2002). Depending on the burial practices of a group, bioarchaeological

data may be applicable at the household level (when significant numbers of individuals are buried around house structures) or at the community level (when individuals are buried in cemeteries or other non-house-associated patterns). Because of the limited number of burials encountered in the household excavations at Calixtlahuaca (n=6), and the fact that most of them cannot be assigned to a phase, I do not include bioarchaeological data in this chapter's analyses.

Economic history has made some attempts at broad, cross-cultural or diachronic regional evaluations of the standard of living over time, based on both archaeological and documentary evidence (Allen, et al. 2011; Morris 2004a, 2004b; Scheidel 2010). While standard of living is a more economically focused measure than quality of life, it is also a more archaeologically approachable measure. This body of work has demonstrated that both ancient and proto-modern societies underwent periods of economic growth, and that there was substantial temporal and regional variation in pre-modern standards of living.

Wealth

Wealth is a measure of valued goods, both social and material, that an individual or larger social unit can control (Smith 1987b). It can be measured at a variety of different scales, including the society, the community, and the individual household, depending on the level of analysis. Traditional archaeological measures of wealth have focused on three primary lines of evidence – household architecture, artifact assemblages, and burial goods. As the latter more commonly actually measures status, I address it under the next subheading.

Houses are likely to be the single largest investment that a family makes and are thus likely to be a good indicator of the long term prosperity of a household. House size is positively correlated with income, both in Mesoamerica (Tax 1953; Wilk 1983), and elsewhere around the world (Bodley 2003; Ellis 2000; Yang 1945), though the number of people in the household may also play a large role. In archaeological contexts with good surface preservation, household size and/or volume can often be estimated without the need for excavation, or extrapolated from a limited excavation sample (e.g. Smith, et al. 2014), especially if there is little known variation in construction methods within a community. In cases with more extensive excavation, more detailed estimates of labor investment in construction are possible (Murakami 2010). Brown et al. (2012) use both absolute (area) and relative (Gini indices and Pareto distributions) distributions of house sizes to compare wealth levels and structures at several Maya sites.

A second approach to wealth estimation uses larger assemblages of artifacts to develop wealth indices by assigning various types of weighted value scores to different types of material culture and then measuring the resulting net value. This method can be applied to a wider range of archaeological data, as it does not require the preservation and excavation of entire residential structures. For central Mexico, the comprehensive work on using ceramics in wealth indices has been done by Garraty (2000). He applied six different indices to ceramics from Aztec-period Teotihuacan. Other culturally appropriate indices using a broader range of artifact types have also been developed by Olsen (2001). Such indices measure economic standing at the level of the archaeological unit of analysis, often the household (excavation) or neighborhood (survey). I use artifact based methods to measure household wealth at Calixtlahuaca, including both analyses of

individual artifact classes (ceramics, lithics, ground stone, and rare items) and multiclass indices combining all of the previous artifact classes.

When both architecture and other artifact classes are available, the former can be used as an independent variable for assessing measures of household wealth based on the latter. In such cases, a discriminant analysis of artifacts from contexts with clear architectural differentiation can be used to assign artifact assemblages from more ambiguous contexts to one or more wealth/status groupings. Such techniques also help identify which artifact types co-vary the most closely with architecture. Olsen and Smith (2016) apply these techniques to excavated households at several sites in Morelos to reinforce previous interpretations of commoner, elite, and probably intermediate (commoner barrio head) households.

Status

Archaeologists often conflate status and wealth, which are different, though not independent variables. While this is conceptually problematic, the archaeological applications are less so. This can be illustrated with the historical counter-examples of the impoverished noble and the nouveau riche industrialist. The first has far more status than wealth, and the latter the opposite. However, over the multigenerational timescales that make up archaeological time periods, the industrialists' daughters marry into the nobility, once again merging wealth and status. Thus, while there may be short-term discrepancies between the two factors, the longer scale pattern will be one of convergence.

In addition, in premodern societies most surplus value was generated by agricultural production. However, in many cases, including Postclassic Central Mexico,

land was not a commercialized good, and could not be bought and sold. This likely strongly limited the number of cases where commoners could successfully achieve a discrepancy between their social status and their economic status. One possible exception, the *pochteca* (merchants), is discussed in more detail below.

Archaeologically, status has been investigated both at the level of the individual and at the level of the social class. Investigations of individual status are usually based on mortuary contexts, and can be nuanced explorations of multiple dimensions of status, including social class, social subgroup (much as sodality or moiety) membership, age, gender, and/or expertise in particular skills (e.g. Crown and Fish 1996; Cucina and Tiesler 2003). At the level of the social class, status can be investigated either through analysis of lifestyles, or the investigation of mortuary contexts. In both cases, the researcher usually seeks the presence of clearly differentiated sub-populations as evidence of social statuses. Investigations of lifestyles are usually *de facto* measuring wealth (e.g. Hirth 1993; Steere and Kowalewski 2012). In contrast, investigations of mortuary contexts are more likely to identify status, based on the elaborateness of funerary architecture and/or mortuary goods, or the presence of goods known to correspond to particular restricted social roles. Analysis of social status based on burials is most useful in cultures that invest heavily in mortuary practices.

Postclassic Central Mexican mortuary practices were relatively simple, limiting this line of inquiry at Aztec sites in general. Excavations of commoner households sometimes recover subfloor or courtyard burials, frequently of infants or children, accompanied by a few objects. Adult skeletons are less common, and very rarely account for even the minimum number of adult residents of a house (De Lucia 2014; Overholtzer

2012). Clear elite burials are also next to unknown; none of the Aztec Emperors' tombs have ever been located. The Toluca Valley may be an exception to this pattern, as almost every excavated site, including Teotenango (Zacarías B. 1975), Tlacotepec (McVicker, et al. n.d.), Metepec (Carbajal Correa and González Miranda 2003), Valle de Bravo (Murillo Rodríguez 2002), and Calixtlahuaca itself (García Payón 1941b), has included a large number of plaza burials (Castillo Romero 1996). The data on specific associations between buried individuals and grave goods are not available for the García Payón excavations. The current CAP only recovered six burials, all of which had none to minimal grave goods. As a result, I do not consider burial evidence in this work.

At Calixtlahuaca, I consider status primarily as something to be controlled for, since any elite households in a primarily commoner sample would result in considerable bias. There is no *a priori* evidence, such as differential architectural construction or restricted artifact types, to suggest that the sample includes any elite household components.

Wealth Variation in Postclassic Mesoamerica

Most research into wealth in Postclassic Mesoamerica has focused on social class related wealth variation. Ethnohistoric documentation of Mesoamerican status patterns describes a clear two-class system of elites and commoners (Hicks 1996; Smith 2003a: chapter 6). There is also documented variation within each class. Elites ranged from the Huehuetlatoni (Emperor) in Tenochtitlan to minor provincial nobles in villages. Where census documentation is available, elites account for approximately 1-2% of households

or 5% of the population (Carrasco 1964; Smith 1993). Commoners included individuals in lower leadership positions, such as *calpulli* (neighborhood) leaders, as well as individuals owing various degrees of obligation to the elite leadership. Commoners included both farmers and part- and full-time craft specialists. Descriptions of elites and commoners present a clear picture of wealth differentiation as well as status divisions, though the degree to which this reflects cultural perceptions as opposed to material realities will require further archaeological research (Olson and Smith 2016). In addition, there is an ambiguous middle-status group of *pochteca*, or long distance merchants. The *pochteca* generally operated as a self-regulated guild, at least some of whom were wealthy enough that they needed to be discrete to avoid getting in trouble with the nobility (Nichols 2013).

Archaeological investigations of status and wealth in Postclassic Mesoamerica have produced varying results. Some researchers do find a clear division in households, which would correspond to an elite/commoner distinction (Charlton and Nichols 1992; Olson and Smith 2016). In contrast, other researchers find a more continuous range of variation. In some of the latter cases, researchers assume the presence of a two-class system and assign top 5% (or similar value) of households to an elite class, regardless of the degree to which these households are materially distinct (Garraty 2000). Others, upon finding a relatively continuous distribution of wealth markers, question the two-class model (Brumfiel and Robin 2012; Steere and Kowalewski 2012), without extensively questioning how much “fuzziness” is likely to occur in the association of wealth and social class. There has been some discussion of the amount of variation within the elite class (Elson and Covey 2006), but little consideration of the amount of variation within

commoner households. (But see Carballo (2009), Hirth (1993) and Brown et al (2012) for studies of commoner or site-average household variation from earlier periods.) The analyses in this chapter serve both to establish the range of variation among commoner households in the Aztec world and relate this variation to broader economic and political changes over time.

Analyses of Wealth at Calixtlahuaca

Due to the nature of the data recovered at Calixtlahuaca, the bulk of the potential analyses are most directly measures of wealth, based on artifact assemblages. Most houses were too incompletely preserved to measure area or volume, and too few burials were encountered during the modern excavations to evaluate the range of mortuary practices. As a result, I present a variety of wealth indices based on individual artifact classes. Following Hirth's (1993) argument that evaluations of household wealth are strongest when drawing on multiple lines of evidence, I then discuss the degree to which these indices identify the same households as being at the top or bottom on the wealth distribution. This is followed by the presentation of a method to incorporate multiple artifact classes into a single index, using prices from historical documents to set the relative values of different artifact classes. After the presentation of the analyses, I discuss their larger implications for wealth and quality of life at Calixtlahuaca and how changes in these relate to broader issues of rulership strategies.

Ceramics

Ceramics are the single most common artifact type in most Mesoamerican household artifact assemblages, both by number and by weight. They include utilitarian items that all households would have needed as well as a wide range of more elaborate vessels for specialized functions or display. Ceramic vessels break and are replaced on a regular basis, and thus, the ceramic assemblage of a household component serves as evidence of what a household was regularly able to acquire.

Ceramic-based measures of wealth generally fall into two categories. First, there are measures based on relatively simple ratios or frequencies. This category includes bowl/jar ratios, decorated/plain ceramic ratios, and slightly more complex measures incorporating two or three factors or ratios. Second, there are labor-based evaluations of value, based on a step-by-step assessment of the complexity of production for each ceramic type. I present several measures from each category below, and then discuss the degree to which they agree with each other.

Because I use ceramics as the baseline type for determining the frequency of other artifact types, absolute ceramic frequencies cannot be standardized against some other artifact type to provide a measure of absolute quantity. Due to the variation in component contents – some are mostly midden, some are refuse scatter, and some are a combination – standardization against excavated volume is not appropriate. All of the ceramic wealth measures are based on rim sherds from the DS-1 sample only.

Frequency-based Ceramic Indices. The three basic measures calculated for ceramics are the percentage of serving vessels (bowls, copas, and pitchers), the frequency

of decorated ceramics, and Index 2 from Olson and Smith (2016), which includes weighted values for local decorated and imported ceramics (Table 6.1). The first is a measure of the amount of wealth a household invested in vessels intended for presenting food to others, rather than those needed for day-to-day food storage and preparation. This measure is likely related to a household's ability to host feasts or other gatherings. The second, the percentage of decorated vessels in an assemblage (or the ratio of decorated to undecorated ceramics), is a closely related measure, since most serving vessels are also decorated (Feinman, et al. 1981; Garraty 2000). Previous studies of Aztec households have demonstrated that the frequency of decorated ceramics in household assemblages tends to increase across Postclassic phases prior to a site's conquest by the Aztec Empire, but drop during the period of Aztec dominion (Brumfiel 2005a). A third index, based on Olson and Smith (2016) incorporates aspects of the previous two indices, combining the frequencies of local decorated ceramics and twice the frequency of imported ceramics ($\% \text{ local decorated ceramics} + 2 * \% \text{ imported ceramics}$). When the artifact assemblages from elite and commoner Aztec households (as determined based on architecture) in Morelos are compared, these artifact classes show the greatest differentiation between classes (Olson and Smith 2016). This index is closely related to prior formulations proposed in (Smith 1992a) and (Garraty 2000).

At Calixtlahuaca, the frequency of serving vessels does not differ significantly between any pair of phases, ranging from 54-57% of average household rim sherds. The coefficients of variation for all three phases are very low, indicating that there is little variation among households based on this measure. Similarly, no component falls more than two standard deviations from the mean for all components, indicating that there are

no extremely anomalous cases among the households in the sample. There is also a high degree of overlap in the range of values present during each phase and the next.

Unit	Phase	% Serving		% Decorated		Olson & Smith	
		Vessels	Rank	Vessels	Rank	Index 2	Rank
307	Dongu	54.99	3	22.14	6	24.33	6
315	Dongu	51.06	6	27.66	5	29.04	5
316	Dongu	53.79	5	32.41	2	33.79	3
320	Dongu	54.43	4	30.13	4	32.66	4
323	Dongu	56.24	2	32.25	3	36.69	2
324	Dongu	57.14	1	35.06	1	49.35	1
303	Ninupi	61.81	2	25.97	6	28.16	6
307	Ninupi	62.49	1	36.77	2	38.18	2
308	Ninupi	61.59	3	30.09	3	34.04	4
311	Ninupi	52.98	5	27.72	5	32.89	5
316	Ninupi	52.90	6	29.88	4	34.12	3
322	Ninupi	54.59	4	41.23	1	50.24	1
307	Yata	60.37	2	32.12	3	43.89	3
309	Yata	60.24	3	32.83	2	51.36	1
316	Yata	56.09	4	35.61	1	46.15	2
317	Yata	61.04	1	30.16	4	42.28	4
324	Yata	51.55	6	25.00	6	30.06	5
327	Yata	54.64	5	28.87	5	28.87	6
Dongu Average		54.61		29.94		34.31	
Ninupi Average		57.73		31.94		36.27	
Yata Average		57.32		30.77		40.43	
Dongu St Dev		2.12		4.56		8.51	
Ninupi St Dev		4.69		5.84		7.56	
Yata St Dev		3.84		3.66		9.04	
Dongu CoVar		0.04		0.15		0.25	
Ninupi CoVar		0.08		0.18		0.21	
Yata CoVar		0.07		0.12		0.22	

Table 6.1 Simple ceramic-based wealth measures (% serving vessels, % decorated ceramics, Smith index of decorated and imported ceramics) by household component. DS-1 sample, rims only.

The frequency of decorated vessels is approximately the same across all three phases. This index features the combined frequency of decorated bowls, decorated jars, copas, and pitchers. The presence of decorated jars in the Toluca Valley means at Calixtlahuaca this measure is less closely linked to the previous one than in many other parts of Postclassic Central Mexico, where almost all decorated vessels are bowls. The inter-household variation in this measure is low. The coefficient of variation remains low for all three phases and there is only one extreme outlier case (322-Ph4) falling more than two standard deviations from the mean for all components.

A measure based on a combination of decoration and imports, Olson and Smith's (2016) Index 2 shows modestly more interphase variation than those produced by the previous two indices. The values produced by this index are comparable between the Dongu to Ninupi phases, rising slightly between the Ninupi and Yata phases. The coefficients of variation for all three phases are very low, indicating little overall variation among households. There are no extreme outliers more than two standard deviations from the mean for all household components. (Note – in order to be comparable to the other ceramic wealth measures in this section, this index was calculated using rim sherds only. This produces higher values than the total sherd counts used in the original article.)

The results of the three simple ceramic indices generally show little change in ceramic wealth over time at the site level, as well as little variation among households. Two of the three measures, vessel form and proportion of decorated ceramics, do not have phase means that differ significantly among phases. The third, the Olson and Smith Index, does show a modest increase over time, driven by the increasing frequency of

Aztec imports noted in Chapter 4. All three indices have low coefficients of variation for all phases, and there is only one case of an outlier household falling more than two standard deviations from the mean. The rankings of individual household components within each phase are variable among the indices. Combined with the low overall degree of intrahousehold variation, this suggests that the variation in these indices is too low to be behaviorally meaningful.

Production Step Ceramic Indices. Production step indices are a measure of the labor investment in a given artifact. For ceramics, they will assign a point value to various aspects of production, such as size, presence of decoration, complexity of decoration, presence of appendages, and/or transport costs. While this is a more specific measure of labor input than those described above, it does not take into account culturally-specific notions of value, which may differ from those based on labor input alone (e.g. Voss 2012), and thus remains a general proxy for value. The following discussion presents four variations of a production step index, each using rim sherds from the DS-1 sample (See Table 6.2 for the complete production step scoring rubric). The first variation is based strictly on the decorative complexity of the piece, with points assigned for interior and exterior base color, additional interior and exterior linework paint colors, and the complexity of decoration. The second index variation maintains the decoration-based score and adds a component for vessel form, which includes points for vessel size and the presence of appendages. The third index variation includes the decoration-based score and adds a transportation distance factor, assigning additional points to non-local ceramic types. The fourth variation combines the weighting for all

three types of data – decoration, form, and distance from the place of production. In each variation, the points assigned to various factors were added up to provide a weighting value for the ceramic type. For each component, the rim sherd count for each type was multiplied by the weighting factor for the type. The weighted results for each type were summed, and then divided by the total number of rim sherds, to provide an average production step score for the household component.

State	Value
<i>Decoration</i>	
Background color, exterior	1
Background color, interior	1
Decorative color, exterior	1 per color
Decorative color, interior	1 per color
Elaborate Decoration, exterior	1
Elaborate Decoration, interior	1
<i>Form</i>	
Appendages, some examples of type	1
Appendages, always on type	2
Vessel Size (XS/S/M/L/XL)	0-4
<i>Source</i>	
Non-local type	1

Table 6.2 Ceramic production step value scoring

The production step values for all types decrease slightly from one phase to the next for all four variants of the index (Table 6.3), when all ceramic types are included and the overall differences between the Dongu and Yata phases are significant at the .90 level for all four variants. On the surface, this would suggest that the ceramic assemblage is being simplified, if very slowly. However, when eroded types, which were assigned low production step values, are removed from the sample, the average production step values

for the three phases are not significantly different for any of the four variants of the index. The high degree of agreement between each set of four analyses suggests that the additional variables (vessel form, source region) reinforce rather than oppose the broader pattern based on general decoration. The general trend is one of stability in investment in ceramic decoration over time, a finding which would support relatively indirect rule by the Aztec Empire due to the lack of observable effects of imperial rule.

While mean trends provide information about the directness of rule, the distribution of variation within each phase provides information about the collectiveness of rule. Due to the similarities among the production step index variants, I only use the fourth, incorporating vessel decoration, form, and source, to look at distributions. The coefficients of variation, which are a relative measure of dispersal of values around the mean, are both low and similar for all three phases, with the differences among phases driven primarily by two low outliers (Table 6.3). These are 307-Ph2 and 307-Ph6, which fall more than two standard deviations below the mean. All of the other household components fall within one standard deviation of the mean. This suggests that despite changes in the preferred types of decorated ceramics and the sources of traded goods over time, the overall amount of labor investment in a household's basic ceramic assemblage varied little among households, a position consistent with a relatively collective social organization of local power, both before and during Aztec rule.

Unit	Phase	All Types					Excluding Eroded Types (0, 10, 30, 60)				
		N. Sherds	Decora tion	Dec & Form	Dec & Source	All	N. Sherds	Decora tion	Dec & Form	Dec & Source	All
307	Dongu	411	1.72	4.24	1.74	4.26	315	2.07	4.42	2.10	4.45
315	Dongu	1,371	2.01	4.82	2.02	4.84	1,019	2.52	5.29	2.54	5.31
316	Dongu	290	2.36	5.12	2.38	5.13	277	2.44	5.16	2.45	5.17
320	Dongu	395	2.05	4.82	2.07	4.84	242	2.97	5.45	3.00	5.49
323	Dongu	834	2.47	5.16	2.52	5.21	788	2.59	5.28	2.64	5.33
324	Dongu	77	2.58	5.12	2.73	5.26	77	2.58	5.12	2.73	5.26
303	Ninupi	817	1.79	4.43	1.81	4.45	466	2.79	5.21	2.83	5.25
307	Ninupi	2,124	2.51	5.10	2.52	5.12	1,928	2.70	5.23	2.71	5.25
308	Ninupi	328	2.09	4.70	2.13	4.73	250	2.62	5.14	2.66	5.19
311	Ninupi	570	1.86	4.51	1.91	4.56	434	2.28	4.79	2.34	4.85
316	Ninupi	1,847	2.07	4.81	2.11	4.84	1,459	2.50	5.19	2.55	5.24
322	Ninupi	207	2.37	5.16	2.45	5.25	185	2.58	5.34	2.68	5.44
307	Yata	1,128	1.72	4.36	1.83	4.46	930	1.88	4.24	2.01	4.36
309	Yata	332	1.72	4.36	1.89	4.53	180	2.76	5.12	3.08	5.44
316	Yata	920	2.16	4.83	2.26	4.93	813	2.39	5.05	2.50	5.16
317	Yata	1,114	1.64	4.28	1.74	4.38	584	2.79	5.30	2.98	5.50
324	Yata	355	1.79	4.56	1.83	4.60	257	2.26	4.91	2.32	4.97
327	Yata	97	2.02	4.77	2.02	4.77	73	2.60	5.44	2.60	5.44
Dongu Average			2.20	4.88	2.24	4.92		2.53	5.12	2.58	5.17
Ninupi Average			2.12	4.78	2.16	4.82		2.58	5.15	2.63	5.20
Yata Average			1.84	4.53	1.93	4.61		2.45	5.01	2.58	5.15
Dongu St Dev			0.33	0.35	0.36	0.37		0.29	0.36	0.30	0.37
Ninupi St Dev			0.28	0.30	0.28	0.31		0.18	0.19	0.17	0.19
Yata St Dev			0.20	0.23	0.19	0.21		0.34	0.42	0.40	0.43
Dongu CoVar			0.15	0.07	0.16	0.08		0.11	0.07	0.12	0.07
Ninupi CoVar			0.13	0.06	0.13	0.06		0.07	0.04	0.06	0.04
Yata CoVar			0.11	0.05	0.10	0.04		0.14	0.08	0.16	0.08

Table 6.3 Average production step index values by household component. DS-1, rims only

Lithics

Postclassic Central Mexican lithic assemblages consist primarily of obsidian (e.g., Hodge 2008; Millhauser 2005; Smith 2006a, 2006c). As a lightweight, high value good, obsidian was traded across large distances. The lithic assemblage at Calixtlahuaca conforms to the expected regional pattern, consisting primarily of obsidian, with limited amounts of basalt and the occasional piece of chert. XRF sourcing has demonstrated that the obsidian at the site comes from both Central Mexican and West Mexican sources, primarily Otumba, Pachuca, and Ucareo, with occasional pieces from other sources in both regions (Glascock 2012). See Chapter 4 for a more detailed analysis of obsidian importation over time. The lithics data in this section are from the basic lithic classification performed by the project lab staff, rather than the more specialized analyses of production done by Dr. Bradford Andrews, and uses the DS-1 sample. This version of the lithic classification was used because its simpler format made extracting necessary information easier. Two potential wealth markers are calculated for each household component: the frequency of green obsidian per 1000 sherds and the frequency of all obsidian per 1000 sherds (Table 6.4).

The most common non-ceramic wealth indicator used in Central Mexico is the proportion of green obsidian in a lithic assemblage. Within Central Mexico, green obsidian comes from a single source, the Pachuca volcano. Pachuca green is a high quality obsidian and would have been functionally equivalent to or better than obsidian from other widely traded sources in the region (Cobean 2002). Because blue/green was a symbolically valued color, archaeologists assume that the visibly green obsidian from the Pachuca source would have been the preferred if consumers had a choice. For most of

Central Mexico, which forms a single trade sphere for obsidian (Braswell 2003), this is probably a valid assumption. However, the results of the sitewide survey at Calixtlahuaca show that Central (including Pachuca) and West Mexican obsidians have different distributions within the site (Novic 2015). Given the shifts in overall source frequencies over time at the site, it is unclear whether the survey pattern is due to differential lengths of occupation of different portions of the site, or differential access to particular sources. As a result, I include the percentage of green obsidian in my evaluation of household wealth, but give it a secondary importance relative to the total obsidian frequency.

The first pattern measures the frequency of obsidian relative to ceramics over time, which is a proxy for the absolute quantity of obsidian used by each household. The frequency of lithic artifacts is even between the Dongu and Ninupi phases, at 39-41 pieces of obsidian per 1000 sherds. It then drops dramatically during the Yata phases, averaging about 25 lithic pieces per 1000 sherds. However, due to the high standard deviations for this measure, there is only approximately a 70-75% probability that this difference is non-random. There is a high degree of intercomponent variability in the lithic/ceramic ratio, with households ranging from 7 to 93 lithic artifacts per 1000 sherds. The variation is continuous, without clear breakpoints or modalities that would suggest a distinction such as craft workshops. This agrees with the previous chapter, which showed no evidence for intensive lithic production at the site. When measured more formally, the coefficient of variation increases slightly from each phase to next.

Unit	Phase	Total Sherds	All Obsidan	Green Obsidian	% Green	Obs. per 1000 sherds	Green per 1000 sherds	Green/ Sherd Rank
307	Dongu	4,770	276	29	10.51	57.86	6.08	3
315	Dongu	13,890	97	26	26.80	6.98	1.87	5
316	Dongu	3,050	30	2	6.67	9.84	0.66	6
320	Dongu	3,840	94	15	15.96	24.48	3.91	4
323	Dongu	8,915	699	59	8.44	78.41	6.62	1
324	Dongu	914	53	6	11.32	57.99	6.56	2
303	Ninupi	8,951	211	38	18.01	23.57	4.25	5
307	Ninupi	20,280	584	235	40.24	28.80	11.59	2
308	Ninupi	3,729	109	40	36.70	29.23	10.73	3
311	Ninupi	5,030	427	40	9.37	84.89	7.95	4
316	Ninupi	15,800	173	64	36.99	10.95	4.05	6
322	Ninupi	1,668	118	79	66.95	70.74	47.36	1
307	Yata	10,200	260	131	50.38	25.49	12.84	3
309	Yata	3,094	70	41	58.57	22.62	13.25	2
316	Yata	7,451	92	44	47.83	12.35	5.91	5
317	Yata	9,638	76	48	63.16	7.89	4.98	6
324	Yata	3,438	185	36	19.46	53.81	10.47	4
327	Yata	948	24	13	54.17	25.32	13.71	1
Dongu Average					13.28	39.26	4.28	
Ninupi Average					34.71	41.36	7.71 (14.32) ¹	
Yata Average					48.93	24.58	10.19	
Dongu St Dev					7.33	29.51	2.57	
Ninupi St Dev					20.00	29.34	3.52 (16.49) ¹	
Yata St Dev					15.46	16.05	3.86	
Dongu CoV					1.81	1.33	1.67	
Ninupi CoV					1.74	1.41	2.19 (0.87) ¹	
Yata CoV					3.17	1.53	2.64	

¹ Excluding(Including) component 322-Ph4

Table 6.4 Obsidian-based wealth indices (Total obsidian/1000 sherds, green obsidian/1000 sherds, % green obsidian) by household component

The second pattern is the frequency of green obsidian per 1000 sherds, which provides a standardized measure of the absolute quantity of green obsidian used by each household. There is one outlier household for this wealth measure, 322-Ph4, which has approximately fifty pieces of green obsidian per 1000 sherds, compared to less than fifteen for all other components. This component is one of two located on the smaller secondary hill to the west of the site, where the survey showed a significantly higher frequency of eastern obsidian sources (including Pachuca). Overall, the resulting pattern shows that green obsidian is rare during the Dongu phase, and then generally increased over time, if the outlier household 322-Ph4 is excluded. The differences between the Dongu phase mean and those for both subsequent phases are statistically significant at the .90 level, while the difference between the Ninupi and Yata phases is not (with or without the outlier). The interhousehold variation in the frequency of green obsidian per 1000 sherds, as measured by the coefficient of variation, increases from each phase to the next. The total range of variation, between the highest and lowest scoring households, also increases from each phase to the next.

In summary, the obsidian data show improving access to lithics between the Dongu and Ninupi phases, with comparable overall levels of obsidian and increasing access to green obsidian. This is then followed by a drop in the total volume of obsidian entering the site, and a lack of further improvement in the average level of access to green obsidian. Despite the fluctuating quantities of obsidian entering the site, the coefficient of variation for all measures shows small increases from each phase to the next, suggesting that access to lithics became increasingly differentiated over time. This increased variation is unlikely to be due to changes in the organization of craft production

over time, as there was very little overall evidence for such production and it decreased over time (See Chapter 5).

Rare Items

In addition to everyday items, such as ceramics and lithics, the occupants of Calixtlahuaca also had to make choices about acquiring rare, highly valuable classes of objects. At Calixtlahuaca, these are bronze items⁷ (including bells, tweezers, needles, and earspools) and stone jewelry (including pendants, beads, lip plugs, and earspools, made from crystal, obsidian, or turquoise). While the circulation of some rare types of objects may be limited by sumptuary laws in some cultures, all of the examples included in this category have been previously demonstrated to occur in commoner households in other Aztec cases (e.g., Brumfiel, et al. 1993; Smith and Heath-Smith 1993). Because the recovery of such items is likely to be highly influenced by random chance and excavation size, I consider them primarily on a presence/absence basis.

⁷ Metal artifacts in Mesoamerica are often described as being “copper”. Given that they are usually made from carefully manipulated alloys of copper, tin and/or arsenic, the more accurate term is “bronze”. See Hosler (1994) for the basics of metallurgy in Mesoamerica.

Unit	Phase	Total Sherds	Bronze	Jewelry	Total Rare Items	Freq./ 1000 Sherds	Presence/ Absence ¹
307	Dongu	5,810	1	0	1	0.17	P
315	Dongu	16,775	0	0	0	0.00	A
316	Dongu	4,710	0	0	0	0.00	n/a
320	Dongu	12,189	0	0	0	0.00	A
323	Dongu	26,947	0	0	0	0.00	A
324	Dongu	914	0	0	0	0.00	n/a
303	Ninupi	9,043	0	0	0	0.00	A
307	Ninupi	22,330	13	3	16	0.72	HF
308	Ninupi	4,359	0	1	1	0.23	P
311	Ninupi	7,838	1	1	2	0.26	P
316	Ninupi	22,563	0	0	0	0.00	A
322	Ninupi	1,855	0	0	0	0.00	n/a
307	Yata	10,257	2	0	2	0.19	P
309	Yata	4,217	1	0	1	0.24	P
316	Yata	10,091	1	0	1	0.10	P
317	Yata	10,860	0	0	0	0.00	A
324	Yata	3,438	0	1	1	0.29	P
327	Yata	1,266	0	0	0	0.00	n/a
Total		175,462	19	6	25	0.14	
Dongu Average						0.03	
Ninupi Average						0.20	0.10
Yata Average						0.14	

¹ n/a=Unknown due to small sample size, A=absent, P=present, HF=High Frequency

Table 6.5 Rare items counts by household component with frequencies per 1000 sherds. DS-2 sample.

Rare artifacts are coded on a four part scale: n/a due to small sample size, absent, present, or present in high frequencies (Table 6.5). The category n/a due to sample size is used for components without rare items, which also had fewer sherds than the average number of sherds per rare item in all excavations. This category is due to the fact that the

size of the excavation will play a large role in the probability of recovering extremely rare artifacts. In the DS-2, there is approximately one bronze or jewelry item for every 7,000 excavated sherds, so for components smaller than this, it is difficult to say whether rare items are missing due to sample size or due to true absence. Absent is used for coding components that are above the threshold size, but which do not have any rare artifacts. Present is used for components with a rare item to sherd ratio within one standard deviation of the mean, and High Frequency is used for components with a frequency of more than one standard deviation above the mean.

The frequency and ubiquity patterns show similar results. The frequency of rare items begins at a very low level in the Dongu phase and then rises to a much higher level during the following two phases. The patterning between the Ninupi and Yata phases is dependent on whether household component 307-Ph4, an extreme outlier, is included. Based on an independent t-test of means, the Dongu to Ninupi phase (including the outlier) difference has a p-value between .85 and .90, while the overall Dongu to Yata phase difference is significant at the .90 level. The Ninupi and Yata phases are not significantly different, regardless of whether the outlier case is included or excluded. Similarly, the ubiquity of rare items increases from a single household during the Dongu phase, to three households during the Ninupi phase and four households in the Yata phase. As the larger and smaller components are fairly evenly distributed across the phases, the change in ubiquity is unlikely to be a result of variation in sample size.

While the small sample sizes for rare items mean that the observed frequency for any given household may be result of random variation, the overall pattern is one of increasing access to rare items between the Dongu and Ninupi phases, followed by

similar levels of both sitewide access and interhousehold variation between the Ninupi and Yata phases.

Summary of Individual Index Results

The previous analyses of individual artifact classes focused on three variables: the magnitude of change from each phase to the next, the directionality of that change, and the degree of variation within each phase. Of these three markers, the magnitude of change is used as an indicator of the directness of Aztec rule, while the directionality of change and the degree of intra-phase variation are used as indicators of the collectiveness of governance under local and Aztec imperial rule.

The majority of the wealth indices for different goods presented here show a consistent pattern at the phase level, but a higher level of variability at the level of the individual components. Of the five indices that are relatively independent of each other (serving vessels, decorated ceramics, average number of production steps, green obsidian to sherd ratio, and rare item to sherd ratio), three (serving vessels, decorated ceramics, production steps) are basically the same across all three time periods, and two (green obsidian, rare items) show a pattern of a relatively large increase in the wealth measure between the Dongu and Ninupi phases, followed by a leveling off with similar values for the Ninupi and Yata phases (Figure 6.1). I consider this latter pattern to be the most representative measure of the relative wealth of Calixtlahuaca's residents over time. This demonstrates a trend toward increasing access to goods prior to the Aztec conquest of the site, followed by a cessation of this growth under Aztec rule.

The temporal patterning of inter-household variation at the site also differs among the indices. All of the ceramic-based indices have very low coefficients of variation, with similar values across all three phases. In contrast, the obsidian and rare item based indices generally have steady increase in coefficients of variation from each phase to the next.

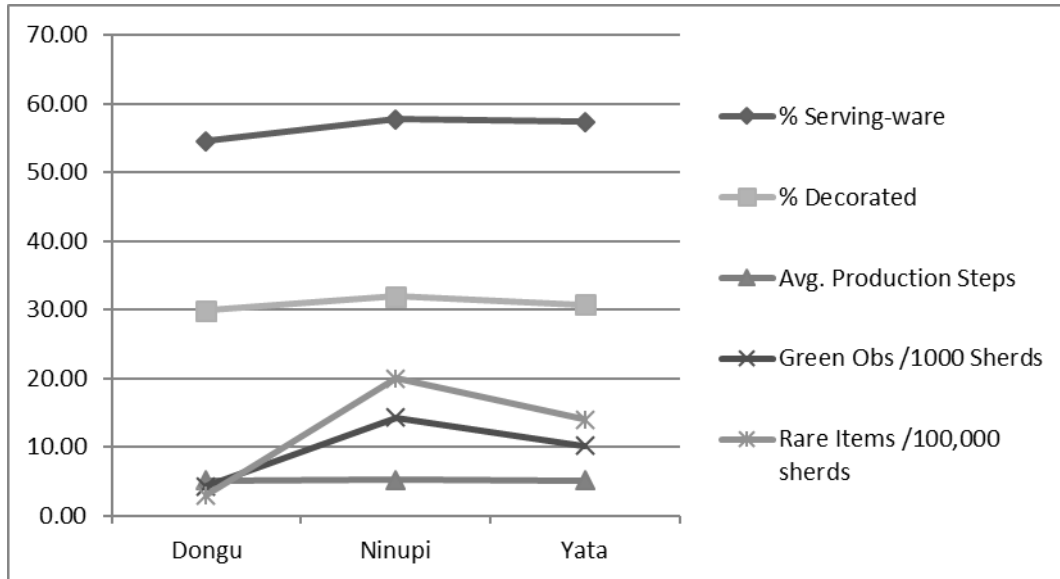


Figure 6.1 Summary of selected indices by phase

When the two highest and lowest scoring components for each phase for each measure are plotted, however, they do not consistently identify the same households (Figure 6.2). While there are general trends for particular households during each phase to score toward the top or bottom of multiple measures, only one household component (307-Ph4) manages to score in the top third for all five measures. Additionally, only two components do not fall within the top third for at least one measure. Because of the number of components with missing data on rare items, I did not assign low-scoring

components for this index. Half of the components include both a low score according to one measure, and a high score according to another. The consistency among the sets indices that track together at the phase level – the three ceramic indices vs. green obsidian/rare items – are not noticeably better or worse than among all five indices. This suggests that individual households were choosing to invest in different types of wealth items, within the larger patterns of availability dictated by temporal trends in trade and the necessities of differing household activities. As a result, a wealth index that can include multiple artifact types will likely be a more accurate measure of the relative rankings of individual households.

Measure	Dongu Phase						Ninupi Phase						Yata Phase					
	307	315	316	320	323	324	303	307	308	311	316	322	307	309	316	317	324	327
Servingware																		
Decoration																		
Production Steps																		
Green Obs/Sherd																		
Rare Items (High only)			?			?						?						?

Figure 6.2 Summary of highest and lowest scoring components for each phase for selected indices.

Master Wealth Index

A single wealth measure incorporating multiple artifact types will provide a more accurate measure of overall household wealth for three reasons. First, it evens out small variations in individual artifact classes resulting from random differences in artifact recovery among households. Second, alternatively, it may allow for the identification of

subtle patterns across artifact types, which only become significant when combined. Third, it provides a means of compensating for differences in household consumption choices, whether these were based on specialized activities (such as needing more obsidian tools for a particular craft activity) or social-group membership (such as ethnicity). In such cases, investment in a single artifact class may be due to particular, household-specific reasons, but this investment will simultaneously reduce the amount of household assets which can be used to acquire other classes of artifacts.

Any attempt to combine multiple artifact classes into a single measure of wealth must first establish their relative values. Two possible methods for assigning relative values are possible. The first is to compare the energetic cost of production and transport to the length of use. Another method is to use historical prices to establish relative values.

The first approach can be used to establish very basic energetics-based calculations of value, such as those applied to the ceramic production step index above. However, it cannot take into account factors of cultural preference or scarcity-based price inflation. As a result, it is primarily useful as a check against which other methods of calculating value can be compared, or as a means of identifying classes of goods with anomalous values.

The second approach, of using documented prices to establish relative values is primarily used by historians. Within the United States, historical archaeologists have made wide use of documentary prices (e.g. Deetz 1977), and applications have been spreading both temporally and geographically. Wills in English speaking countries often include probate inventories, allowing for a wide range of studies of the wealth distributions, household occupations, and gender issues (Bragdon 1988; Brown 1988;

Green Carr and Walsh 1980; Shackel 1992). These types of documents often provide information on the value of exactly the range of small, everyday items of interest to the household archaeologist, which has also resulted in their use in historical archaeology. Document-based studies of wealth or value also draw on advertising material and store ledgers to provide time-of-sale values for household items. In the latter vein, Miller (1988) developed a pearlware index, measuring the relative values of ceramic types in “CC” units, or the number of times more than a comparable vessel of the cheapest possible ware other types cost, on the premise that the cheapest type would have such a low profit margin that the value would remain constant (The abbreviation “CC” comes from historical merchants’ records of such pottery and stands for “Cream Colored”). This method can also be extended to provide comparisons between classes of goods, using an item type with little potential for fluctuations in value as the base measure, and this is the approach I follow in establishing the relative values of different artifact classes.

Historical Values of Domestic Goods in Mesoamerica

The corpus of everyday documents from Colonial Latin America has been much less well explored than its English language equivalent. Spanish legal practice did not require systematic probate inventories following a death, and thus the documentary corpus includes far less systematic information about household goods. As a result, I draw on price data from four different classes of documents: wills and probate information, other legal documents, town council records, and histories produced by the chroniclers. Where possible, I have drawn on sources likely to represent indigenous views of the value of goods; most of the wills were written in indigenous languages, the

legal documents were entered as evidence in courts cases by Native individuals (though often against Spaniards), and the town council records are from Native towns. Values given by Spanish chroniclers or other non-native writers are used only when a value for the type of item could not be found in another source. The resulting list of items and prices are listed in Table 6.6.

There are three collections of published Native-language wills from single locations, the Testaments of Culhuacan (Nahuatl) (Cline and León-Portilla 1993), the Testaments of Toluca (Nahuatl) (Pizzigoni 2007), and Life and Death in a Maya Community (Yucatec) (Restall 1995). There is also a three-volume published compilation of colonial indigenous wills held in Mexico's Archivo General de la Nación (Rojas Rabiela, et al. 1999-2000), and various publications of single or small groups of wills (Anderson, et al. 1976; Gasco 1992; Wood 1997). With a few exceptions, the wills do not include systematic lists of the values of the goods owned by the deceased. As a result, historians have focused more on land ownership and inheritance patterns in their studies of these documents (García Castro 2000; Lockhart 1992; Pizzigoni 2013). However, it is not uncommon for the values of a few items to be specified in a will, and these can be compiled to provide values for a range of domestic goods.

I also draw price information from legal documents, primarily the Codex of the Potters of Cuauhtitlán (also known as the *Códice de los alfareros de Cuauhtitlán* and the *Pieza de contaduría de una fábrica de cerámica indígena, posterior a la Conquista*) which is a pictorial document with Spanish glosses entered as evidence in a lawsuit in AD 1568 (Cuauhtitlán 1568). The lawsuit was presented by a number of native potters who were suing Juoan Suarez de Peralta, Alcalde Mayor, for failure to pay for goods

received. The document is held in the French National Library as Mesoamerican Codex 109 (Barlow's identification of the piece as #107 is incorrect), and a transcription and good quality images have recently been made available through the Amoxocalli project (2009). It has been previously published in Barlow (1951), though the accompanying images are of poor quality. Charlton and Fournier (2011) discuss the historical context of the codex, including further information about Suarez de Peralta. The codex lists contemporaneous prices for a wide range of ceramic vessel forms, produced in a single town.

The third category of documents, town council records, comes primarily from two compilations and translations of a wide range of types of native language documents (Anderson, et al. 1976; Restall, et al. 2005). Among other things, these works provide meeting minutes, receipts, and council decrees from multiple communities. Examples of council records with price information include the widely cited decree of prices for various goods at the Tlaxcala market (Anderson, et al. 1976:document 34), lists of expenditures for celebrations, and lists of contributions to religious institutions. Such reports most often give prices for foodstuffs, but do include some archaeologically recoverable items.

The fourth category of documents, reports by Spanish chroniclers, was generally only used in cases where they provided the only price for a given category of good, or they were the original source for a value widely cited in the secondary literature. I consider prices in large-scale summary works on Central Mexico to more likely reflect perceived "normative" values for a given item over a longer period of time, as opposed to the time-specific prices recorded in the other types of sources.

Item	Year	Given Price	Given Price, Tomines	Inflation Adjustment 1 year ¹	5 year ¹ Location	Source	Location in source
<i>Ceramics</i>							
Simple Vessels	1568	.19-.33 tomin each	0.25	0.09	0.12 Cuauhuitlan	Codice de los	
Complex Vessels	1568	.5 tomin each	0.5	0.19	0.23 Cuauhuitlan	Alfareros de	
Tinaja (Large Vessel)	1568	3 tomines each	3	1.14	1.39 Cuauhuitlan	Cuauhuitlan	
Michoacan-style Tecomate	n.d. (1580) ²	2 tomines ⁴	2	0.46	0.44 Culhuacan	Cline & Leon-Portilla 1993	Test. 13
Three broken tecomates	n.d. (1580) ²	.5 tomin	0.5	0.12	0.11 Culhuacan		Test. 13
Jug	n.d. (1580) ²	.5 tomin	0.5	0.12	0.11 Culhuacan		Test. 13
Collapsed tecomate, cracked	n.d. (1580) ²	15 cacao	0.15	0.03	0.03 Culhuacan		Test. 13
Clay jar	1587	2 tomines	2	0.60	0.59 Santa Maria Tezcatzonco	Rabiela et al 1999-2000	v. 2; p. 272
Comal	1625	2 pesos	16	4.71	2.06 Amecameca		v. 3; p. 168
Earthenware tub	1687	1 peso, 2.5 reales	10.5	3.53	2.47 Soconusco	Gasco 1992	Table 3
Porcelain basin	1724	2 reales	2	0.57	0.52 Soconusco		Table 3
Small pitcher or jar	1724	2 reales	2	0.57	0.52 Soconusco		Table 3
Water jar (new)	1724	2 reales	2	0.57	0.52 Soconusco		Table 3
Small Majolica cups (Puebla)	1740	1.5 reales	1.5	0.28	0.31 Soconusco		Table 3
Porcelain cups	1740	2 reales	2	0.37	0.41 Soconusco		Table 3
Porcelain cup	1740	1 peso	8	1.47	1.66 Soconusco		Table 3
Water jar (Tehuantepec)	1740	2 or 3 reales	2-3	.37-.55	.41-.62 Soconusco		Table 3
<i>Ground Stone</i>							
Two metates	1597	1 peso	8	2.40	2.00 Tecamachalco	Rabiela et al 1999-2000	v. 1; p. 156
Metate w/ mano	1599	5 tomines	5	1.15	1.29 Quauhuitlan		v. 2; p. 334
Metate	1599	3 tomines	3	0.69	0.77 Quauhuitlan		v. 2; p. 334
Mano (for a metate) (new)	1724	1 peso	8	2.26	2.09 Soconusco	Gasco 1992	Table 7
Metate with mano	1724	3 pesos	24	6.79	6.27 Soconusco		Table 7
Metate w/o mano	1724	2 pesos	16	4.53	4.18 Soconusco		Table 7
Grinding stone (metate?)	1724	4 pesos	32	9.06	8.36 Soconusco		Table 7

Table 6.6 Documentary values for domestic items recovered in Mesoamerican archaeological contexts

Item	Year	Given Price	Given Price, Tomines	Inflation Adjustment 1 year ¹	5 year ¹	Location	Source	Location in source
<i>Lithics</i>								
20 obsidian blades	1565-1575 ³	1 real	1	0.52	0.47	Central Mexico	Mendieta 1945	p. 58
<i>Metal/Jewelry</i>								
Cozcatl (jewel)	1551	5 pesos	40	40.00	40.00	Moyotlan	Rabiela et al 1999-2000	v. 2; p. 90
String of beads	1569	3 pesos	24	24.00	24.00	Xochimilco		v. 2; p. 152
Feather bracelet	1577	26 pesos	208	47.94	42.32	Tulantzinco		v. 2; p. 186
Emerald	n.d. (1580) ²	3 pesos	24	7.19	5.99	Culhuacan	Cline & Leon-Portilla 1993	Test. 23B
Blue and white glass beads	1654	4 reales	4	3.47	2.82	Soconusco	Gasco 1992	Table 6
Silver ring with no stone	1654	1 real	1	0.86	0.77	Soconusco		Table 6
Small tin medallion	1654	1 real	1	0.27	0.25	Soconusco		Table 10
Metal medallion	1724	.5 real	0.5	0.14	0.13	Soconusco		Table 10
Ring from China	1740	.5 real	0.5	0.12	0.11	Soconusco		Table 6
Crystal earrings/pair	1740	1 peso	8	2.41	2.24	Soconusco		Table 6
Gold earrings with 34 pearls	1740	8 pesos	64	54.79	49.09	Soconusco		Table 6
Gold cross weighing 3/8 of a peso	1740	5 pesos, 3 reales	43	11.73	10.75	Soconusco		Table 10

¹ Prices standardized for inflation using "BBB" values for Central Mexico from the Global Price and Income Group 2013, based on the year given for the document ("1 year") and the average of the preceding five years ("5 year")

² Date estimated based on position in original source document

³ Date estimate based on Hirth 2013

⁴ Tomines and reales are synonymous terms. Both are worth 1/8 of a peso.

Table 6.6 (continued). Documentary values for domestic items recovered in Mesoamerican archaeological contexts

Price Standardization

The information on historic prices contains internal variation from two sources: reported currency and year of recording. I describe each issue and the methods used to compensate for the resulting variation below.

First, prices are given in a number of different currencies. These include native units, such as cacao beans and lengths of cotton cloth, and Spanish coinage, such as pesos and tomines. The exchange rate between native and Spanish currencies changed over time. Coins also came to contain lower percentages of silver over time, but the effects of this devaluation are included in the compensation for inflation discussed under temporal issues. In “Price, Tomines” column of Table 6.6, prices are standardized into tomines, as this is the most common given denomination. Prices originally given as cacao beans are converted using internal information in each document about the local relative cacao to peso value.

Second, the sources also cover a wide temporal span, from AD 1551 to 1740. This period saw substantial price inflation due to the amount of precious metals entering circulation from New World mines. This requires some method of standardizing prices to account for inflation, as one peso had wildly varying real purchasing power in different decades. To do so, I use the concept of the “Bare Bones Basket” (BBB), measure of the basic cost of living borrowed from economic history. The BBB has been used for comparisons of the quality of life and real purchasing power between world regions (Allen 2001; Allen, et al. 2011) and factors in the price of a staple grain (maize, for Mexico), a small amount of other foodstuffs (such as meat, oil, or beans), and other basic commodities (clothing, fuel, soap, and candles/lamp oil). It has also been applied to

ancient states where written records are available, such as Rome (Allen 2009) and Egypt (Scheidel 2010), which generally show very low incomes for unskilled laborers. The Global Price and Income History Group, based at University of California Davis (Global Price and Income History Group 2013), has compiled data on the prices of basic commodities in various Latin American countries, including Mexico, from the Spanish conquest through independence (Arroyo Abad, et al. 2012). As part of their project, the research group calculated the price of a BBB for most years between AD 1520 and 1810, which can then be used to standardize prices in “AD 1551 tomines” based on the relative increase in the basic cost of living. I also include a standardization based on the average of the BBB value for the five years preceding the date of a document as a standardization factor for the price actually written in the source. I use an average for the preceding years because households would be more likely to purchase items beyond those required for basic subsistence in “good” years with relatively low prices for basic staples. Prices from documents lacking a precise date are standardized using the average BBB value for the original author’s best estimate of the range of publication dates.

Calculation of Value Ratios

When the historic prices are standardized to account for the two issues raised in the previous section, price ratios can be developed for the various categories of goods recovered archaeologically at Calixtlahuaca. I include four categories of artifacts: ceramics, lithics, ground stone, and rare copper or jewelry items.

I use one whole plain bowl as the basic unit of value for establishing subsequent value ratios among artifact types. Following the logic used to create the CC index, plain

bowls are likely to have a stable value over time. From this baseline, most local ceramics are assigned value up to five times that of a simple bowl, and imported ceramics are given values twice that of locally produced pieces. For other artifact classes, four obsidian blades or four formal tools are considered equal to one plain bowl. Small ground stone artifacts are weighted as equal to five bowls and large ground stone items are weighted as being equal to ten bowls. Copper and jewelry items are weighted as equaling 30 bowls. Fragmentary ceramic and lithic items are summed into whole item equivalents, while ground stone and rare items are treated as whole items. These ratios are based on the prices given in documentary sources, and the specific rationale for the values assigned for each category is discussed in more detail under the following subheadings.

The total value of a household assemblage can potentially be calculated and standardized several ways, based on either excavated volume or a ceramic based-factor. Because of the formation process based variation in artifact density at Calixtlahuaca, I have chosen to standardize value calculations per ceramic vessel equivalent (total rim sherds/average rim arc for the component). This results in a numerical value that can be considered an average total value per vessel for each household component. It is calculated as follows:

$$index = AVV + \sum_{type=1} \left(\frac{AC * ACvalue}{CerVes} \right)$$

Where: AVV=Average Ceramic Vessel Value; AC=artifact count for any other artifact class; ACvalue=value per item, in “plain bowl” units; CerVes=number of ceramic vessel equivalents; type=uniform value artifact class or subclass.

Scoring Specific Value Categories

In this section, I discuss the specific reasoning behind each of the relative value scores for different artifact classes presented above. I use two general cross-cutting principles to address the variation in historical sources. First, I consider the earlier sources more likely to represent prehispanic value ratios. Second, I consider sources that contribute values for more items to generally be more important, since these can be compared in multiple dimensions. While I am aware that there is a substantial subjective component in setting these value ratios, I feel that I have reasonably represented the value ratios present in the original historical documents.

Ceramics

Ceramics are the most variable class of artifacts included in this analysis and have the largest set of historical values. In order to structure this variability, I focus on two dimensions. First, what are the primary causes of variation in value of locally produced ceramics? I answer this question using data from the *Codex of the Potters of Cuauhtitlán*. Second, to what degree does non-local origin (or style) increase value? I answer this question using a wider range of data sources, with a focus on specific documents that included values for both local and non-local ceramic vessels.

Local Ceramics. As noted previously, the *Codex of the Potters of Cuauhtitlán* is highly useful for archaeological studies of value because it provides a set of prices for different ceramic types. The prices are contemporaneous, and the pieces should not have

any variation due to differential transport costs. As a result, the document can be used to establish both the range of values present in a ceramic assemblage – is the most expensive pot worth twice or ten times the cheapest one – and potentially, particular attributes – such as decoration - that might increase the cost of an item.

The vessels shown in the document fall within a relatively narrow range of prices (Table 6.7). With one exception on each end of the scale, the pots cost between .18 and 1 tomin each, with the most common value being .5 tomin for a vessel. The single exception to this range is a line of very large jars (“tinajas”), which cost either 3 tomines (according to the gloss) or 4 tomines each (according the images). This suggests that the locally produced vessels within an archaeological assemblage are likely to have a similar spread of values, with most vessels falling within five times the value of the simplest item, and a few high outliers. These values are, on average, on the lower end of the range of prices in the other sources examined, likely because higher value ceramics were more likely to be specifically mentioned in wills.

Doc. Order ¹	Vessel form	Name	Price given	Tomines per pot
1	1		1 tomin for 4	0.25
40	1		One small coin for 1 ²	0.25
41	1	molcajete	20 cacao for 2 ³	.75?
6	2		3 tomines for 6	0.5
14	3		.5 tomines for 1	0.5
22	3		4 tomines for 21	0.19
25	3		.5 tomin for 1	0.5
28	3	jarros	2 tomines for 8 (6) ⁴	.25 (.33)
29	3		1 tomin for 4	0.25
32	4		2 tomines for 4 (6)	.5 (.33)
13	5		.5 tomines for 1	0.5
4	6	jarro	4 tomines for 22(21)	.18(.19)
5	6		2 tomines for 22	0.09
10	7		2 tomines for 6 (8)	.33(.25)
11	7	jarro	2 tomines for 9	0.22
9	8		2 tomines for 6 (8)	.33(.25)
19	10		One small coin for 1	0.25
18	11		.5 tomines for 2	0.25
26	11		1 tomin for 3 (4)	.33 (.25)
38	12	alcarraza	1 tomin for 2	0.5
39	12		2 tomines for 4	0.5
42	13		1 tomin for 2	0.5
43	13	alcarraza	6 granos for 1	0.5
55	14		3 tomines for 6	0.5
56	14	alcarraza	1.5 tomines for 3	0.5
7	15		2 tomines for 4	0.5
8	15		2 tomines for 4	0.5
23	15		2 tomines for 4	0.5
24	15	alcarraza	1 tomin for 2	0.5
35	16		1 tomin for 1	1
46	16		1 tomin for 2 (1)	.5 (1)
20	17		2 tomines for 5	0.4
21	17	alcarraza	1.5 tomines for 5	0.3
2	18		2 tomines for 4	0.5
3	18		1 tomin for 2	0.5

Table 6.7 Ceramic vessel forms and prices in the Codex of the Potters of Cuauhtitlan (Cuauhtitlan 1568). Vessel form numbers correspond to Figure 6.3.

Doc.	Vessel	Name	Price given	Tomines
16	18		2 tomines for 4	0.5
30	18		3 tomines for 6	0.5
31	18	jarros como picheles	1.5 tomines for 3	0.5
36	18	jarros como picheles	1 tomin for 2	0.5
37	18		2 tomines, 6 granos for 5	0.5
47	19		1 tomin for 2	0.5
17	20		1 tomin for 2	0.5
49	21	jarros que le dimos la hechura como negritos	1 peso, 2 tomines, and 6 granos for 21 (20)	.5 (.53)
50	21		2 tomines, 6 granos for 5	0.5
57	21		1 tomin for 2	0.5
58	21	jarros	1 tomin for 2	0.5
59	21		2 small coins for 1	0.5
60	21	jarros	3 tomines for 6	0.5
44	22		2 tomines for 6	0.33
45	22	jarros como caracoles	1 tomin for 3	0.33
33	23		3 tomines for 6	0.5
34	23	jarros	3 tomines for 6	0.5
53	23		1 tomin for 2	0.5
54	23	jarro	.5 tomin for 1	0.5
12	24		1 small coin for 1	0.25
51	25	tinaja	6 tomines for 2 (1.5)	3 (4)
52	25		6 tomines for 2	3
27	11 & 3	jarros	1 tomin for 4	0.25
48	16 & 19		1 tomin for 3	0.33
15	9 & 10		2 tomines for 8	0.25

¹ Left to right within each block of the document, blocks read top to bottom

² The small coin is never named in the glosses. Context suggests that it equals 1/4 tomin.

³ Contextually, six cacao are used as equivalent to half a tomin. A 100 cacao/peso rate would equal 6.5 cacao per half tomin, so the author may simply be ignoring the resulting fraction of a cacao.

⁴ Prices in parentheses note discrepancies between pictorial images and Spanish glosses and/or edits to the pictorial images themselves

Table 6.7 (continued) Ceramic vessel forms and prices in the *Codex of the Potters of Cuauhtitlan* (Cuauhtitlan 1568). Vessel form numbers correspond to Figure 6.3.

The document shows a range of vessel forms (Figure 6.3). It is uncertain exactly how accurately the scribe was depicting the vessels under consideration. On one hand, there is a wide range of variation in forms, and variation within general form classes (e.g. the same body shape, with and without handles), demonstrating that the scribe was not just repeating a couple of stock images. On the other hand, in at least one case, it appears that the scribe was not exactly clear on what a vessel looked like – the gloss reads “jarros como caracoles”, and the accompanying image shows rows of shells. In either case, the vessels include both open (bowl) and restricted (jar) forms, of both Aztec and European derivation. Many of the forms correspond to archaeologically recovered colonial Redware vessels (e.g. Charlton 1996; Charlton, et al. 1995). Prices can be calculated for both a number of general variables (type of form, size, decoration, name in gloss), and specific attributes (presence/absence of handles, lids, bases).

Most of the vessels can be assigned to one of three general form categories – bowls (open vessels), jars (closed vessels), and pouring vessels with spouts. The majority of the assignments here are obvious, but a few require more explanation. Barlow (1951) previously identified #24 as a larger denomination coin. Based on the position of the item within the arrangement of the codex, and the fact that it is not colored yellow like the other coins, I consider it a vessel, probably a plate. It is treated as a bowl/open form for analytical purposes. Form 23 may be another variety of anthropomorphic jar, similar to northern European bellarmine jars. It is treated as a jar for the purposes of this comparison. Vessel forms 6 and 22 are not included in the comparison of vessel forms, because they could not be confidently assigned to a form category. Bowl forms are generally the least expensive, with prices between .19 and .5 tomines per piece; over half

of the bowls cost less than .5 tomines. Jars are slightly more valuable on average, ranging from .22-.5 tomin, (with the exception of forms 16 and 25), with the majority of the examples of the form costing .5 tomines. Spouted vessels uniformly cost one .5 tomines each. This comparison suggests that vessel size may be more important than vessel form in determining price. Jars and spouted vessels are often similarly sized, while bowls are, on average, somewhat smaller. This position is supported by the fact that form 25 is both the largest image depicted, and the most expensive.

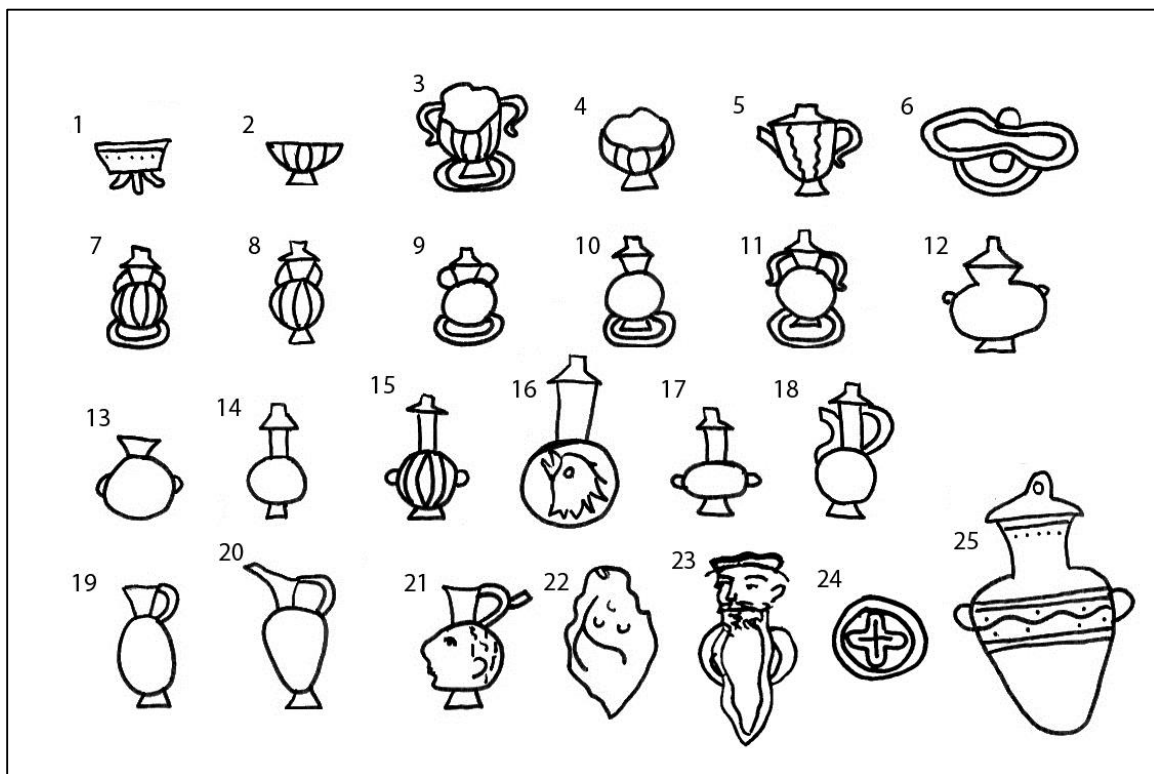


Figure 6.3 Vessel forms depicted in the Codex of the Potters of Cuauhtitlan (Cuauhtitlan 1568)

Vessels are decorated in two ways – painting and molding. There are four vessel types that show clear evidence of painted decoration: 1, 16, 24, and 25. The prices for

painted bowls or plates are about average for open form vessels. However, there are no bowls without some form or decoration (scalloping or painting), so the value of a truly unornamented bowl may be lower than the range presented here. In contrast, the painted jars are not only the most expensive jars, but also the only two vessels to cost more than .5 tomines each. For form 25, the tinaja, the higher price may be in part a function of the vessel's larger size. However, form 16 is twice as expensive as form 14, which is an undecorated version of the same shape.

Molded decoration takes two forms: simple scalloping, and more complex designs. Scalloping does not appear to significantly increase the price of a vessel. There are three pairs of simple and scalloped versions of the same basic vessel shape – 7/10, 8/11, and 15/17. In the first two, the scalloped variant is midway within the range of prices for the plain variant. In the third case, the scalloped variant is slightly more expensive. The vessel forms with more complex molding, 21, 22, and 23, are priced comparably to jars and spouted vessels in general, though all of them fall in the upper half of the range for these vessel types.

There are also two minor traits that can be tested for their effect on the price of the vessels – handles, and bases. In both cases, there are pairs of vessels with and without the trait in question. For handles, these are 10/11 and 14/17. In the first case handles do not affect the price, while in the second, the version with handles is actually less expensive. There are three states for bases – none, a simple pedestal, and a saucer-type base. The second two may co-occur. The pairs are 7/8, 9/10/11, and 12/13. The presence or absence of a base does not affect the price of the vessel. These minor traits suggest that small additions to a vessel, such as handles, or a base, do not affect the value of the piece.

In summary, the two most important variables for determining the price of a vessel in the *Codex of the Potters of Cuahutitlan* are size and decoration. This corresponds well to most “common sense” or “rule of thumb” methods that archaeologists use to assign relative values for ceramics. Small variations are unlikely to change the value of a piece, suggesting that many archaeological production step indices may create more gradations of value than the producers originally perceived in an assemblage. Based on the general premise that ceramic vessels range within one and five times the value of the cheapest piece, each local ceramic vessel type at Calixtlahuaca was scored as worth one (small and plain), three (large and plain, or small and decorated), or five (large and decorated) times the value of a plain bowl. A few extremely large types, such as temple braziers, were scored as being worth ten times the value of a plain bowl.

Imported Ceramics. The second major question in assigning value to ceramics is to what extent imported ceramics were considered more valuable than locally produced items. There are three documents with ceramics that can be inferred to be both local and imported: the undated testament from Culhuacan, and the 1724 and 1740 wills from the Soconusco (Table 6.6). In the first case, the imported vessel is worth four times the value of the only other unbroken ceramic vessel listed. In the second case, the presumably imported (porcelain) vessel is listed at precisely the same value as the other two vessels, though the fact that they represent three different vessel forms of varying sizes makes this difficult to interpret. In the third case, the majority of the ceramic values are for sets of cups, leaving it unclear whether these sets included the same number of items. However, the porcelain cups are listed with higher values (.3-5 times) than the set of majolica cups.

The majolica may or may not have been produced in the immediate area (In the 17th century, majolica production was concentrated in a number of major cities in Latin America), but in either case would have been substantially more local than the Asian porcelain. Both the majolica and the less expensive porcelain have similar values to the remaining piece, a local water jar, though the latter was likely a large vessel. This suggests that there should be some overlap between the prices of larger/more complex local vessels and the smaller/simpler end of the range of imported vessels.

The combination of the variation in local values and the differences between local and imported pieces can be used to generate a general set of value ratios for ceramics. For the purposes of this analysis, I assigned non-local ceramic types a value twice that of a locally produced pieces of the same general size and decoration. This is approximately the halfway point in the variation between local and imported pieces seen in the historical data, and does create a range of overlap between the values of local and imported pieces.

Once relative values were assigned to all local and non-local ceramic types at Calixtlahuaca, I calculated the average value per rim sherd for each household component (Table 6.8). This procedure is similar to that used in calculating the average number of ceramic production steps in the first half of this chapter. I also calculated the number of ceramic vessel equivalents at this time. This measure was calculated by multiplying the total number of rim sherds in the component by the average fraction of the vessel rim arc for that component, based on the attribute sample for the component. The use of vessel equivalents rather than rim sherds standardizes for differences in sherd size among household components, as well providing an easier point of comparison with the whole vessels described in the documentary sources.

Unit	Phase	Total Rim Sherds	Total, non- erod.	N. Local Rims						N. Imported Rims				Average		# Vessel Equiva- lents	
				small, plain			large, dec.			XL, plain	small, plain		large, dec.		Known Value ¹		Average Rim Arc
				Unkn.	plain	dec.	plain	dec.	plain		dec.						
Weighting																	
307	Dongu	539	434	105	162	109	114	38	2	6	3	0	2.49	6.78	36.53		
315	Dongu	1,670	1,219	451	267	399	409	122	3	19	0	0	2.81	6.09	101.73		
316	Dongu	459	412	47	116	130	117	42	0	6	0	1	2.70	5.32	24.44		
320	Dongu	1,173	624	549	116	281	111	100	1	2	12	1	0	3.02	4.59	53.80	
323	Dongu	2,454	2,220	234	452	954	557	192	6	58	1	0	2.84	5.76	141.27		
324	Dongu	77	77	0	26	16	19	5	1	9	1	0	2.83	10.42	8.02		
303	Ninupi	829	471	358	141	157	89	65	0	17	2	0	2.80	4.90	40.65		
307	Ninupi	2,356	2,068	288	566	782	464	191	2	49	14	0	2.73	5.71	134.54		
308	Ninupi	383	298	85	86	111	65	24	2	1	9	0	2.68	4.40	16.85		
311	Ninupi	941	692	249	190	206	183	70	1	2	26	14	0	2.83	6.61	62.21	
316	Ninupi	2,557	2,055	502	427	622	668	240	1	5	71	21	0	2.95	5.32	136.04	
322	Ninupi	229	200	29	23	63	72	20	1	20	1	0	3.28	3.66	8.39		
307	Yata	1,141	664	477	85	236	101	100	1	7	71	63	0	3.65	5.16	58.91	
309	Yata	426	230	196	22	63	34	41	2	47	21	0	4.04	4.65	19.81		
316	Yata	1,218	1,079	139	209	328	345	90	6	74	27	0	3.05	5.12	62.34		
317	Yata	1,274	685	589	55	204	141	126	3	8	97	49	2	3.89	5.77	73.52	
324	Yata	355	257	98	67	63	82	30	2	8	5	0	2.86	4.94	17.55		
327	Yata	147	86	61	14	34	26	12	0	0	0	0	2.95	5.13 ²	7.54		

¹ Average Known Value = $\sum (N \text{ sherds in category} * \text{weighting factor}) / \text{Total non-eroded sherds}$

² 327 Value is Phase 6 average, due to lack of attribute data

Table 6.8 Excavated ceramic assemblage value calculations, based on historic price ratios. DS-2 sample.

Lithics

I encountered only one documentary value for lithic artifacts, the 20 obsidian blades/real price given in Geronimo de Mendieta's *Historia Eclesiastica Indiana* (1945 [ca. 1571-1596]). Given that this is a summary work by a Spaniard, rather than a native-perspective price and/or a price dating to a specific year, this is not as reliable of a source of evidence as those used for other artifact classes. It is also contextually unclear whether the figure refers to whole blades or some fraction thereof. Most lithicists interpret the phrase as referring to whole blades (Hirth 2013), and I do the same for the purposes of this analysis.

This leaves a problem of establishing equivalencies between the lithics actually recovered during excavations, which are fragmented into pieces far smaller than an entire blade, and include both blade and non-blade artifacts. The average blade (pressure or percussion) fragment at Calixtlahuaca measures 1.9-2.1cm, making it about a fourth to a fifth of the 8-11cm core length commonly used in Mesoamerica (Parry 2002). Due to formation processes, most non-blade artifacts are similarly sized. As a result, I treat most of the recovered lithics as having the value of 1/5th of a blade. The exception to this is formal tools, which would have required more work, and are generally sufficiently unique that each recovered fragment represents a unique original piece. As a result, formal tool fragments are assigned a value equal to one whole blade. For purposes of weighting lithics relative to other artifact classes, twenty complete blades (or the equivalent thereof) are treated as equal to five times the value of a plain ceramic bowl, or a four blade to one bowl ratio.

As a note, this procedure for assigning lithic values works at Calixtlahuaca precisely because there is almost no evidence for lithic production at the site (See Chapter 5). As a result, the majority of lithics recovered in household contexts can be considered as evidence of consumption, not production.

Ground Stone

The documentary sources provided information on two types of ground stone items, manos and metates. Based on information from two wills with prices for both items, a metate was generally worth twice as much as a mano. The domestic excavations at Calixtlahuaca recovered a much wider range of ground stone items. For the purposes of this analysis, the excavated ground stone was coded as “large” (metates, molcajetes, supports from one of the two preceding forms, plaster smoothers, and anvils), and “small” (all other ground stone items, such as manos, pestles, bark beaters, etc). Pebble tools were excluded from the analysis on the basis that they were likely opportunistic tools, rather than specially purchased items. Artifacts from each excavation unit had been informally checked for reconstructible pieces both during their initial cataloging and during later analysis, meaning that there is little probability that any of the pieces listed under different catalog numbers were originally from the same object. As a result, each ground stone fragment is valued as if it were a whole item.

There is a high degree of variability in the standardized prices for manos and metates, but when each is compared to relatively simple ceramics from the same region and time period, this variation is less than it originally appears. I use pieces with the

earliest dates to approximate a value of five simple bowls equaling a small piece of ground stone and ten equaling a large piece of ground stone.

Rare Items

Small, rare, high value items are the hardest category to estimate values for. The documentary sources present a very wide range of items and associated values for items in this category. This category is probably the most likely to have been influenced by European contact, which dramatically changed metal production technologies in the New World. The items recovered archaeologically at Calixtlahuaca, which include both bronze and semi-precious stone artifacts, likely correspond to the simpler end of the spectrum represented in the historical documents. None of the excavated artifacts is particularly elaborate and none was recovered in a context that would suggest that it was part of a more complex, multicomponent piece, such as an inlaid piece of jewelry.

As a result, I weight the archaeologically recovered items as being worth 30 simple bowls each. This is subjective decision, placing the archaeological value in the middle to upper portion of the less expensive items on the list of historical values.

Master Wealth Index: Results

The Master Wealth Index, which calculated the per-vessel value of ceramics, obsidian, ground stone, and bronze/jewelry items, shows a modest but statistically significant (at the .90 level) increase in average household wealth between the Dongu and Ninupi phases, followed by statistically equivalent values between the Ninupi and Yata

phases (Table 6.9, Figure 6.4). When the index is broken down by artifact type, there is variation in how the individual artifact types pattern over time, which is not unexpected in light of the variation in the individual analyses in the first half of this chapter.

Paralleling the results of the individual artifact type indices (though with slightly different numbers due to the use of whole vessel equivalents, rather than number of rim sherds as the standardizing factor), obsidian and copper/jewelry rise between the Dongu and Ninupi phases before dropping during the Yata phase, while ground stone features the opposite pattern, dropping and then rising, and the average ceramic value rises from each phase to the next. The overall pattern, of modestly increasing household wealth values prior to Aztec rule, followed by a cessation of further growth while part of the empire, is consistent with a modest degree of Aztec imperial control over local affairs.

The overall range of within-phase variation in wealth is generally low, but does consistently increase over time. Both the absolute range of within-phase variation and the coefficient of variation show an increase from each phase to the next. However, with the exception of one outlier household, 324-Ph2 (discussed in more detail below), the distribution of household scores for each phase is similar. Each phase has one component falling between one and two standard deviations above the mean, and one falling between one and two standard deviations below the mean. All other components fall within one standard deviation of the phase mean. As a result, while the amount of variation among households increases over time, the patterning of that variation is remaining relatively similar, as a continuous spread of values. The low degree of interhousehold variation is generally consistent with relatively collective forms of governance, both before and during Aztec rule.

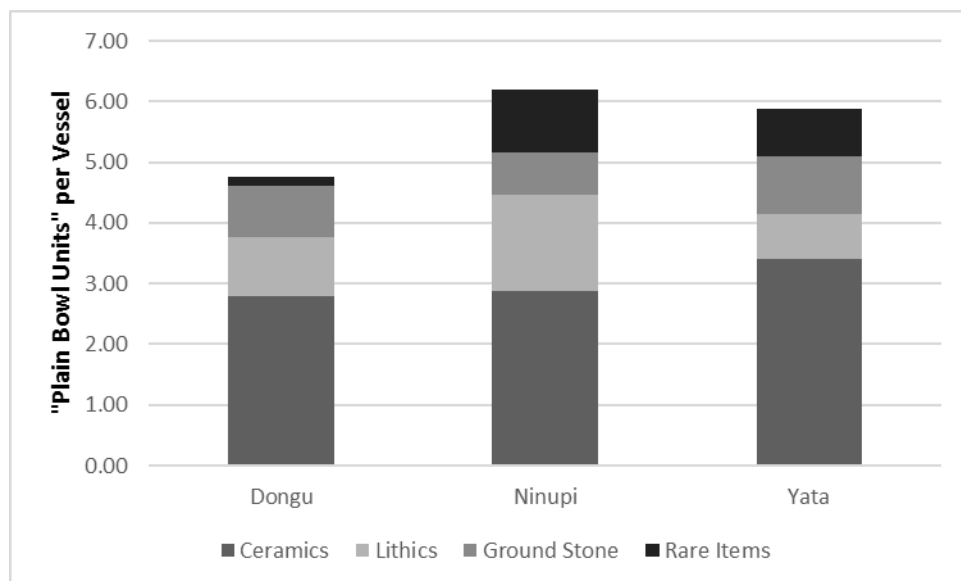


Figure 6.4 Master Wealth Index results by phase, with contribution of each artifact class

			Lithic					Mean	Lithic	Ground	Rare	Master
			N.	Frag/	Lithic	GS,	GS,	Rare	Vessel	Stone	Item	Wealth
Unit	Phase	Vessels	100	Tools	Small	Large	Items	Value ¹	Value/	Value/	Value/	Index
Weighting Factor			5	5	5	10	30		Vessel	Vessel	Vessel	Total
307	Dongu	36.53	2.7	9	1	2	1	2.49	1.60	0.68	0.82	5.59
315	Dongu	101.73	1.03	6	8	0	0	2.81	0.35	0.39	0.00	3.55
316	Dongu	24.44	0.29	3	4	2	0	2.70	0.67	1.64	0.00	5.01
320	Dongu	53.80	2.55	9	4	4	0	3.02	1.07	1.12	0.00	5.21
323	Dongu	141.27	7.34	27	10	2	0	2.84	1.22	0.50	0.00	4.55
324	Dongu	8.02	0.54	1	10	3	0	2.83	0.96	9.97	0.00	13.76
303	Ninupi	40.65	3.35	16	5	2	0	2.80	2.38	1.11	0.00	6.29
307	Ninupi	134.54	5.69	33	14	3	16	2.73	1.44	0.74	3.57	8.48
308	Ninupi	16.85	0.84	3	2	0	1	2.68	1.14	0.59	1.78	6.19
311	Ninupi	62.21	4.63	29	5	1	2	2.83	2.70	0.56	0.96	7.06
316	Ninupi	136.04	2.06	15	9	3	0	2.95	0.63	0.55	0.00	4.13
322	Ninupi	8.39	1.02	1	1	0	0	3.28	1.20	0.60	0.00	5.08
307	Yata	58.91	2.82	11	11	3	2	3.65	1.17	1.44	1.02	7.28
309	Yata	19.81	0.67	4	5	1	1	4.04	1.18	1.77	1.51	8.50
316	Yata	62.34	0.84	6	7	4	1	3.05	0.55	1.20	0.48	5.29
317	Yata	73.52	0.75	2	13	3	0	3.89	0.19	1.29	0.00	5.37
324	Yata	17.55	1.74	2	0	0	1	2.86	1.07	0.00	1.71	5.63
327	Yata	7.54	0.38	0	0	0	0	2.95	0.25	0.00	0.00	3.21
Dongu,								2.78	.86(2.38) ²		0.14	4.78(6.28) ²
Ninupi,								2.88	0.69		1.05	6.20
Yata, Mean								3.41	0.73		0.95	5.88
Dongu, StD								0.18	.51(3.75) ²		0.34	.79(3.73) ²
Ninupi, StD								0.22	0.80		0.21	1.43
Yata, StD								0.52	0.46		0.76	1.83
Dongu, CoV								0.06	0.45		0.59	2.45
Ninupi, CoV								0.08	0.50		0.31	1.36
Yata, CoV								0.15	0.63		0.80	0.94

¹ See Table 6.8 for calculation of this value

² Excluding (Including) component 324-Ph2

Table 6.9 Master wealth index values for ceramics, lithics, ground stone, and rare items, by excavated component, based on historical price ratios

This analysis also identified one extreme outlier, household component 324-Ph2, which has a Master Wealth score approximately fifty percent higher than that of any other component during any phase. The score is approximately three times the average for the remaining components dating to this phase. This component may be the result of specialized ritual activities. The component consists exclusively of material from a single pit sealed under a stone pavement, only half of which was excavated due to time constraints. As a result, the component is much less of an “average” than those which include material from more mixed contexts and/or multiple contexts. The ceramics from this excavation are a fairly standard mix of types and forms, but the component has the largest sherd size of any household component at the site (both based on average sherd weight and in the attribute sample, rim arc) and an unusually high frequency of partially reconstructable vessels, including a complete crude unfinished bowl. The high score for this component is primarily driven by the amount of ground stone (3 pieces of large items and 10 of small items) recovered in an otherwise small excavation. As a result, this component is excluded from both interhousehold correlations among artifact types and the calculations of general temporal trends in the Master Wealth index.

The individual artifact types included in the Master Wealth index (Ceramic, Lithic, Ground Stone, and Rare Items) show poor correlation with each other at the individual household level, though the latter three are significantly correlated with the household score on the Master Index (Table 6.10). Of the six possible correlations between the four artifact classes, only ceramics and ground stone are significantly (positively) correlated at the $p=.10$ level. Two variable pairs are very weakly correlated: Ceramics/Lithics (negative) and Rare Items/Lithics (positive). The household component

values for the remaining three variable pairs (Ceramics/Rare Items, GS/Lithics, Rare Items/Ground Stone) are essentially random relative to each other, which is not surprising given the small sample sizes for ground stone and rare items. The findings of the lack of correlation between many artifact types supports the use of a multi-factor wealth index in order to compensate for both recovery bias in rare artifact classes and variation in consumer choices by ancient people.

Pearson's r					
	Master	Ceramic	Lithic	GS	Rare
Master	1.00	.	.	.	.
Ceramic	0.31	1.00	.	.	.
Lithic	0.56	-0.26	1.00	.	.
GS	0.48	0.54	0.01	1.00	.
Rare	0.75	-0.07	0.28	-0.05	1.00

Chi-squared p-value					
	Master	Ceramic	Lithic	GS	Rare
Master	1.00	.	.	.	.
Ceramic	0.23	1.00	.	.	.
Lithic	0.02	0.31	1.00	.	.
GS	0.05	0.03	0.96	1.00	.
Rare	0.00	0.79	0.28	0.86	1.00

Table 6.10 Household component level Pearson's r correlations and Chi-squared significances for the Master Index and its component factors (Excludes 324-Ph2)

Conclusions

This chapter analyzed changes in household wealth over time at Calixtlahuaca. It included analyses based individual artifact classes (ceramics, obsidian, and rare items)

and a master index which weighted various artifact classes (ceramics, obsidian, ground stone, and rare items) based on their relative values in early colonial historical documents. When contextualized within the broader range of findings at the site, the analyses in this chapter provide information on household wealth, and more indirectly quality of life, over time. I then relate this to changes in rulership practices at this site.

First, most measures analyzed in this chapter show increasing wealth between the Dongu and Ninupi phases, followed by a leveling out between the Ninupi and Yata phases. Changes are unevenly distributed among different artifact classes, with primarily non-local items (obsidian, rare items) paralleling the general pattern, while primarily locally produced items either remain relatively unchanged (ceramics) or increase during the final Yata phase (ground stone). The timing of the overall patterning shows that the majority of the economic gains at the site occurred prior to its incorporation into Aztec Empire. This suggests that these pre-Aztec economic gains were the result of increased participation in the Central Mexican market system, and a local political organization that supported widespread participation in this system. The more ambiguous later results suggest that the residents of Calixtlahuaca maintained many of their earlier economic gains under Aztec rule, but that further growth slowed or stopped. This may parallel the lack of growth in trade with areas other than the Basin of Mexico during the Yata phase.

Moving beyond simple measures of wealth, I argue that the quality of life at Calixtlahuaca improved between the Dongu and Ninupi phases, followed by a decrease during the Yata phase, when the site was under Aztec rule. This conclusion draws on several factors in addition to the average wealth trends. First, prior to the Aztec conquest of the site, the quantity and diversity of imported goods at the site was steadily

increasing, likely leading to a perception by households that they were getting more “bundles”. Following the Aztec conquest, the loss of trading partners likely created a perception of resource bundles that were known, but now unavailable. This would have been particularly notable for obsidian, where the evidence for bipolar “recycling” goes up sharply during the Yata phase. Second, for those crafts that increased over time, especially textile production, the larger increase in production occurred between the Ninupi and Yata phases, suggesting that the increase in production did not result in increased household wealth, but rather, that increased production was necessary to maintain the status quo under Aztec rule. Finally, the amount of variation in access to culturally relevant “bundles” also likely reached its highest level during the Yata phase, leaving many households with the self-perception that they were even less relatively well off than they may appear in a longer contextual view. This variation in access is visible both in the less uniform access to ceramics from various imported sources discussed in the previous chapter, as well as in the higher standard deviations and coefficients of variation in the master wealth index during this time period.

The changes in the quality of life at the site provide evidence for the nature of Aztec rule at Calixtlahuaca. The independent, pre-Aztec social organization of power at the site was relatively collective. This position is supported by the steady economic growth between the Dongu and Ninupi phases, as well as by the relatively even distribution of changes in access to non-local goods and overall wealth among commoner households. Subsequently, under Aztec rule, further economic growth stalled, demonstrating that imperial policies and/or actions had sufficient force to penetrate and influence local economic networks. This interruption of economic growth indicates that

Aztec rule, while still relatively indirect, should not be considered completely hands-off.

The increasing unevenness of commoner wealth distributions and the variability in individual household's sources of non-local goods under Aztec rule implies a reduction in the collectiveness of the social organization of power, with households depending more heavily on individual network connections for household provisioning.

CHAPTER 7. “BY THEMSELVES THEY CELEBRATED THE FEAST DAY”⁸: CULTURAL CHANGES IN RITUAL PRACTICES

The shift from local to imperial rule has consequences for commoner households beyond the economic. Imperial rule potentially provides new avenues for negotiating status, marking identity, and interacting with non-local people. However, the degree and ubiquity of changes in cultural practices in provincial areas are also strongly influenced by imperial rulership strategies. Cultural interaction under imperial rule can occur in various ways. In the next two chapters, I look at changes in ritual practices (this chapter) and foodways (Chapter 8) and how these relate to the directness and collectiveness of local and Aztec rule at Calixtlahuaca.

As with the previous chapters addressing economic issues, I focus on identifying the direction, magnitude, and intra-household variation in changes in cultural practices at Calixtlahuaca over time. However, unlike the previous chapters, which were primarily concerned with the distribution, production, and acquisition of physical objects, the discussion of cultural practices requires a focus on the activities of ancient people. As a result, I use a two-part strategy, looking at both the use of non-local objects and non-local use patterns.

One potentially confounding factor in looking at cultural practices is whether such changes were due to the immigration of new people into the area or due to the local

⁸Florentine Codex: A General History of the Things of New Spain. Book 10: The People. Chapter 29, Section “The Quaquata, The Matlatzinca, The Toloque”.

adoption of new cultural practices. At Calixtlahuaca, the original Middle Postclassic population may have been partially replaced by Nahuatl populations from the Basin of Mexico at various points during the site's history. The next two chapters also evaluate the probability of immigration as opposed to the local adoption of Aztec practices, based on the appearance of Aztec traits in high- and low- visibility contexts. These two scenarios have very different implications for the interpretation of the observed cultural and economic shifts.

I find that ritual practices at Calixtlahuaca were both distinct from those seen in other parts of Central Mexico and relatively homogenous among households at the site during the Dongu and Ninupi phases. During the Yata phase, overall ritual practices shift toward moderately more Aztec pattern. This is accompanied by an increase in interhousehold diversity, with some households remaining strongly local, while others conform to patterns expected of emulation and immigration. The overall pattern is consistent with relatively collective local rule, paired with indirect and relatively non-collective imperial rulership.

Rulership and Cultural Change

Individuals mark and reinforce particular cultural identities under circumstances in which doing so is beneficial to themselves (Laitin 1998). Demonstrating a common cultural identity with another often results in increased trust and preferential interaction with those sharing a common identity (Bowles and Gintis 2004; La Ferrara 2003). Both the directness and collectiveness of rule carry implications for the degree of cultural

variability within the resulting state and the conditions under which shifting toward a more imperial affiliation will be beneficial. In both cases, cultural changes may be the targeted result of state policy, the indirect result of increased interaction between the core and province, or the result of intermediate positions between these two degrees of state intervention. The first position, state-enforced cultural change, is primarily top-down and depends on the power and desire of the state to enforce such change. In contrast, the second position, cultural change due to increased interaction, is a relatively bottom-up process by provincial people adopting some aspects of foreign cultures for their own reasons.

Relatively indirect rulership will generally result in few top-down cultural changes to provincial areas. Under relatively indirect rule, an empire will lack the penetration into local societies to enforce changes in cultural practices. In addition, it is not in the state's interest to promote beliefs or practices which would destabilize the local rulers on which the state relies for local control. While there may be a limited increase in interaction with the imperial core, overall interaction patterns are expected to follow their preexisting trends.

In contrast, under more direct rule, empires have greater penetration into local societies. This offers more opportunities for the state to successfully introduce or suppress cultural practices in provincial areas (e.g. Hechter 2013:Chapter 4; Parker 2003). Under more direct rule, provincial people also have more indirect interaction with the imperial core, at a minimum due to the increased presence of state agents from the core stationed in the provinces, such as bureaucrats, tax collectors, military garrisons, or state-sponsored merchants. Such people bring their own cultural practices with them,

providing provincial people the opportunity to observe or participate in a wider range of core-style practices than would generally be targeted by official state policy.

The collectivity of both local and imperial rule will also influence how provincial culture changes under imperial rule. The literature on collective action in modern societies generally predicts that higher group social homogeneity (but not necessarily economic homogeneity) will improve collective action outcomes (Ostrom 2007:190). More homogenous groups will have more shared norms concerning appropriate behavior and sanctioning, leading to better group cohesion. As a result, groups with a strongly collective pre-imperial organization should have more success resisting forcibly imposed cultural changes. As far as voluntary adoption of new cultural traits, more collectively organized groups should probably sanction individual cultural experimentation that threatens group identity. If imperial practices are adopted, the adoption should occur relatively evenly across the group in order to maintain internal coherence.

On the ruling side, relatively collective imperial rulership should provide substantial motivation for local people to adopt imperial practices and identities. Under this form of rulership provincial people have opportunities for participation in the imperial system, provided that they conform to its norms. Relatively collective rulership practices also involve large portions of the population in public events, such as religious ceremonies and feasts (Carballo 2015), promoting widespread exposure to imperial-style practices. In contrast, under less collective forms of local rule, personal connections are an important means of social advancement. As a result, some individuals (or households, or particular social subgroups) are likely to seek to develop and publically express ties to the imperial state.

Relatively non-collective imperial rulership will focus on promoting a shared culture among elites (Scheidel 2006). Any promotion of imperial values to the population at large will likely to be linked toward promoting elite differences, such as cults of the emperor as a divinity. If local elites adopt imperial practices, these may trickle down due to the local emulation of local elites, but such adoption is likely to be uneven across the population, due to differing levels of personal ties to local elites.

Aztec Policies Toward Acculturation

Aztec policies toward the acculturation of subject populations varied along two lines: social status, and geographic distance. Aztec imperial policy included a suite of actions which served to promote a common culture, heavily influenced by central Mexican practices, among ruling elites within the empire (Berdan and Smith 1996). Such actions included marriages between the ruling dynasties of the Triple Alliance and those in provincial areas, ritual and feasting events in the imperial capital where attendance was mandatory for provincial leaders, and requiring that children of provincial leaders live in the imperial capital of Tenochtitlan. These practices built on pre-imperial traditions of elite interaction in Central Mexico. As a result of both imperial policy and prior trends, public architecture, including both elite residences and temple complexes, followed a single relatively standardized architectural cannon across central Mexico by the Late Postclassic (Evans 2006; Smith 2008). Aztec imperial actions vis-à-vis provincial elites should be considered a network-oriented strategy.

In contrast to imperial actions serving to integrate elites across the empire, Aztec imperial policies toward the acculturation of commoners are mostly absent outside of the

Basin of Mexico, and uneven within the Basin. According to the *Relaciones Geographicas*, the worship of the Mexica patron god Huitzilopochtli (or close cognates) had been adopted by some other communities in the Basin or which had migrated out of the Basin relatively shortly prior to the Spanish conquest (Umberger 1996). However, based on analyses of figurines in the Basin of Mexico, commoner domestic ritual had few to no ties to imperial state religion (Brumfiel 1996; Klein and Victoria Lona 2009). Aztec goods, including both items produced in the Basin of Mexico and locally produced imitations, become progressively more common in provincial areas over the Late Postclassic (Smith 1990). However, in areas with sufficient chronological control, including Calixtlahuaca, this increase begins prior to the historic dates for the beginning of Aztec rule of the province (Huster and Smith 2015; Smith 1987a). This strongly suggests that the use of Aztec goods and/or associated cultural practices in provincial areas was voluntary, rather than imposed by state policy.

Geographically, areas toward the center of the Aztec Empire generally show more adoption of practices and objects characteristic of the Basin of Mexico (Smith 1990; Umberger 1996). However, there are some regional differences in the degree to which areas at similar geographic distances adopted Aztec practices. Additionally, in many areas, the adoption of Aztec style objects and/or practices begins prior to the historical date of Aztec rule for the region, strongly suggesting that their adoption was due to local, bottom-up processes rather than imperial policy.

Causes of “Aztec-ization”: Travelling Pots, People or Ideas

Given that the appearance of Aztec-style items in other parts of Mesoamerica is not likely a direct product of imperial rule, the mechanism for increasing “Aztec-ization” bears further exploration. Archaeological explanations for the appearance of non-local forms of material culture fall into three categories – the movement of objects, the movement of people, and the movement of ideas.

Physical objects can move from one region to another through trade and gifting. The movement of objects is usually the easiest explanation to evaluate, as sourcing techniques can definitively establish whether an object travelled from one region to another. Explaining why trade patterns changed is more complicated, and often incorporates political or economic factors. As discussed in Chapter 4, Calixtlahuaca shows a clear increase in goods imported from the Basin of Mexico over time. This may simply be due to changing political circumstances, and an increased availability of goods from the Basin as the Toluca Valley became more incorporated in the Late Postclassic market network.

The second explanation, the movement of people, postulates that changes in material culture are due to changes in the population producing and using the artifacts. In this case, the immigrant population continues making goods from their homeland, or using locally produced goods in ways more consistent with practices from their homeland. At Calixtlahuaca, there is a historical suggestion of immigrants from the Basin of Mexico, either under the umbrella of Tepanec control during the Ninupi (LPC-A) phase, or under Aztec control during the Yata (LPC-B) phase (García Castro 1999).

The third explanation is that the idea of a particular type of material culture travelled, causing the local production of a foreign-style object. The causes for the spread of an idea are diverse. Most overtly, a technology may spread because it is useful and relatively easily replicated in a new area (e.g. the popularity of log cabins, originally of Fenno-Scandinavian origin, among settlers on the American frontier (Burmeister 2000)). Functional explanations are unlikely to apply at Calixtlahuaca, as technologies were broadly comparable across Postclassic highland Central Mexico. More subtly, an idea can spread because it implies an affiliation with another group. This may lead to its spread due to a direct desire to integrate oneself with a specific group for political gain, or a more generalized desire to reference groups or places seen as cosmopolitan or powerful. Different subgroups within a single population may choose to adopt foreign styles for different reasons. Over time, such originally foreign styles may become integrated into local traditions.

Migration

People move across the landscape in diverse ways, and the more permanent and/or long distance of these are generally called migration. Migration has a long conceptual history in archaeology, though it has only relatively recently moved from an explanation in itself, to a process to be studied (Anthony 1990; Burmeister 2000; Rouse 1986). One useful conceptual model of migration is provided by Tilly (1978), who categorizes migration in terms of the distance moved and the degree of social breakage involved in the move. This model has been considered in archaeological terms by Smith (2014). For pre-modern states, this model provides three useful forms of migration to

consider: local migration, chain migration, and career migration. A fourth form of migration, circular migration, is considered too difficult to identify archaeologically at the chronological resolution currently available in Postclassic Central Mexico. These categories are useful heuristic concepts, but any real world case, whether archaeological or modern, is likely to contain evidence for multiple forms of migration. Thus, the well-known Oaxaca Barrio at Teotihuacan may have been founded as an example of career migration (a large group moving at once), but saw ongoing chain migration from Oaxaca after that.

The first type of migration under consideration is local migration, which involves relatively low levels of both geographic distance and social rupture. It involves circulation within preexisting social, economic, or marriage networks. This is a well-documented phenomenon in medieval and early modern Europe (Osborne 1991). It is rarely considered archaeologically, though this level of background mobility should probably be considered the normal state of affairs in antiquity, rather than the exception (Smith 2014). Because most local migration happens over relatively short distances and within existing social networks/cultural areas, it is almost invisible archaeologically. It does provide a reasonable interpretation for households where DNA or biodistance analyses show a lack of continuous descent over multiple generations, but few individuals with non-local isotopic signatures (e.g. Mata-Míguez, et al. 2012; Miller 2015). At Calixtlahuaca, this type of migration could be associated with the low degree of household continuity over time; two thirds of households occupied in one phase are not occupied in the subsequent phase. In addition, a locally mobile population would help explain the survey pattern at the site, where distinct ceramic assemblages are highly

spatially intermixed (Novic 2015). Such a pattern would be consistent with families from a variety of nearby communities moving in and out of the site on a regular basis, under some sort of conditions that prevented immigrants from settling near others from their prior home community. This type of migration is taken to be the default background state of affairs at Calixtlahuaca, likely accounting for some of the inter-household variation in cultural practices during all phases of the site's history.

On a broader scale, chain migration involves the ongoing movement of individuals or households from one community to another, across larger social and geographic distances than what is observed in local migration. Movements are facilitated by preexisting contacts between the source and destination communities, such as family members, trading partners, or previous immigrants from the source community. This scale of migration is likely to be visible bioarchaeologically as scattered individuals in a population with non-local bone isotope values or other evidence for an origin outside of the surrounding area. In Mesoamerica, Bullock Kreger's (2010) dissertation findings on burials from Cholula could be considered an example of this form of migration. She found that 18-20% of the burials in her commoner sample had non-local strontium or oxygen values, despite not being distinguished by unusual burial practices. Because this type of migration also crosses greater social boundaries, it may be visible in domestic material culture. In the US Southwest, Clark's (Clark 2001; Clark, et al. 2009) work on immigration into the Hohokam San Pedro Valley provides cases where a strong argument can be made for immigration by households, which then integrated into particular destination communities. While this scale of immigration is not likely to explain an initial

influx of settlers at Calixtlahuaca, it could play a role in the subsequent maintenance of immigrant households at the site.

The third category, career migration, is characterized by a high degree of both social rupture and geographic distance. While originally used to describe individuals who made definitive moves in response to opportunities for new positions in government, military, or trade organizations (Tilly 1978), Smith (2014) expands the category to include “most cases of big-groups-of-people-moving-from-one-place-to-another.” Under this expanded definition, most archaeologically documented cases of migration fall into this category. This is especially true in cases of site unit intrusions, where an entire site or neighborhood within a site features a broad range of traits from a single non-local origin. In Mesoamerica, the best known archaeological examples of this phenomenon are the Oaxaca and Gulf Coast barrios at the site of Teotihuacan (Cowgill 2008). Bone chemistry work at these neighborhoods shows that 29-40% of the occupants had either been born elsewhere or lived elsewhere for a significant portion of their lives (Price, et al. 2010; White, et al. 2004). However, the archaeology of the Pipil migrations into Central America (Bove, et al. 2012) and of the Malpais sites of west Mexico also places them firmly into this category of large-groups-of-people-moving.

Career migration can also occur over more moderate geographic and cultural distances. At Early Postclassic Xaltocan in the northern Basin of Mexico, immigrants, likely from the southern Basin of Mexico, settled around the periphery of the previously established site center (De Lucia and Overholtzer 2014). Households in the periphery have different house layouts, construction techniques, and burial practices from those characteristic of households in the longer-occupied site core. At the archaeologically-

visible temporal resolutions, it is difficult to determine whether Xaltocan and similar cases represent chain migration (an ongoing influx of people over time) or career migration (a single, relatively cohesive movement of people). If Aztec immigrants are present at Calixtlahuaca during a single phase, it will most likely be impossible to determine whether they arrived via chain migration building on previous trade-based ties, or as a result of imperial-sponsored resettlement.

An additional useful distinction in looking at migration is the difference in the size of the migrant population relative to the preexisting local population (Rouse 1986). In cases where migrants move in relatively small units and/or constitute a minority relative to the local population, they will face a choice between assimilating into the local culture or explicitly marking and maintaining their differences. In contrast, in cases where an immigrant population either moves into an uninhabited area or is large enough to swamp the preexisting population, tensions in local/immigrant identity are not as significant of a factor and immigrants may innovate with their identity in ways tied to neither preexisting local populations nor their homeland. All cases of local and chain migration fall into the former category. However, cases of career migration straddle the two categories, and should be considered on a case by case basis. At Calixtlahuaca, it is unlikely that Aztec immigrants arrived in sufficient numbers to swamp the considerable preexisting local population. This means that they could have muted their cultural differences in the face being a disliked foreign minority, or they could have been confident enough in their position as members of the conquering group to express a Mexica identity openly.

This category of career migration also plays a large role in the ethnohistory of Postclassic Mesoamerican peoples. In native histories, large groups, which could be glossed as ethnic groups under a loose definition of ethnicity, are often recorded as moving through dozens of cities over multiple centuries. While the arrival of the Mexica to Tenochtitlan may be the best known of these stories, it is only one example of a widespread genre. Due to this written evidence, migration played a large role in early culture-historical reconstructions of the Postclassic Basin of Mexico and surrounding areas, with changes in material culture linked to the arrival of particular groups at particular sites. With the advent of chronometric dating showing that such correlations were not likely to be valid, and an increased skepticism in the historical validity of the mythic histories (Smith 1984), migration was set aside as a topic in inquiry in Central Mexico. More recent work (Beekman and Christensen 2003; Cowgill 2013) has returned to the subject, using multiple lines of linguistic, biological, and archaeological evidence to argue for large-scale population movements in Mesoamerica during the Epiclassic and Early Postclassic.

There have also been a limited number of artifact-based studies of Postclassic migration in the context of the Aztec Empire. These address longer-distance migration, usually in cases where there was a historically documented movement of people from the Basin of Mexico to a peripheral portion of the empire. The resulting settlements show varying degrees of distinction from the surrounding regions. Near the Tarascan border, the Aztec fortress of Oztuma and surrounding Chontal sites can be clearly distinguished on the basis of decorated ceramic types and obsidian from particular sources (Silverstein 2001). In contrast, efforts to identify the material presence of the Aztec garrison at

Coixtlahuaca, in Oaxaca, found only trace evidence for an Aztec presence at the site (Kowalewski, et al. 2010), obsidian source frequencies and the majority of recovered ceramics matched those of other sites in the Mixteca Alta.

Local Acculturation

In addition to the appearance of foreign styles due to the movement of people, foreign styles or practices may also appear due to their adoption by local peoples. Local adoption of foreign practices or styles of material culture may occur for a variety of reasons, variously referred to as emulation, appropriation, and assimilation (Stark and Chance 2012). These may generally be grouped into two axes of variation, based on the status of the people adopting non-local styles, and the degree of fidelity to the original practice.

Non-local objects and/or practices are often more widely adopted by elite members of a society than by commoners, as a means of signaling status (Neff 2014). At the most basic level, this appears as higher levels of imported goods in elite households (Smith 1987b). Higher social classes seek to distinguish themselves via unique markers, which are gradually adopted by lower classes, at which point they begin to fall out of use by the original higher class users because they no longer reliably fulfill their original function as exclusive status markers (Bourdieu 1984). (For the relationship between taste and status from modern Mexico, see Bustamante and Garcia (2015).) Non-local items can often fill this role, as elites often have more geographically extensive social networks due to marriages and other alliances. This may take the form of widespread aspects of elite culture that cross-cut ethnic or other regional identities, due to marriage ties or

participation in “high culture” used to mark elite status. Archaeological examples of this phenomenon include the use of specialized drinking sets across much of the Greek Mediterranean (Hodos 2009) and the widespread use of Harappan-style luxury items by elites in areas outside the Harappan area proper (Chase, et al. 2014). In Mesoamerica, this can be seen in the uniform appearance of palaces across much of Postclassic Central Mexico (Smith 2008:115-119), a uniformity which cross-cuts variation in the size, layout, and construction methods of commoner houses in the same regions. Elites may also adopt non-local material culture due to its association with politically or ideologically powerful locations, such as Maya rulers’ references to Teotihuacan (Spence 1996; Stuart 2000). Provincial elites may adopt imperial or higher ranking elites’ practices as a means of demonstrating their own status (Elson and Covey 2006)

Commoners may adopt non-local practices either in direct reference to the source location, or indirectly, in imitation of their local nobility. For example, in Cuertlaxtlan, there was an Aztec imperial presence in the regional capital, where local nobles interacted with Aztec officials using a subset of the full range of Aztec material culture. In more rural surrounding areas, commoners made and used locally-produced versions of a subset of that subset of items (Ohnersorgen 2006). At Calixtlahuaca, the Aztec style items that were recovered in the current excavations of commoner households are categorically similar to those recovered during Garcia Payón’s excavations of elite and temple contexts at the site.

There is also variation in the degree of fidelity to which a non-local item or practice is adopted by a new area. On one end of the scale, non-local practices may be adopted in forms and with meanings very close to those in the source region, while on the

other end all that may be desired is an ability to signal “foreignness” within local frameworks of meaning. This range of variation may be seen in Aztec Black-on-Orange pottery, where production outside the Basin of Mexico ranges from very close copies at Tlacotepec (McVicker, et al. n.d.) to very general references in the Soconusco (Voorhies and Gasco 2004). In yet other cases, the meanings of objects may be actively subverted or changed to fit local frameworks. As a result, the meaning of an object in a provincial area may not be the same as in the source area, though some degree of reference to that source is generally intended.

Ethnohistoric Evidence for Migration in the Toluca Valley

Ethnohistoric evidence for an Aztec presence in the Toluca Valley is mixed. Ethnohistoric information on the prehispanic Toluca Valley comes from two groups of sources – secondary references in sources from the Basin of Mexico, and a number of bureaucratic documents from the Toluca Valley itself. Each presents its own biases. The Basin sources show a Triple Alliance view of Central Mexico, presenting Aztec dominance and Aztec forms of social organization as the natural and proper state of affairs. In this narrative, the lords of the Matlatzinca are descendents of the kings of Tula, and the Matlatzinca first appear as one of the groups arriving from Aztlan. They appear in eight of the twelve migration histories, though García Payón (1942:19-24) argues that they were added in an effort to justify the Aztec conquest of the Toluca Valley, a position also supported by Umberger (Umberger and Hernández Fahan submitted 2014). After this time, there are suggestions that the Tepenac state extended into the eastern Toluca

Valley, though the precise geographic extent of this conquest is unknown. The estimated limits of this zone parallel Sugiura's proposed Postclassic "Grupo Mica" ceramic complex identified during her regional survey (Sugiura Yamamoto 2011), though any definitive association is dependent on a more refined dating of the complex. During this time period, Calixtlahuaca ("Matlatzinco") may have paid tribute to the Tepaneca state (Carrasco 1999), though there is little archaeological evidence of interaction with the Basin of Mexico during this time period. The written record becomes richer with the Triple Alliance conquest of the region, providing the names of kings and suggestions of alliances. Most importantly for my discussion in this chapter, Basalenque (1975 [1642]) describes many Matlatzinca as fleeing to the west after the Aztec conquest of the Toluca Valley. The historical presence of speakers of Matlatzinca and similar Oto-Pamean languages just inside the eastern border of the Tarascan Empire would support the position that at least some of the occupants of the Toluca Valley did emigrate in the face of Aztec conquest (Pollard 1993:101-103). However, archaeological work at Xaltocan has demonstrated that Aztec descriptions of the complete abandonment (and later Aztec reoccupation) of towns may be more political propaganda than truth (Overholtzer 2013). The Toluca Valley also served as a later source of colonists for imperial colonies in more distant parts of the empire (Umberger 1996:152-159). Given that such colonist populations were almost always drawn from either the Basin of Mexico itself or very heavily Nahuacized populations in immediately adjacent areas, this suggests either the presence of a significant Nahua population in the Toluca Valley or a high degree of regional acculturation toward Aztec cultural norms.

In contrast, many of the local colonial bureaucratic documents provide more prosaic information about the Toluca Valley, though even this is often filtered through particular agendas. There is little Spanish documentation on the Toluca Valley prior to about AD 1550. Based on the Sumas de Visitas and ecclesiastical records, García Castro (1999) has reconstructed overlapping zones of Matlatzinca, Mazahua, and Otomi speakers within the Toluca Valley. The distributions of these languages were accompanied by the widespread distribution of Nahuatl speakers, who decreased in frequency with distance from the Basin of Mexico. While the timing of the records means that there is no way to determine whether the presence of Nahuatl speakers in the Toluca Valley dates primarily before or after the Spanish conquest, their pronounced east-to-west distribution gradient does suggest that they were relative latecomers to the region.

Differentiating Migration and Emulation

I apply a framework based on the use of local and non-local style objects and practices in low and high visibility contexts to distinguish between immigration and local emulation at Calixtlahuaca (Figure 7.1). Based on archaeological research in the US Southwest and an extensive review of ethnographic cases, Clark (2001) has presented a model arguing that low-visibility traits are less likely to be consciously used to signal group identities, and are therefore more likely to be maintained among immigrant groups. (Burmeister (2000) makes a similar argument, based on historical and Anglo-Saxon data, as do Carr and Neitzel (1995) in wide range of case studies.) In contrast, in cases where a local household is emulating aspects of a foreign group, they are most likely to emulate

primarily high-visibility traits. This model is based on the intersection between Bourdieu's (1977) argument that many aspects of culture are due to *habitus* or learned frameworks, and work showing that some types of material culture are more useful than others for signaling social differences (Sackett 1977; Wiessner 1983).

As a result, low visibility traits, such as hearth construction, plainware pottery production techniques, or cooking methods, are likely to be preserved through migration or cultural change. In contrast, high visibility traits, such as decorated pottery, are likely to be actively manipulated, often to minimize differences between the immigrant and host populations or to forge new, common identities between the two. This method of focusing on low visibility traits has been used to identify immigrant sites in various parts of the Southwest, and has proven very useful in identifying immigrants in cases which fail to make the cut-off as full scale site unit intrusions (Clark, et al. 2013; Clark, et al. 2009). Other researchers have found similar contrasts between evidence for migration in low and high visibility contexts in historical cases (Burmeister 2000; McGuire 1982), though the maintenance of low-visibility traits is tempered by their appropriateness to the new environment. While these types of models have not been explicitly applied to Mesoamerican contexts, there is a growing awareness of the distinction between low and high visibility traits and their utility for distinguishing between potential causes of cultural change (Beekman and Christensen 2003; Cowgill 2013).

The model requires some modification for use in more complex societies, especially those with market-based economies. First, households in such cases are likely to acquire a significant portion of their household goods from other producers, rather than making them directly. This makes interpretations based on low visibility production

techniques of portable material culture poor candidates for identifying immigrants in these societies. Instead, the analysis of how items were used in high- and low-visibility settings is likely to be a more effective line of evidence for identifying non-local households. At Calixtlahuaca, the relatively low levels of evidence for production above the household level paired with the relatively even access to non-local goods, suggests an intermediate situation, where households produced some goods for their own use, but purchased others. In this case, practices of use in different visibility contexts remain the best potential line of evidence for identifying immigrant households as people can use either produced or purchased goods for the same activity.

A: Isolated			B: Local Emulation (or Local Female/Immigrant Male)		
	Low Visibility	High Visibility		Low Visibility	High Visibility
Local Style	X	X	Local Style	X	(X)
Foreign Style			Foreign Style		X

C: Hidden Migration			D: Site Unit Intrusion Migration		
	Low Visibility	High Visibility		Low Visibility	High Visibility
Local Style	(X)	X	Local Style	(X)	(X)
Foreign Style	X		Foreign Style	X	X

X = Required for pattern (X) = Not required for pattern, but may be present

Figure 7.1 Expected patterns of high- and low- visibility items in cases of migration and local emulation

The second point requiring a modification of the models is that immigrants, especially from dominant groups, may continue to use both high- and low-visibility objects and/or practices from their homeland, rather than attempting to assimilate into the host culture. While this makes immigrant households easier to see archaeologically, it also makes them easier to confuse with cases of local emulation.

There are four possible pairings of high and low visibility traits and local and foreign practices. These are presented in Figure 7.1 and referred to as the Isolated, Local Emulation, Hidden Migration, and Site Unit Intrusion patterns. The patterns described here are stereotyped extremes, and most archaeological cases will be messier, falling on a continuum between two of the patterns described here.

In the *Isolated* pattern, both high- and low- visibility traits are primarily associated with local style objects and practices. This pattern is probably the most common archaeologically, associated with sites with little population movement and either little external interaction or little desire to reference foreign groups. However, sites in this category are rarely brought in to discussions of migration or emulation because they are basically the “negative” case where the processes of interest were not occurring.

In the *Local Emulation* pattern, foreign objects or practices are primarily associated with high-visibility traits. Low visibility traits continue to follow local patterns, and there may be some use of high-visibility local traits in conjunction with foreign ones. Archaeologically, this pattern can be seen in the Mantaro Valley of Peru, where decorated Inka pottery occurs in conjunction with local plainwares (D'Altroy and Hastorf 2001), or in the Cuexcatlan region of Mexico where most of the evidence for an Aztec presence occurs in high-visibility objects (Ohnersorgen 2006). Due to the

association between female activities and low-visibility activities, this pattern does run the risk of equifinality with the pattern produced by settlements made up of local females and foreign males. This latter interpretation was originally pioneered by Deagan (Deagan 1973; Deagan and Koch 1983) for situations of Spanish/Native American interaction. It has continued to be applied primarily in historical contexts, though there are some applications to prehistoric contexts, such as the Egyptian/Nubian frontier (Smith 2003f), and Uruk period Hacinebi (Stein 2012). The latter case has the advantage of being sufficiently nuanced to avoid the issue of equifinality; both male (butchering) and female (cooking) low visibility practices are examined, showing that the former were foreign, but the latter were local.

The third pattern, referred to as *Hidden Migration*, is characterized by foreign style objects or practices in low visibility contexts, but local style objects in high visibility contexts. This is the pattern that originally drove Clark's model of ways to identify migrants. To date, cases matching this pattern are primarily limited to the US Southwest (Clark 2001; Clark, et al. 2009). I suggest that this pattern is likely to occur when immigrants have a relatively low status vis-à-vis the local population.

The final pattern, of *Site Unit Intrusion*, is what is most commonly thought of as evidence for migration. Foreign traits occur in a wide range of both high and low visibility contexts. Depending on the size of the immigrant group and the type of local economy, immigrant households may also use substantial amounts of local items. In Mesoamerica, this pattern can be seen in the Middle Postclassic Mixtequilla, where foreign items appear in both high (serving vessels) and low visibility (storage and cooking vessels) objects (Stark and Chance 2008). It may also appear at the Aztec

garrison site of Oztuma on the Tarascan frontier, where both food preparation and serving assemblages include characteristically Aztec elements (Silverstein 2000). Based on McGuire (1982), this pattern is likely to occur when either the dominant or the subordinate group strongly benefits from the visible signaling of cultural differences.

Questions for Calixtlahuaca

The combination of historically specific information on the Toluca Valley, the expected effects of different rulership strategies, and the general implications of different types of cultural interaction allow for the formulation of three questions:

1. *Pre-Aztec Cultural Diversity and Collectivity of Rulership*: How culturally diverse were households at Calixtlahuaca prior to the Aztec conquest of the site? More collective forms of social organization should generally produce more homogenous cultural identities, particularly in high-visibility practices and material culture. If there is substantial cultural variation at the site, I expect to see distinctive clusters of specific types of material culture, representing ethnically specific cultural practices, dividing the household components into two or more distinctive groups during multiple phases. I expect similar dimensions of variation to continue through time, and that households that remain occupied from one phase to the next continue to show affiliation with the same group. This line of inquiry establishes the existing local baseline.

2. *Overall changes resulting from Aztec rulership:* What was the overall degree of cultural change at Calixtlahuaca following the Aztec conquest of the site and does it likely relate to imperial rulership strategies? The magnitude of change toward activities more characteristic of the Basin of Mexico is a product of the directness of rule. The evenness of the distribution of any such changes among households measures the degree to which locally collective institutions persisted or formed under Aztec rule.
3. *Causes of changes under Aztec rule:* Can the mechanisms of cultural change in particular households be explained as either local emulation or foreign immigration? Cases of emulation are expected to be visible as the appearance of Aztec material culture primarily in high visibility contexts, conforming to the “Local Emulation” pattern. In contrast, cases of migration will be visible as the appearance of specific households featuring Basin of Mexico style household practices (and associated material culture) in low visibility contexts. These households may also use Aztec-style material in high visibility contexts, but this is not required to demonstrate the presence of immigrants. As a result, households in this category may conform to either the “Hidden Migration” or “Site Unit Intrusion” patterns of low and high visibility material culture.

Public and Private Ritual at Calixtlahuaca

I evaluate the three preceding questions using ritual items from Calixtlahuaca and surrounding sites. Carballo (2015) identifies ritual as an important component of social dynamics, especially of rulership. Ritual can be either inclusive, such as community-wide activities meant to promote group solidarity, or exclusive, such as events intended to demonstrate ownership of esoteric knowledge. As such, evidence for household ritual practices can both serve to identify the degree to which households were participating in shared, community-wide practices, and to what extent they were attempting to distinguish themselves from their neighbors. Higher visibility ritual practices will serve as better vectors for communicating group identity than lower visibility practices.

More specially, in terms of assessing migration and local emulation, ritual has both higher and lower visibility aspects. Clark (2001) does not include ritual practices in his review of ethnographic practices and their utility for identifying migration. However, Smith (2002) has previously suggested a quadripartite classification of Mesoamerican ritual practices, dividing them into state and domestic rituals, and between public and private rituals. In the context of the discussion of evidence for migration, the latter distinction provides a rough approximation of high and low visibility activities. Ritual practices are not generally subconscious or isochrestic variations in the strict sense of low-visibility traits. However, some aspects of ritual do have a much lower visibility than others, due to the context in which they took place, the size of the artifacts involved, and the size of the group involved.

In order to contrast changes in public and private ritual practices at Calixtlahuaca, it is first necessary to determine which artifacts are generally associated with each category. Many objects were likely used in multiple contexts, with multiple degrees of public visibility. As a result, a perfectly clean split between artifacts used in “public” and “private” contexts is unlikely, and the assignment of artifacts to one category or the other should be seen as indicative of a general trend rather than an absolute division.

Objects used primarily in public contexts were determined based on the results of García Payón’s excavations at Calixtlahuaca. While specific objects cannot be linked to particular structures in most cases, the 1930s excavations focused on monumental architecture, including the royal palace, several temple groups, and cemetery burials in the associated plazas (García Payón 1979). All three of these types of contexts are far more likely to be associated with public, group oriented ritual activities than with private rituals. As a result, the artifact classes more commonly recovered in the García Payón excavations, or shared between the García Payón and domestic excavations, can generally be taken to be indicative of more public aspects of ritual, while those artifact classes recovered primarily in domestic contexts can be taken to be characteristic of more private ritual practices.

Based on this comparison of contexts at Calixtlahuaca, figurines and scored censers are primarily associated with household contexts, large braziers and Tlaloc vessels are primarily associated with public, state contexts, and most other censer and sahumador forms were shared between domestic and state ritual practices (Huster, et al. 2015). This suggests that of the ritual items used in household contexts, figurines are lowest visibility, both due to their lack of use in contexts associated with state ritual, and

because of their small size. Censers and sahumadors are likely to have been medium-visibility items, with some use in private settings and some in public settings.

Figurines

Figurines are the most commonly used type of artifact in discussion of Aztec ritual. They are generally associated with private, household-level ritual practices, particularly those performed by women (Brumfiel 1996; Brumfiel and Overholtzer 2009; Faust and Halperin 2009; Klein and Victoria Lona 2009; Smith 2002). They are usually thought to be associated with domestic concerns, such as pregnancy, healing, and possibly agriculture. This is contrasted with the focus of public-and-temple ritual, which concentrated on state concerns such as warfare. This contrast can be seen in the complete absence of figurines in the Templo Mayor excavations (Klein and Victoria Lona 2009), compared to the ubiquity of figurines in domestic excavations. In addition, the subjects of figurines, which include animals, humans, and gods/god-impersonators, occur in decidedly different frequencies than would be expected considering the importance of various topics in state level Aztec religion (Brumfiel 1998; Klein and Victoria Lona 2009). As a result of both their relatively private contexts of use, and their lack of association with state religion, figurines provide an appropriate artifact class for evaluating lower-visibility ritual practices. In addition, figurines should not be considered a strictly gendered artifact type. In modern Nahua communities, both male and female curers use cut paper figurines (Sandstrom 2008), which are likely used similarly to prehispanic ceramic figurines (Sandstrom 2009). Because of their low visibility, changes

in figurine use should be considered indicative of more fundamental cultural shifts. These could either be due to a substantial integration of Aztec beliefs into local society, or due to the immigration of people with different practices of figurine use.

At Calixtlahuaca, figurines cover a wide range of production methods, time periods, subjects, and styles (Figure 7.2). The figurines include both molded and hand-formed pieces. Hand-formed pieces are decorated using a range of incising, punctate, and applique techniques. The figurines also come from a range of time periods, with stylistically Formative and Classic period pieces occurring in otherwise Postclassic contexts.

The figurines depict animals, humans, a small number of deities/deity impersonators, and an even smaller number of temple models. Stylistically, the figurines include Aztec style pieces, local Matlatzinca style pieces, and pieces belonging to broader, shared, Central Mexican traditions of figurine manufacture (“ghost” or “mud men” figurines). The Aztec style pieces include examples most likely imported from the Basin of Mexico (fine, hard, orange paste), and examples probably produced locally (white paste with more inclusions). The figurine coding at Calixtlahuaca classified each piece by “Type” and “Group”. Type codes the subject matter of the figurine. Group was a composite category which first separated out non-Postclassic pieces into period based groups, and then divided the remaining pieces by style and then by paste. As discussed in Smith (2002), the various aspects of figurines described above can be cross referenced against each other in assorted combinations, depending on the purpose of inquiry.

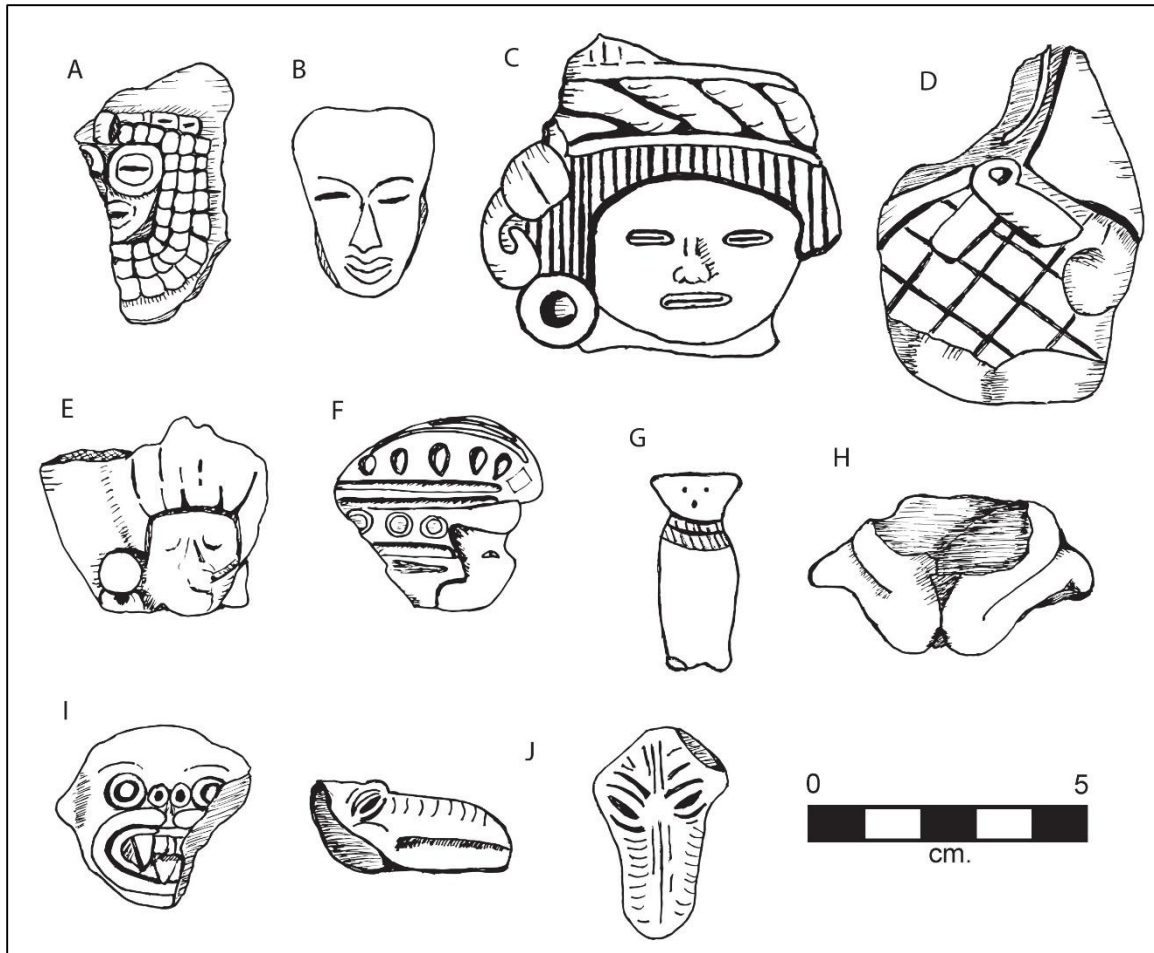


Figure 7.2 Selected figurines from Calixtlahuaca. A-Curated, Classic period; B-Curated, Formative period; C-Woman, Aztec style and paste; D-Woman, Aztec style, local paste; E-Man, Aztec style; F-Man, Matlatzinca style; G- "Mud Man/Ghost"; H-Human; I&J- Animals.

I analyze figurines in three stages. First, I present the general categories of figurines present at the site, based on type coding, and evaluate the general trajectory of change in figurine use and amount of variation among household figurine assemblages during each period. This contributes toward identifying the amount of inter-household variation present before and after the Aztec conquest of the site. Second, I compare the use of figurines at Calixtlahuaca with those from other domestic contexts in Postclassic

Central Mexico, again based on the subject matter of the figurines. This identifies to what degree figurine use at Calixtlahuaca was shifting toward a more characteristically Aztec pattern over time. Third, I consider whether any groups of figurines should be considered to be imported, based primarily on the group coding. This is accompanied by a determination of whether non-local figurines are concentrated in particular household components. This provides information on household-level variation in non-local object ownership, which complements the prior analysis of non-local use practices. The results of these analyses show that figurine use at Calixtlahuaca moves toward a more characteristically Aztec pattern over time, based on total quantity of figurines, their subject matter, and the frequency of imported pieces.

Interhousehold Variation in Figurine Use over Time

Differences in figurine content over time and between elite and commoner contexts have provided useful information in other studies (Brumfiel 1998). While the approach has generally been used in collections consisting primarily of molded, Aztec-type figurines, it can be applied more broadly across multi-style figurine assemblages (e.g. Olson 2007). In this case, contemporaneous differences in subject matter might reflect differences in ritual practices resulting from differences in social group identity. In order to allow comparisons both among households at Calixtlahuaca and among sites, I coded grouped figurines into general subject-matter based categories.

Figurine Type Categories: In order to allow for both inter- and intra-site comparisons of figurine subject matter, I categorized figurines into very broad subject categories: curated

pieces, women, men, unspecified human, ghost/mud-men, animal, and temple model. At Calixtlahuaca, these data were coded under figurine “Type”, though some project-specific categories had to be combined to match the intersite categories, and Formative/Classic pieces were separated based on “Group” codes. Other items sometimes included in figurines analyses, such as non-anthropomorphic rattles, ornaments from whistles, flutes, censers, or sahumadors, and effigy vessels are excluded from this analysis because they most likely were used in different contexts.

Figurines dating to earlier time periods are commonly found in Postclassic contexts, and are referred to as curated figurines for the purposes of this analysis (Figure 7.2, A, B). They were likely found at older sites nearby, similarly to how farmers in the modern village of Calixtlahuaca will often have a collection of figurines that they have found in their fields. They are treated as a separate analytical category, rather than grouped by subject matter, as they were likely already broken when found, and thus used differently. At Calixtlahuaca, these “recycled” figurines include pieces in both Formative and Classic period styles. Pastes are generally buff colored and not especially fine, generally matching vessel clays from the Toluca Valley. All of the comparative sites discussed in the next section are also located near earlier period sites, meaning that it would not have been difficult for Postclassic residents to acquire these pieces.

Women are one of the most common subjects depicted in figurines, and these depictions crosscut most of the major stylistic types at the studied sites (Figure 7.2, C, D). The frequency of figurines showing women tends to increase over time at Postclassic sites. At Calixtlahuaca, figurines were coded as women based on the presence of breasts, skirts, *quechquemitl* (triangular blouses) or female-associated hairstyles/headaddresses. If

hollow rattle figurines were separated in an original classification, these were considered women for the purposes of this analysis, as most rattle figurines are women (The rare exceptions are usually monkeys). At other sites, I followed the original analysts' determinations of gender, though most use similar characteristics. This category includes primarily flat-molded and hollow molded pieces at most of the comparative sites, and a mix of these and hand-formed pieces at Calixtlahuaca.

Men are somewhat less common among figurines, but like women, cross-cut stylistic categories. They tend to decrease in frequency over time at Postclassic sites (Figure 7.2, E, F). At Calixtlahuaca, figurines were coded as men on the basis of loincloths, headdresses, or attributes associated with male deities, and the analysts at the comparative sites generally used similar criteria. This category includes both molded and hand-formed pieces.

Figurines were coded as human if they were generally humanoid, but could not be assigned to a particular gender (Figure 7.2, H). As a result, this category includes both pieces that were probably not gendered, as well as pieces that probably were gendered, but were too small to identify.

“Ghost” or “Mud Men” figurines are a stylistically consistent group of crude, hand-molded humanoid figurines with punctate facial features and/or body decoration (Figure 7.2, G). They occur widely across Postclassic Central Mexico, but usually match local clays and there is no reason to think that they were traded from a single point of origin. They generally decrease in frequency over time, indicating that they are predominately a Middle Postclassic (or earlier) type in most regions. Brumfiel and Overholtzer (2009) argue that they may be intended to represent non-human beings.

Animal figurines are a diverse group, including both molded and hand-formed pieces (Figure 7.2, I, J). They feature a range of species, including dogs, opossums, frogs and monkeys. (Most ceramic birds were attached to musical instruments, and are not considered here.) There is some variation in which species occur at different sites.

Animal figurines are generally made from local pastes.

Temple models are small figurines of stepped pyramids, topped by a temple or image of a deity. They are a rare form of figurine across the entire comparative area and only three examples were found at Calixtlahuaca, none of which are in the DS-2 sample.

Variation at Calixtlahuaca. The use of figurines at Calixtlahuaca over time has two dimensions. First, did average figurine use practices change over time? Second, did the amount of variation among households dating to the same phase change over time?

The figurine assemblage at Calixtlahuaca shows a trend toward increasing frequencies of figurines over time, especially between the Ninupi and Yata phases (Table 7.1). While the difference in figurine frequency between the Dongu and Ninupi phases is not statistically significant, the increase between the Ninupi and Yata phases is at the .90 level, based on a t-test of means. The Yata phase households are also more variable, with the coefficient of variation being much higher than those for either preceding phase. Additionally, the only two components to fall outside of one standard deviation from the mean for all phases, 307-Ph6 and 309-Ph6, are both from the Yata phase. These components have figurine frequencies 2-4 times higher than any other component during any other phase. Taken together, these patterns suggest an uneven adoption of changes to figurine use during the Yata phase.

Figurine content also shifts over time (Table 7.1). When the components with very low numbers of figurines (1-2 pieces) are excluded, the assemblage is characterized by increasing proportions of female and male figurines, and decreasing proportions of curated, ghost, and unspecified human figurines over time. The remaining two type categories are either absent during all phases (temple models) or occur only in a few pieces in each phase (animals). Due to the small number of cases, I cannot formally test whether these patterns represent a significant change.

The level of variation in figurine content among components remains similar over time. The average Euclidian distances among cases with more than three identifiable figurines are similar across the three phases, ranging from 38-41. The ranges of within-phase variation for most figurine categories also cover similar ranges across the three phases. In summary, there are larger changes and more variability in the quantity of figurines used at Calixtlahuaca over time. These are accompanied by relatively minor changes in the content of figurines.

		F/1000	N.			% of Known Subjects					
	Unit	N. Figs	Sherds	Known	Curated	Female	Male	Human	Ghost	Animal	Temple
Dongu											
	307	4	0.69	2	0.0	0.0	0.0	100.0	0.0	0.0	0.0
	315	9	0.54	11	27.3	9.1	0.0	54.5	9.1	0.0	0.0
	316		0.00								
	320	6	0.49	4	50.0	25.0	0.0	25.0	0.0	0.0	0.0
	323	12	0.45	10	30.0	10.0	0.0	0.0	60.0	0.0	0.0
	324	1	1.09	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Ninupi											
	303	7	0.77	9	66.7	0.0	0.0	22.2	0.0	11.1	0.0
	307	12	0.54	11	18.2	27.3	18.2	0.0	36.4	0.0	0.0
	308	3	0.69	3	33.3	33.3	0.0	33.3	0.0	0.0	0.0
	311	8	1.02	6	83.3	0.0	0.0	16.7	0.0	0.0	0.0
	316	12	0.53	11	18.2	18.2	9.1	18.2	27.3	9.1	0.0
	322	1	0.54	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Yata											
	307	40	4.29	40	22.5	30.0	17.5	22.5	5.0	2.5	0.0
	309	9	2.85	9	11.1	33.3	33.3	11.1	0.0	11.1	0.0
	316	6	0.59	6	16.7	66.7	0.0	16.7	0.0	0.0	0.0
	317	8	1.01	8	25.0	0.0	0.0	25.0	37.5	12.5	0.0
	324		0.00								
	327		0.00								
Dongu Mean, All			0.54		21.5	8.8	0.0	35.9	13.8	20.0	0.0
Ninupi Mean, All			0.68		36.6	13.1	4.5	31.7	10.6	3.4	0.0
Yata Mean, All			1.46		18.8	32.5	12.7	18.8	10.6	6.5	0.0
Dongu Mean, Large					35.8	14.7	0.0	26.5	23.0	0.0	0.0
Ninupi Mean, Large					43.9	15.8	5.5	18.1	12.7	4.0	0.0
Yata Mean, Large					18.8	32.5	12.7	18.8	10.6	6.5	0.0
Dongu SD			0.36								
Ninupi SD			0.19								
Yata SD			1.74								
Dongu CoVar			0.65								
Ninupi CoVar			0.28								
Yata CoVar			1.19								

Note: Summary statistics for subject categories do not include components without figurines

Table 7.1 Total figurine frequencies per 1000 sherds and subject matter percentages of identifiable pieces, by household component and phase at Calixtlahuaca

Intersite Comparisons of Figurines

The analyses in the prior section demonstrated that figurine use at Calixtlahuaca changed over time, in quantity and possibly also in content. However, in order to determine whether this change was influenced by cultural practices originating in other regions, I now compare the quantity and subject matter of the figurine assemblages at Calixtlahuaca to those from other sites in Central Mexico. On a general level, I compare the figurine frequencies at Calixtlahuaca to a wide range of contemporaneous sites in Central Mexico (Table 7.2). I then compare the specific subject matter of figurines at Calixtlahuaca, using the previously described “Type” categories, to those from the sites of Cuexcomate, Capilco, and Yautepec in Morelos (M. Smith, personal com.), and Xaltocan (Brumfiel 2005b; Brumfiel and Overholtzer 2009), Chalco (Hodge 2008), Xico and Huexotla (Brumfiel 1996) in the Basin of Mexico (Table 7.3).

Calixtlahuaca and the two comparative regions show differences in both the total quantity and the relative frequencies of different types of figurines (Table 7.2, Table 7.3). Prior to the Yata phase (LPC-B), Calixtlahuaca and other Toluca Valley sites have frequencies substantially lower than those seen in Morelos and at the lower end of the range for sites in the Basin of Mexico. During the Yata phase, figurine frequencies jump into the range seen in Morelos and above the frequencies seen at most sites in the Basin of Mexico. Sites in the Basin of Mexico and Morelos show inconsistent temporal patterning in figurine frequencies; at some sites figurines increase over time, while at others they decrease. As a result, the increase in figurine use at Calixtlahuaca during the Yata phase is consistent with a shift toward more pan-Central Mexican patterns of

figurine use, rather than being part of a broader regional trend toward increased figurine usage across the Postclassic period.

The most pronounced differences in figurine content among regions occur in the Curated, Male, and Ghost figurine categories. As a general pattern, sites in Morelos have very low frequencies of curated figurines, and sites in the Basin have moderate levels. During the Dongu and Ninupi phases, Calixtlahuaca has higher frequencies of curated figurines than either of the other regions, but during the Yata phase the frequency drops to midway in the Basin of Mexico value range.

Morelos generally has lower frequencies of male figurines than the Basin of Mexico. During the Dongu and Ninupi phases, Calixtlahuaca generally has lower frequencies than either of these regions. During the Yata phases, the frequency of male figurines at Calixtlahuaca is comparable to those observed in Morelos, and within the lower end of the range for the Basin of Mexico.

Ghost figurines are absent at all Basin of Mexico sites except Xaltocan, and primarily present in Middle Postclassic components in Morelos. At Calixtlahuaca, they occur in the highest levels of any region during all phases, and the primary decrease in quantity occurs between the LPC-A and B, later than in Morelos.

Animal figurine frequencies are similar for the Basin of Mexico and Morelos, while those for Calixtlahuaca are lower. There are also site-specific differences in the particular types of animals depicted in figurines. The three regions under comparison all have highly overlapping ranges for the other categories of figurines: Female, Human, and Temple Models.

Site	Phase	N. Figs	F/1000 Sherds	F/100 Rims	Total sherds	Total Rims	Source
<i>Toluca Valley</i>							
Calixtlahuaca	MPC	32	0.49	0.50	65,709	6,382	
Calixtlahuaca	LPC-A	43	0.63	0.59	67,946	7,317	
Calixtlahuaca	LPC-B	73	1.81	1.60	40,321	4,568	
Huamango	EPI-EPC	4	0.02		16,689		PiñaChan 1981, p. 92, 119
Teotenango	PC	71	1.10		64,424		PiñaChan 1975, p.194,322-4
Cerro Toloche	LPC	4	0.64		6,204		Jaramillo & De la Peña 2012, Tbl 2
<i>Basin of Mexico</i>							
Xaltocan	EPC	8		0.83		965	Brumfiel 2005a, Tables 4.4, 4.5. Phases revised per Overholtzer 2014
Xaltocan	MPC	33		0.88		3,740	
Xaltocan	LPC	23		1.00		2,298	
Chalco	PC	15		1.04		1,442	Hodge 2008, Tables 9.2-9.7, 17.2, 17.3
Chalco	MPC	10		0.48		2,101	
Chalco	LPC	18		0.79		2,288	
Huexotla ^a	MPC	24		0.74		3,225	Brumfiel 1996, Table 5.1
Huexotla ^a	LPC	76		0.64		11,874	
Huex. Pied. ^a	LPC	59		0.77		7,659	
Xico ^a	MPC	25		0.49		5,062	Brumfiel 1996, Table 5.2
Xico ^a	LPC	12		0.37		3,248	
Cihuatecpan	LPC	409	4.21		97,252		Evans 1988, Table 1.2
Tlatelolco	LPC	62	5.05		12,284		Gonzalez Rul 1988a, p. 186
Zacatenco	LPC	32	3.68		8,681		Gonzalez Rul 1988b, Tbl. 1
<i>Morelos</i>							
Capilco	MPC	10	2.06		4,848		Smith 2006a, Table B1-9, B1-10 and personal com.
Capilco	LPC-A	56	1.23		45,632		
Capilco	LPC-B	79	1.33		59,398		
Cuexcomate	LPC-A	67	2.88		23,238		
Cuexcomate	LPC-B	262	2.72		96,289		
Yautepec	MPC	64	1.17		54,682		Smith 2006c, Table C1-5, personal com.
Yautepec	LPC-A	262	1.48		176,602		
Yautepec	LCP-B	839	1.50		559,339		
Yautepec	COL	24	2.77		8,677		

Note: Postclassic Central Mexican sites have approximately 1/10 rim-to-total sherds ratios, so the figurines per total sherds and figurines per rims are offset by a factor of ten to produce equivalent values between the two data types

^aSurface Survey

Table 7.2 Figurine frequencies per 1000 sherds and/or 100 rims at Calixtlahuaca and comparative Postclassic Central Mexican sites, arranged by region

Site	Phase	N. Figs	N.	% of Known Subjects				K-Means Clusters							
				Curated	Female	Male	Human	Ghost	Animal	Pyramid	2	3	4	5	6
Toluca Valley															
Calixtlahuaca	MPC	32	28	28.6	10.7	0.0	32.1	25.0	3.6	0.0	1	1	1	1	1
Calixtlahuaca	LPC-A	43	41	39.0	14.6	7.3	17.1	17.1	4.9	0.0	1	2	4	1	1
Calixtlahuaca	LPC-B	73	63	20.6	30.2	15.9	20.6	7.9	4.8	0.0	2	1	1	5	3
Basin of Mexico															
Xaltocan	EPC-MPC		107	18.7	10.3	13.1	31.8	14.0	12.1	0.0	1	1	1	1	3
Xaltocan	MPC-LPC		177	11.3	33.9	10.7	28.2	4.5	11.3	0.0	2	1	1	5	3
Huexotla	MPC	24	24	4.2	45.8	33.3	0.0	0.0	16.7	0.0	2	3	2	4	6
Huexotla	LPC	76	76	6.6	57.9	19.7	2.6	0.0	11.8	1.3	2	3	2	4	6
Huex. Piedmont	LPC	59	59	1.7	62.7	13.6	8.5	0.0	8.5	5.1	2	3	2	4	6
Xico	MPC	25	25	56.0	20.0	20.0	4.0	0.0	0.0	0.0	1	2	4	2	4
Xico	LPC	12	11	27.3	0.0	27.3	0.0	0.0	36.4	9.1	1	2	3	3	2
Chalco	PC	43	33	15.2	18.2	12.1	30.3	0.0	24.2	0.0	2	1	1	5	3
Morelos															
Yautepec	MPC	64	58	1.7	25.9	3.4	51.7	6.9	10.3	0.0	2	1	1	5	5
Yautepec	LPC-A	262	226	2.2	36.3	10.2	37.6	2.2	11.5	0.0	2	1	1	5	3
Yautepec	LPC-B	839	744	1.9	33.9	13.4	32.4	1.6	15.2	1.6	2	1	1	5	3
Capilco	MPC	10	6	0.0	16.7	16.7	50.0	16.7	0.0	0.0	2	1	1	5	5
Capilco	LPC-A	56	48	0.0	20.8	18.8	29.2	4.2	8.3	0.0	2	1	1	5	3
Capilco	LPC-B	79	69	1.4	21.7	15.9	37.7	1.4	8.7	0.0	2	1	1	5	3
Cuexcomate	LPC-A	67	59	0.0	22.0	15.3	25.4	0.0	11.9	0.0	2	1	1	5	3
Cuexcomate	LPC-B	262	212	0.5	13.7	17.9	33.0	0.9	10.8	0.0	2	1	1	5	3

Table 7.3 Percentages of figurine subject categories at Calixtlahuaca and comparative sites, with K-means clustering results for 2-6 groups (Sources same as Table 7.2)

In order to identify patterns of variation that might cross-cut regional divisions, I performed both hierarchical clustering and k-means clustering for 2-6 groups (Table 7.3, Figure 7.3). These two methods produced relatively similar clustering patterns. Both separate out the cases from Xico and Huexotla relatively early, suggesting that the survey, rather than excavation, nature of these collections produced skewed results. Among the remaining cases, temporal patterns play a significant role, with Late Postclassic cases generally clustering together and Middle Postclassic cases generally clustering together. The first two phases at Calixtlahuaca are generally relatively distinctive. The cases from the Basin of Mexico and Morelos divide primarily along temporal lines, with the Middle Postclassic cases separating from the Late Postclassic cases at higher numbers of clusters. Those cases from Morelos tend to be more uniform than those from the Basin of Mexico, possibly because they were all coded by a single research team, which would have reduced variability in how ambivalent pieces were classified. Most importantly the Dongu and Ninupi-phase Calixtlahuaca cases group together while the Yata phase is usually grouped with sites from other regions, suggesting a shift in figurine content toward a more Aztec pattern during the last phase of the site's occupation.

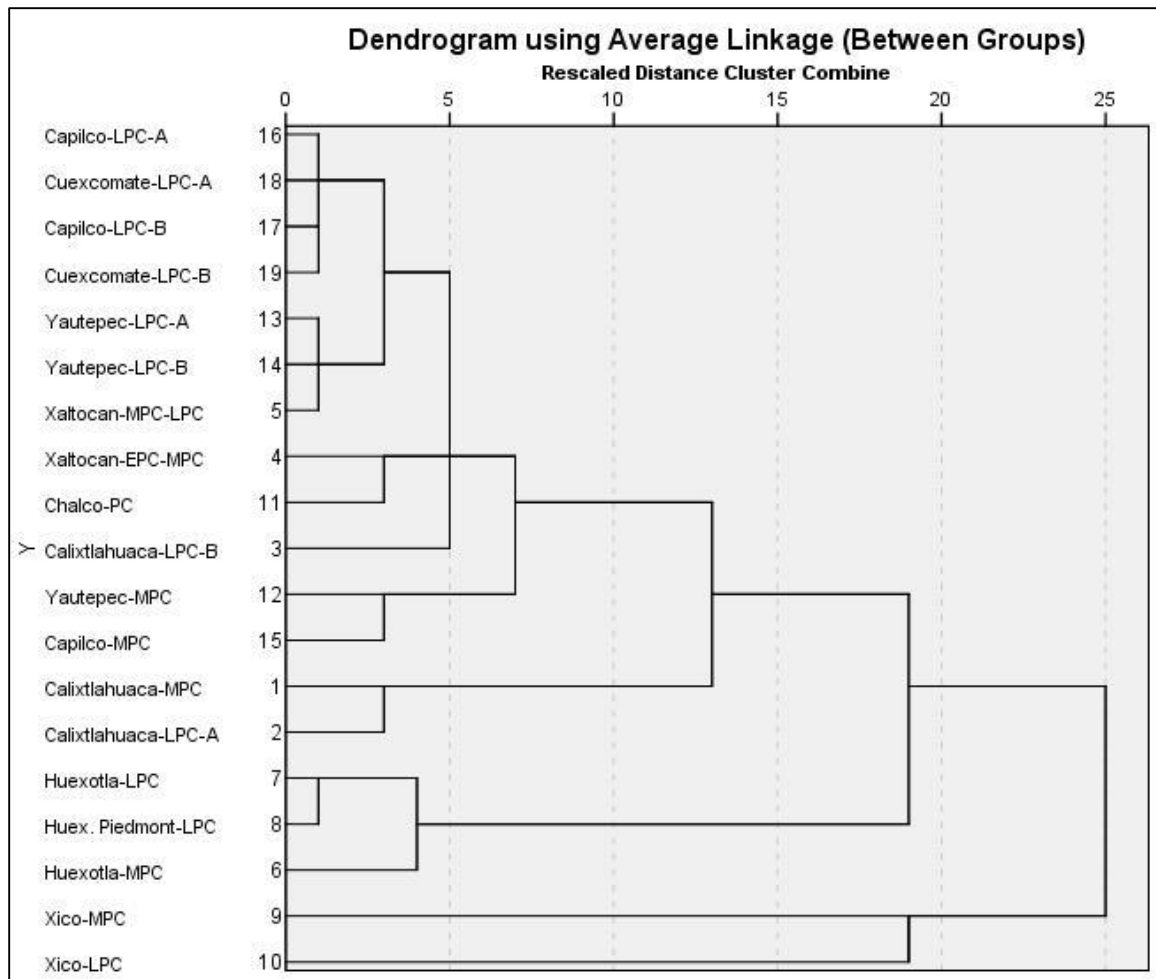


Figure 7.3 Hierarchical clustering results for figurines for Calixtlahuaca by phase and comparative sites

Local and Imported Figurines at Calixtlahuaca

In addition to coding by subject matter (“Type”), figurines at Calixtlahuaca were also sorted in to groups. Groups first sorted out stylistically non-Postclassic figurines by period, and then sorted stylistically Postclassic pieces by paste. This classification allows for the evaluation of temporal trends in the total quantity and interhousehold variability in access to non-local figurines. In conjunction with the analyses in the previous section, this provides a measure of the degree to which figurines as physical objects and figurine-

related ritual processes were being adopted together. The use of imported Aztec figurines without the adoption of associated practices suggests a relatively low level of cultural diffusion, while the use of both suggests a higher level of information transfer.

Based on the Group codes, the figurines at Calixtlahuaca can be divided into three source groups: Aztec (consisting of figurines assigned to the Aztec Orange, Orange slipped, and Fine White paste groups), Local (consisting of local pastes, miniatures, and stylistically Formative and Classic pieces⁹), and unknown (a small number of truly unknown pieces, and all of the “Colonial” group figurines depicting Spaniards, as these include both Aztec and local paste pieces.) (Table 7.4). Due to INAH policy prohibiting the export of figurines for technical analysis, no petrographic or INAA sourcing data are available. As a result, paste is discussed primarily in terms of color and fineness.

The groups assigned to the Aztec category are visually consistent with figurines from the Basin of Mexico, consisting of very fine white and/or orange clays. Where these pastes occur in fragments large enough to identify stylistically, they are also consistent with pieces from the Basin of Mexico.

The primary local figurine category is consistent with those observed in the majority of locally produced ceramic vessels. These pieces incorporate a wide range of styles, including local-molded, local-hand shaped, mud-men, and a few Aztec-style figurines. These pastes account for about two thirds of the figurines in the DS-2 sample used for this analysis.

⁹ Formative and Classic period pieces are included in the “local” category on the premise that the Postclassic residents of Calixtlahuaca found them at nearby sites.

Unit	N. Sherds	Local & PrePC	Aztec	Col & Unk	Total Figurines	Az/Local Ratio
<i>Dongu</i>						
307	5,810	3	1	0	4	0.33
315	16,775	8	1	0	9	0.13
320	12,189	5	1	0	6	0.20
323	26,947	11	1	0	12	0.09
324	914	1	0	0	1	0.00
<i>Ninupi</i>						
303	9,043	7	0	0	7	0.00
307	22,330	8	1	3	12	0.13
308	4,359	2	1	0	3	0.50
311	7,838	8	0	0	8	0.00
316	22,563	8	3	1	12	0.38
322	1,855	1	0	0	1	0.00
<i>Yata</i>						
307	10,257	16	9	19	44	0.56
309	4,217	7	3	2	12	0.43
316	10,091	4	2	0	6	0.50
317	10,860	7	2	2	11	0.29
Dongu Mean						0.15
Ninupi Mean						0.17
Yata Mean						0.44
Dongu SD						0.13
Ninupi SD						0.22
Yata SD						0.12

Table 7.4 Figurine paste groups (Local/Pre-Postclassic, Aztec, Colonial/Unknown) by household component. Excludes components without figurines.

Based on these source group assignments, the distribution of figurines among households can be assessed two ways: the frequency of figurines in each paste group per 1000 sherds, and the proportion of Aztec to local paste pieces (Figure 7.4). There are two components with a percentage of Aztec figurines more than one standard deviation from

the all-component averages, 308-Ph4 and 316-Ph6. However, both of these components have low numbers of figurines (3 and 6, respectively), making it likely that their somewhat elevated frequencies of Aztec figurines are due to sample size. Unfortunately, two of the Yata phase components (324 and 327) did not recover any figurines, most likely due to their small sample size, making it difficult to determine whether the anomalously high values for total and/or Aztec figurines during the Yata phase are specific to particular households or are part of a broader chronological pattern.

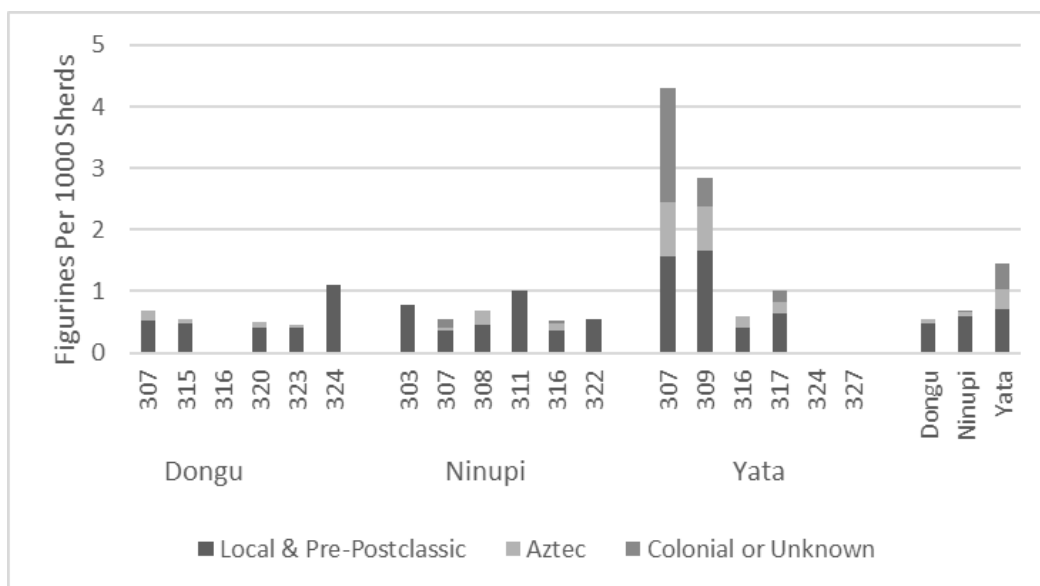


Figure 7.4 Figurine frequencies per 1000 sherds by household component, subdivided by figurine source group

The proportion of Aztec-paste figurines approximately triples during the Yata phase. According a t-test of means, this increase is significant at the .90 level, relative to either of the preceeding phases. However, the Yata phase does not have a higher standard deviation for the proportion of Aztec-paste figurines, indicating that this increase was relatively evenly distributed among all households with figurines during this phase.

Figurine Analyses: Results

The analyses of figurines pertain to all three of the questions presented for this chapter: overall trends over time, the adoption of potentially non-local practices under Aztec rule, and the possible explanations for any changes.

First, there are relatively few changes between the Dongu and Ninupi phases, and households are relatively homogenous during these periods. The overall household use of figurines is similar between these two phases, based on the total quantity of figurines and the proportion of Aztec-paste figurines. The figurine subject matter of these two phases is also similar, as they usually cluster as each other's closest case when compared with figurine assemblages from sites on a regional scale. The amount of interphase variation is also relatively low, based on multiple measures. While many households at Calixtlahuaca do not have large enough assemblages of figurines to permit formal analyses of similarity, most of the households have assemblages with high frequencies of curated figurines. Most households also have female, human or ghost figurines, with few to no male, animal or temple model figurines. All household components with more than two figurines have pieces in at least two of the primary categories, and these do not form mutually exclusive groups (i.e., women-and-ghosts vs. curated-and-human). This suggests a lack of multiple, distinctive groups and a relatively collective orientation to figurine-based ritual at Calixtlahuaca prior to the Aztec conquest of the site.

Second, there are significant changes in figurine usage at the site during the Yata phase. The total quantity and the proportion of Aztec-paste figurines both show statistically significant increases relative to the two preceding phases. In most clustering solutions, this phase at Calixtlahuaca is grouped with comparative cases from other parts

of Central Mexico, indicating that the content of the figurines at the site is also shifting toward a more characteristically Aztec pattern. These overall changes are accompanied by an increase in interhousehold variation, indicating that the changes were not evenly adopted across households at the site. This uneven adoption is consistent with relatively network-oriented rulership by the Aztec Empire, where cultural change was not targeted toward commoners.

As a relative low visibility item demonstrating the adoption of both non-local items and non-local practices, the Yata-phase figurine assemblage at Calixtlahuaca demonstrates a relatively high level of “Aztec-ization”. Due to the low visibility of figurines, they may serve as a marker for immigrant households from the Basin of Mexico, though this will require further comparisons with other lines of evidence.

Censers

Postclassic Central Mexican censers are a catch-all category, encompassing a wide range of sizes, shapes, and styles of artifacts (Figure 7.5). They include small censers that could have been held in a single hand to temple braziers that would have required several people to move. They also include items that were intended to be used in motion, such as sahumadors (frying pan censers), and items that were most likely intended to be stationary, such as the biconical censers found at Calixtlahuaca. Censers are presumed to have been used for burning incense, or offerings of blood on grass or paper. This is rarely demonstrated though residue analysis and some plainer examples may have been heating/cooking braziers rather than ritual items.

As with the figurines, I analyzed censers in three stages. The first stage was to measure trends of overall censer use and interhousehold variation over time at Calixtlahuaca. The second stage was to compare the uses of censers at Calixtlahuaca with those found at other Postclassic Aztec sites. The third stage was to determine whether imported/foreign style censers occur at Calixtlahuaca, and whether they were concentrated in particular households.

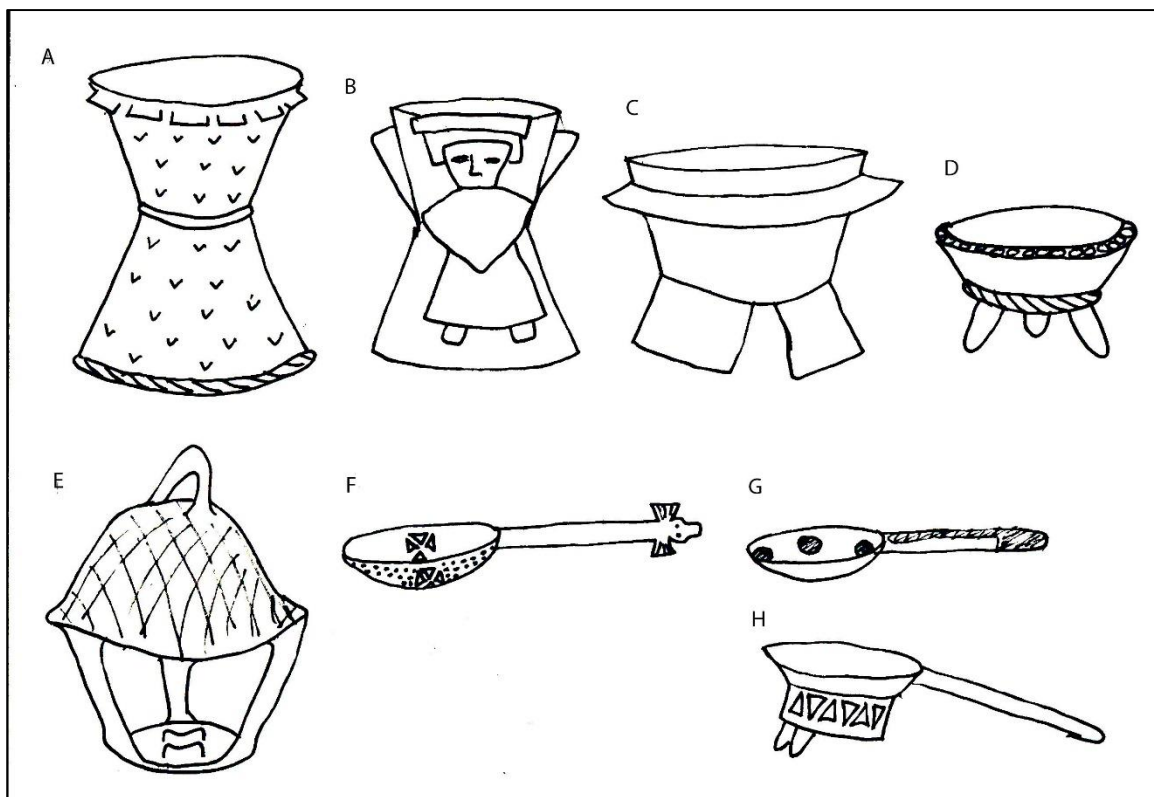


Figure 7.5 Censer and sahumador forms. A-D are freestanding forms found in the Toluca Valley (A), the Basin of Mexico (B-D), and/or Morelos (C-D). E is a scored censer, found in all three regions. F-H are sahumadors, with F characteristic of the Basin of Mexico and G-H found largely in the Toluca Valley. (Relative sizes of censers approximate)

These analyses show that household censer use at Calixtlahuaca is relatively homogenous within phases, and highly stable over all three phases of the site's history. This stability occurs despite the presence of potential alternative patterns of censer use in other parts of Central Mexico, including in the southern Basin of Mexico core of the Aztec Empire.

Interhousehold Variation in Censer Use over Time

In order to allow for both intra- and inter-site comparisons of censers, the individual types at Calixtlahuaca were grouped into three broader functional categories which could also be applied to other regions: top-loaded censers generally used in stationary manner (large freestanding censers), bottom-loaded censers which would not have produced a smoke plume (scored censers), and censers used in motion (sahumadors) (Figure 7.5).

The first category, stationary censers, includes a range of vessel forms and decorative surface finishes, including both bowl and hourglass shapes (Figure 7.5, A-D). The types placed in this category are characterized as being able to be moved by a single individual without too much trouble, but with the ability to be freestanding when placed on a surface. Most pieces in this category are decorated with appliqué points, spikes, flanges, or pie-crust rims. They include pieces with a range of plain, slipped, and plastered finishes. At Calixtlahuaca, the only type placed in this category are biconical hourglass censers (Type 267).

The second category, scored censers, is a distinctive category of braziers or censers shaped in the form of a small round base, topped by three legs, supporting a dome

(Figure 7.5, E). In the sense that they are both reasonably portable and freestanding, they are similar to the previous category. However, they are very rough pieces with no decoration other than very heavy surface scoring, which is likely functional rather than decorative due to its irregular depth, angle, and spacing. Their form also requires different mechanics of use; coals and copal can be dropped directly into the open mouth of vessels in the previous category, while scored censers require loading from the bottom. These censers are variably referred to as “Saturnos”, “Scored Censers”, “Lantern Censers” and “Cross-Hatched Ware” by different researchers. At Calixtlahuaca, this category is listed under two type codes, 101 and 180, because the upper and lower portions of the type were originally considered two separate vessel forms.

The third category, *sahumadors*, consists of a small bowl at the end of a single long handle (Figure 4.5, F-H). Some examples also include two supports. They are lighter than any of the previous types and intended for use in motion. Depictions of Aztec priests regularly show them holding and using this form of censer. This category includes both the Texcoco molded and filleted *sahumadors* characteristic of the Middle and Late Postclassic Basin of Mexico, as well as other types with similar forms. At Calixtlahuaca this category includes local Red-on-Buff *sahumadors* (Type 262), Basin of Mexico type Texcoco molded/filleted *sahumadors* (Type 64), and the miscellaneous Other Censers (Type 170) category, because after the initial ceramic classification we realized that most of the pieces in this category were low-frequency local *sahumador* variants.

A fourth potential category, massive temple braziers (freestanding, not easily portable), was excluded from the analysis because it is primarily associated with state ritual and very rarely occurs in domestic contexts. The few fragments of this type

recovered at Calixtlahuaca, which in at least one case were likely buried as offerings, were coded as Type 65.

Within-site variation in censer use of these three functional types at Calixtlahuaca over time includes two components: average trends over time and the degree of intra-phase variation. Average trends over time provide information about general shifts in ritual practices, while intra-phase variation measures how uniformly any changes were adopted by the residents of Calixtlahuaca. The rim- and total-sherd based frequencies of each functional censer category are given in Table 7.5.

Based on these frequencies, there are no changes in overall censer use at Calixtlahuaca over time. On a simple presence/absence basis all but one household component during all three phases have examples of all three functional types. On a more nuanced level, based on t-tests of means, none of the phase means for the total quantity of censers are significantly different at the .90 level. In addition, the patterning of change is different between the total sherd and rim sherd based values, suggesting a relatively high degree of random noise. The temporal patterning for individual functional classes of censers is more internally consistent, with *sahumador* frequencies dropping and scored censer frequencies rising in both data sets between the Ninupi and Yata phases. However, the only pair of means for these types which are significantly different at the .90 level are scored censer rims between the Ninupi and Yata phases.

	N.	% of Total Rims				N.	% of Total Sherds			
Unit	Rims	Free	Scored	Sahum	Total	Sherds	Free	Scored	Sahum	Total
Dongu										
307	411	2.92	0.24	0.49	3.65	4,756	0.53	0.11	0.17	0.80
315	1,374	3.64	0.15	1.02	4.80	13,772	1.29	0.11	0.25	1.65
316	290	6.21	0.69	1.72	8.62	2,684	1.97	0.22	0.34	2.53
320	395	2.53	0.25	1.01	3.80	3,951	1.47	0.13	0.10	1.70
323	834	3.24	0.48	4.56	8.27	8,827	1.01	0.14	0.79	1.94
324	77	2.60	0.00	1.30	3.90	892	0.67	0.11	0.22	1.01
Ninupi										
303	824	2.18	0.24	0.24	2.67	8,991	1.18	0.09	0.09	1.36
307	2,127	4.28	0.09	1.65	6.02	20,259	2.18	0.25	0.45	2.88
308	329	3.34	0.30	1.22	4.86	3,724	1.13	0.19	0.27	1.58
311	570	1.75	0.18	1.05	2.98	4,986	0.88	0.06	0.26	1.20
316	1,851	4.27	0.27	2.76	7.29	15,794	2.00	0.25	0.68	2.93
322	211	2.84	0.00	0.47	3.32	1,668	2.04	0.12	0.18	2.34
Yata										
307	1,130	2.65	0.27	0.35	3.27	10,225	1.18	0.20	0.15	1.53
309	332	1.81	0.30	0.60	2.71	3,096	0.94	0.16	0.19	1.29
316	921	4.02	0.54	0.76	5.32	7,492	1.49	0.21	0.31	2.02
317	1,114	2.06	0.54	0.72	3.32	9,616	1.22	0.26	0.22	1.70
324	373	1.34	0.27	1.61	3.22	3,754	1.07	0.13	0.24	1.44
327	97	6.19	1.03	0.00	7.22	945	1.80	0.32	0.00	2.12
Dongu Mean		3.52	0.30	1.68	5.51		1.16	0.14	0.31	1.60
Ninupi Mean		3.11	0.18	1.23	4.52		1.57	0.16	0.32	2.05
Yata Mean		3.01	0.49	0.67	4.18		1.28	0.21	0.18	1.68
Dongu SD		1.38	0.25	1.46	2.32		0.54	0.04	0.25	0.63
Ninupi SD		1.05	0.12	0.90	1.86		0.56	0.08	0.21	0.77
Yata SD		1.81	0.29	0.54	1.74		0.31	0.07	0.10	0.33
Dongu CoVar		0.39	0.82	0.87	0.42		0.46	0.33	0.80	0.39
Ninupi CoVar		0.34	0.64	0.73	0.41		0.36	0.51	0.66	0.38
Yata CoVar		0.60	0.60	0.80	0.42		0.24	0.31	0.57	0.19
Dongu Range		3.68	0.69	4.07	4.97		1.45	0.12	0.69	1.73
Ninupi Range		2.52	0.30	2.51	4.62		1.29	0.19	0.59	1.73
Yata Range		4.85	0.77	1.61	4.51		0.86	0.18	0.31	0.82

Table 7.5 Rim and total sherd based frequencies of functional censer classes (Freestanding, Scored, Sahumador) by household component, with summary statistics by phase

The overall degree of inter-household variation is also similar over time. The coefficients of variation for both the total quantities of censers and the individual functional categories are either inconsistently patterned between the rim and total sherd based data sets or show little change. The ranges of values present during each phase are also either similar over time or inconsistent between the two data sets.

Intersite Comparisons of Censers

As a result of this lack of variation over time or among phases at Calixtlahuaca, I frame the macroregional comparison slightly differently than in the previous discussion of figurines. Primarily, are there differences in censer use between Calixtlahuaca and contemporaneous sites in other parts of Central Mexico? If there are, then the lack of change at Calixtlahuaca may reflect a lack of adoption of other possible censer-based ritual practices. However, if there are few interregional differences, then the lack of change at Calixtlahuaca does not provide information for or against the adoption of non-local practices.

In order to evaluate regional variation, I compared censers from Calixtlahuaca with those recovered in domestic excavations in the Basin of Mexico, Morelos, and Puebla using the same three previously-described functional categories. As noted earlier in this chapter, in a market-based economy, immigrants may choose to purchase stylistically local items, but use them in non-local manners. They may purchase local items because comparable items from the homeland are not commercially available and because the members of the household either lack the skills, raw materials, and/or time to reproduce such items for themselves. As a result, functional equivalency may be an

acceptable substitution, when goods from the homeland or in the homeland style are not available. Conversely, local people may acquire imported items, but not the associated knowledge concerning their use, especially in situations of relatively low-intensity culture contact.

At a general level, there are broad regional trends in censer use. Censer assemblages at sites in Puebla, Morelos and the southern Basin of Mexico are dominated by *sahumadores*. In contrast, sites in the northern Basin of Mexico and the Toluca Valley tend to be dominated by either scored or freestanding censers. As with figurines, Xaltocan flips from a northern Basin pattern during the Early and Middle Postclassic to a more characteristically southern Basin pattern during the Late Postclassic. The total percentage of censers is not geographically sensitive; there is more variation within regions than between them and the regional ranges show a high degree of overlap.

In a more formal analysis, I compared the frequency of functional censer classes among regional sites via k-means and hierarchical clustering. Due to differences in whether ceramic counts were recorded as rim sherd or total sherd counts, I ran two sets of analyses. Using rim sherd counts resulted in a comparison between Calixtlahuaca and sites in both the northern and southern Basin of Mexico. Using total sherd counts resulted in a broader regional comparison among sites in the Toluca Valley, Morelos, Puebla, and a smaller set of sites from the Basin of Mexico. All of the comparative datasets are from either broad sitewide testing or primarily residential deposits, and probably represent material primarily from commoner households. Due to the way the comparative data were generally reported, in most cases, the unit of comparison is either all material from a site or all material from a phase. Due to the small number of variables, K-means and

hierarchical clustering methods produced very similar results for both data sets. The K-means groups were also very stable, with each additional group (from 2-4) simply splitting a single previous group.

In the rim sherd based comparative analysis (Table 7.6, Figure 7.6), the total percentages of censer rim sherds in the Basin of Mexico divide strongly by sub-region, with the lone site in the southern Basin of Mexico, Chalco, standing out relative to the remaining northern Basin sites. The phase averages for total censers at Calixtlahuaca fall near the midpoint of the range seen in the Basin of Mexico, and all individual households at Calixtlahuaca also fall within the range seen among Basin sites. Censers range from about 1.5-11% of rim sherds in the Basin sample, and about 2.5-9% in the Calixtlahuaca sample.

Site	Phase	N.	% of Total Rims				K-Means Clusters					Source
		Rims	Free	Scored	Sahum	Total	2	3	4	5		
Toluca Valley												
Calixtlahuaca	MPC		3.52	0.30	1.68	5.51	1	1	1	1		
Calixtlahuaca	LPC-A		3.11	0.18	1.23	4.52	1	1	1	1		
Calixtlahuaca	LPC-B		3.01	0.49	0.67	4.18	1	1	1	1		
Basin of Mexico												
Tepexpan	LPC	1,961	0.25	0.41	1.63	2.29	1	3	3	3	Parsons 1966, Tbls	
Maquixo	LPC	4,000	0.05	0.63	1.00	1.68	1	3	3	3	28-40	
Teacalco	LPC	1,856	0.00	0.54	0.75	1.29	1	3	3	3		
Xometla	LPC	562	0.00	0.71	2.67	3.38	1	3	4	3		
Xaltocan	EPC	867	1.15	0.12	0.46	1.73	1	3	3	5	Brumfiel 2005a, Tbls	
Xaltocan	MPC	3,731	0.72	0.21	0.48	1.42	1	3	3	5	4.2-3. Phases per	
Xaltocan	LPC	2,335	0.60	0.17	2.61	3.38	1	3	4	3	Overholtzer 2014	
Chalco, Unit A	PC	1,442	2.50	0.76	5.69	8.95	2	2	2	4	Hodge 2008, Tables	
Chalco, Unit B	MPC	2,101	2.81	1.90	5.28	10.00	2	2	2	4	9.2-9.7	
Chalco, Unit B	LPC	2,288	2.14	1.62	7.04	10.80	2	2	2	2		

Table 7.6 Functional censer form (Freestanding, Scored, Sahumador) frequencies out of total rim sherds at Calixtlahuaca and comparative sites, with K-means cluster results

Both clustering methods divide Calixtlahuaca and the rim-sherd based comparative cases primarily by site (or site cluster for the rural Teotihuacan Valley sites) at the higher cluster levels. In addition, both methods separate the Chalco components as being the most different from all other sites, and group the rural Teotihuacan Valley sites and Xaltocan together during lower cluster solutions.

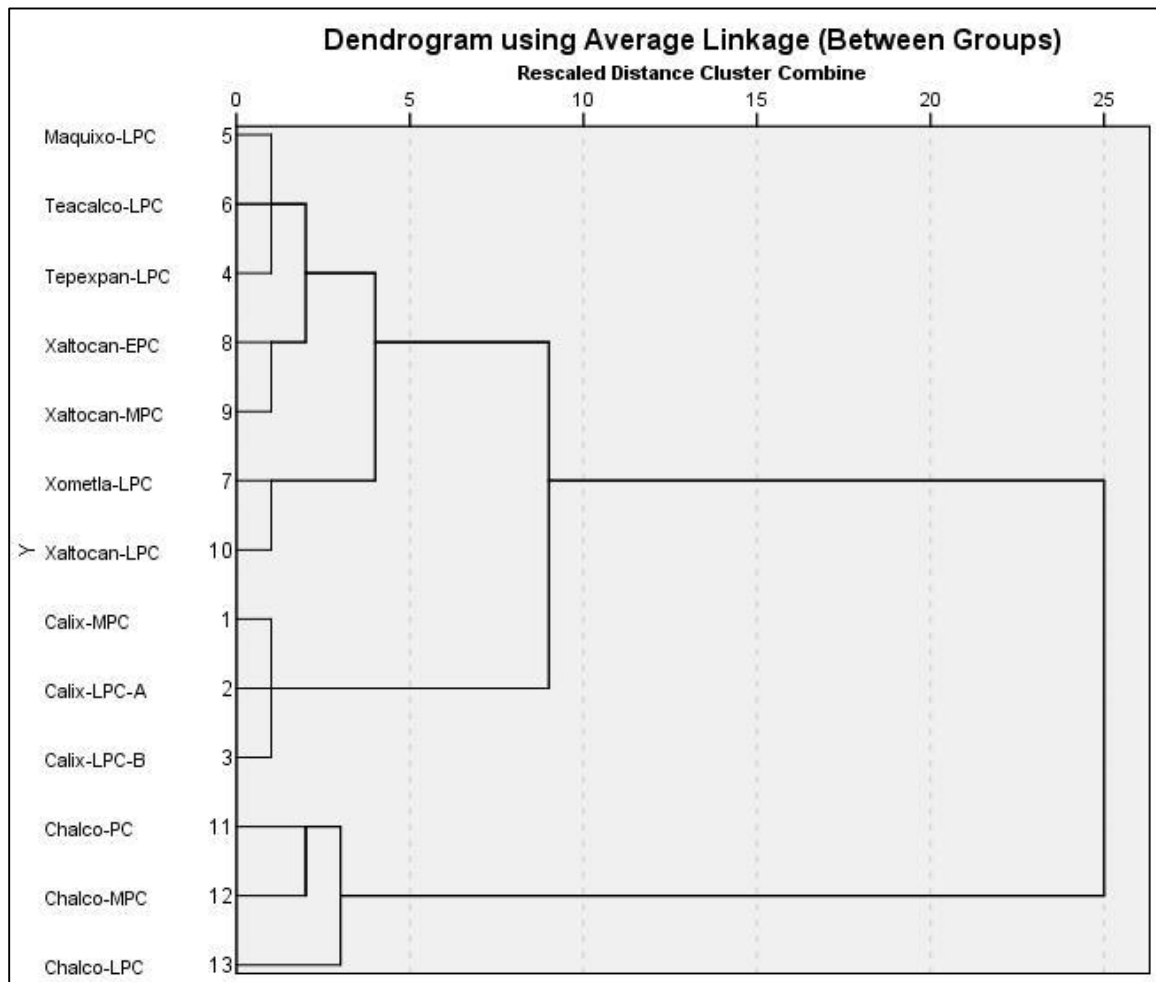


Figure 7.6 Hierarchical clustering results for functional censer forms at Calixtlahuaca and comparative sites, based on percentages of rim sherds..

The second set of cluster analyses compares Calixtlahuaca with a broader range of other regions of Central Mexico, based on total sherds counts (Table 7.7, Figure 7.7). In these analyses, the cases from Calixtlahuaca generally have a higher total percentage of censers than the comparative cases from Puebla and Morelos, but similar values to those seen in the Basin of Mexico.

Site	Phase	N.	% of Total Sherds				K-Means Clust.				Source
		Sherds	Free	Scored	Sahum	Total	2	3	4	5	
Toluca Valley											
Calixtlahuaca	MPC		1.16	0.14	0.31	1.60	2	2	2	2	
Calixtlahuaca	LPC-A		1.57	0.16	0.32	2.05	2	2	2	2	
Calixtlahuaca	LPC-B		1.28	0.21	0.18	1.68	2	2	2	2	
Cerro Toloche	M-LPC	6,204	1.21	0.02	0.90	2.13	2	2	2	5	Jaramillo & De la Peña 2012, Table 2
Basin of Mexico											
Tlateloco	LPC	12,303	0.30	0.01	2.15	2.46	1	1	4	4	Gonzalez Rul 1988a, 186-7
Zacatenco	LPC	8,681	0.07	0.01	1.26	1.34	1	1	1	1	Gonzalez Rul 1988b, Tbl 1
Morelos											
Capilco	MPC	3,496	0.12	0.00	1.19	1.30	1	1	1	1	Smith 2006a, Table B2-2
Capilco	LPC-A	23,115	0.07	0.00	1.42	1.49	1	1	1	1	
Capilco	LPC-B	29,444	0.09	0.00	1.18	1.27	1	1	1	1	
Cuexcomate	LPC-A	20,286	0.43	0.00	1.97	2.39	1	1	4	4	
Cuexcomate	LPC-B	99,828	0.16	0.00	1.08	1.23	1	1	1	1	
Yautepec	MPC	30,795	0.14	0.29	0.36	0.79	2	3	3	3	Smith 2006c, Table C2-3
Yautepec	LPC-A	130,206	0.10	0.18	0.52	0.80	2	3	3	3	
Yautepec	LPC-B	204,243	0.15	0.09	0.45	0.69	2	3	3	3	
Yautepec	COL	8,866	0.09	0.06	0.40	0.54	2	3	3	3	
Puebla											
Cholula	LPC	355	0.28	0.28	0.28	0.85	2	3	3	3	McCafferty 2001, Table 5.2
Cholula	LPC	377	0.00	0.53	0.27	0.80	2	3	3	3	
Cholula	MPC	170	0.00	0.00	0.59	0.59	2	3	3	3	

Table 7.7 Functional censer form (Freestanding, Scored, Sahumador) frequencies out of total sherds at Calixtlahuaca and comparative sites, with K-means cluster results

Once again, the two clustering methods produced similar results, with a strong tendency to group cases by site. Both methods identify two outlier components – Tlateloco in the Basin of Mexico and Late Postclassic-A Cuexcomate in Morelos. Both

cases separate due to their higher overall frequencies of censers, though their relative frequencies of the three functional categories otherwise correspond to their respective regions and at lower k-means cluster values both do group geographically. Otherwise, the division between the Toluca Valley sites of Calixtlahuaca and Cerro Toloche and all of the comparative cases forms the first division in the data set. The second division divides Yautepec in Morelos and Cholula in Puebla from the Basin of Mexico and rural Morelos sites of Cuexcomate and Capilco.

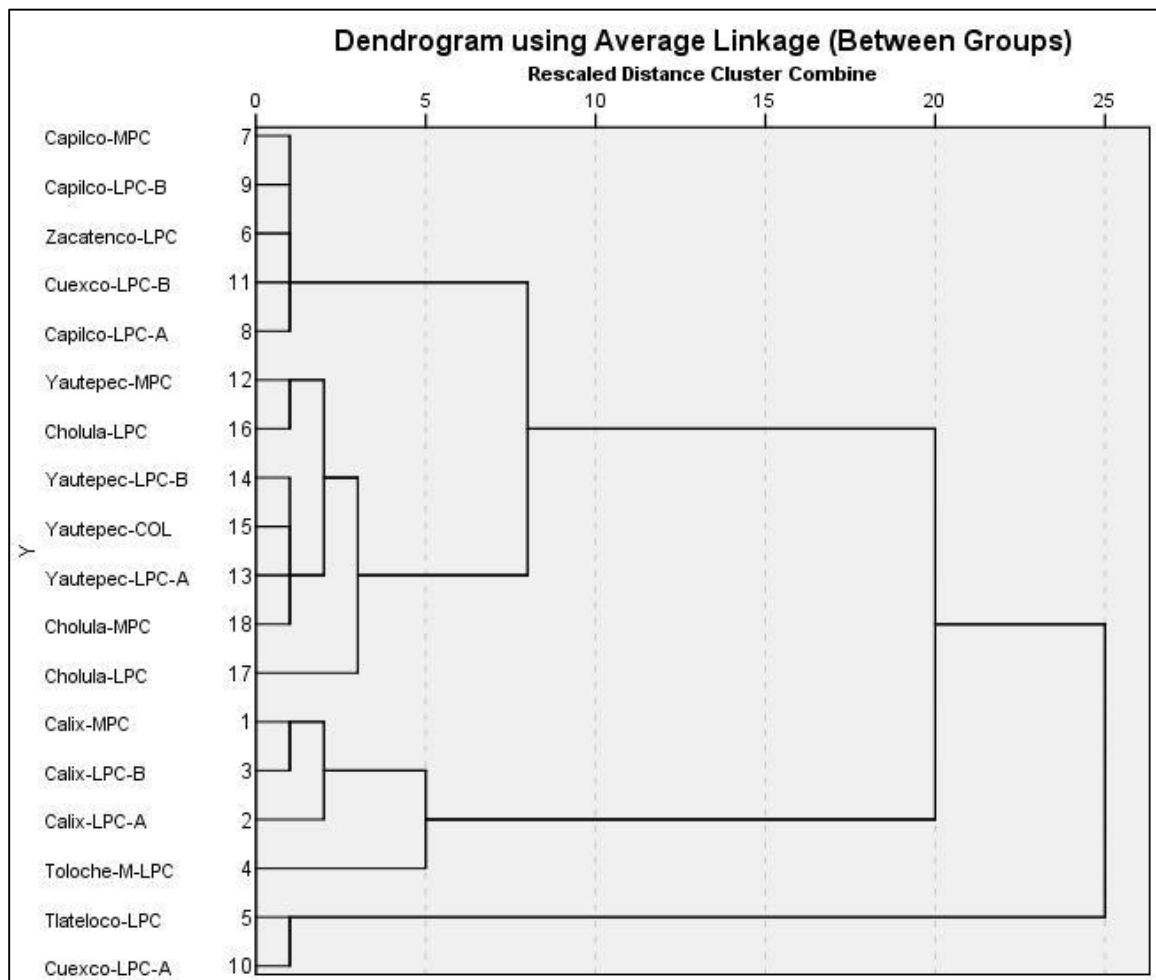


Figure 7.7 Hierarchical clustering results for functional censer forms at Calixtlahuaca and comparative sites, based on percentages of total sherd counts.

Taken together these analyses demonstrate a reasonably high level of variation in the use of various censer forms in Middle and Late Postclassic Central Mexico. While much of this variation is site or sub-region specific, there are general trends toward higher levels of sahumador use in the southern Basin of Mexico and Morelos, and higher levels of freestanding and/or scored censer use in the northern Basin and Toluca Valley. None of the individual Yata-phase household components at Calixtlahuaca have the higher sahumador frequencies characteristic of the southern Basin heartland of the Aztec Empire. Given the presence of regional variation in censer use, the consistency of censer use over time at Calixtlahuaca demonstrates an overall lack of adoption of Aztec practices, both at the sitewide and individual household levels.

Local and Imported Censers at Calixtlahuaca

As with the analysis of local and non-local figurines, the distribution of non-local censers at Calixtlahuaca provides an independent means of assessing the relationship between the adoption (or rejection) of non-local practices and non-local items. I assigned censer types to local and imported categories, based on two lines of evidence. First, I considered the INAA and petrographic sample results. I also considered the relative frequency and antiquity of each type within the Toluca Valley and surrounding areas, based on published data, on the premise that a type will likely be the oldest and probably the most common in its source region.

The specialized analysis samples (petrography and INAA) were not selected with ritual vessels as a primary focus. As a result, the frequency of samples roughly parallels their frequency within the assemblage as a whole, and some rarer types are not included

at all (Table 7.8, Table 7.9). Both types of analysis demonstrate that the majority of all censers recovered at Calixtlahuaca were locally produced. Interestingly, most censer types occur in a range of local paste variants, demonstrating that censers were not produced by a single subgroup of specialists. For three of these types, biconical censers, scored censers and local style sahumadors, there is no reason to think that they do not have a long history in the Toluca Valley. In addition to local sourcing results, all three types occur in all three phases at the Calixtlahuaca excavations and are commonly found in other Postclassic excavations in the Toluca Valley (Piña Chán 1981:101, 111; Romero Padilla 2015; Tommasi de Magrelli 1978; Vargas Pacheco 1975:235).

Type No.	Type	N.	Local			Aztec		S/SW		Un-known
			1	2	3	4	5	7	8	
267	Censer, Biconical	20	14					1		5
101/180	Censer, Scored	4	2	1	1					
262	Sahumador, Toluca	11	8		1					2
64	Sahumador, Texcoco	2	1							1
170	Censer, Other	4	2		1					1
<i>Total</i>		41	27	1	3	0	0	1	0	9

Table 7.8 INAA group results (1-9, Unknown) with regional affiliations (Local, Basin of Mexico, South-Southwest State of Mexico, Unknown) for censers and sahumadors, by project ceramic classification type

Type No.	Type	N.	Local					Aztec
			I-A	I-B	II	I-C	III	
267	Biconical Censer	12	5	2	1	2	2	
180/101	Scored Censer	5	1	1		2	1	
262	Sahumador, Toluca	2		1				1
170	Censer, Other	2				1	1	
<i>Total</i>		21	6	4	1	5	4	1

Table 7.9 Petrography group results with regional affiliations for censers and sahumadors, by project ceramic classification type

The assemblage includes two censer types with reasonable evidence of a possible non-local origin: Texcoco molded/filleted sahumadors and Other Censers. Texcoco sahumadors were represented by two sherds in the INAA analysis, but were not included in the petrography sample. Of the two INAA samples, one was actually assigned to the primarily local group and Calixtlahuaca and the other remained unassigned. This suggests that some examples of the type may have been locally produced, possibly by the same group which produced the Aztec Black-on-Orange pieces that were assigned to the local source groups. However, the broader temporal and spatial distribution of the ceramic type in Postclassic Central Mexico makes it clear that it is not local to the Toluca Valley. It first appears at Calixtlahuaca during the Ninupi phase (AD 1380-1450), and actually decreases slightly in frequency during the subsequent Yata phase. In the Basin of Mexico, the type is often attributed to the Late Aztec period (Parsons 1966:255-256), and there is no doubt that it reaches its highest frequency and extent during this period. However, an examination of well dated contexts at Chalco (Hodge 2008), Xaltocan (Brumfiel 2005b, chronology revised based on Overholtzer 2014), and in Morelos (Smith 2006a, 2006c) consistently show that the type first appears during the Middle Postclassic/Early Aztec period, clearly making it older in both of these regions than in the Toluca Valley. Once it appears in the Basin of Mexico, it remains in use until after the Spanish conquest. After Aztec Black-on-Orange, Texcoco-style Sahumadors are one of the more widespread Late Postclassic ceramic types, appearing from Morelos (Smith 2002), to the Gulf Coast (Garraty and Stark 2002; Ohnersorgen 2006; Venter 2012). The type also occurs in higher frequencies in the Basin of Mexico, accounting for about 2-2.5% of rim sherds at Basin of Mexico sites, compared to 0.2% of rim sherds at

Calixtlahuaca. As a result, it can clearly be considered a non-local type at Calixtlahuaca, though one whose original appearance predates the Aztec conquest of the site.

The second case, Other Censers, includes both a fairly uniform group of sahumador style censers with triangular cut-outs, red or white-on-red decoration, and strongly outflaring rims on the bowl (Figure 7.5 H), as well as an assortment of miscellaneous censer pieces that did not match any of the other defined categories of censers. As a result, I expected that any sourcing of the category was likely to include a fair amount of noise. However, with the exception of one unassigned INAA sample, all of the analyzed sherds for this type (4 INAA and 2 petrography) were placed into a local source or paste group. Not surprisingly, they include a wide range of local assignments. The dominant subgroup within the type does occur relatively widely in the Toluca Valley, though examples have also been found in other parts of Central Mexico.

Based on this evaluation of the stylistic origins and likely perceived cultural affiliation of each type of censer found at Calixtlahuaca, only Texcoco molded/filletted sahumadors can be considered a type with non-local affiliations. On a sitewide level, the average household frequency of Texcoco sahumadors rises from completely absent during the Dongu phase to low, but similar levels during the Ninupi and Yata phases. This increase parallels the generally increasing levels of imported goods from the Basin of Mexico between the Middle and Late Postclassic periods.

Given that this is a very rare type (<1%), there is also little change in the level of within-phase inter-household variation between the Ninupi and Yata phases. The type is present in four of six Ninupi components and five of six Yata components (Figure 7.8). The coefficient of variation shows a small decrease between phases, from .6 to .4,

indicating that insomuch as there is any change in inter-household variability, it is toward reduced variation over time. This reduction in variability is also supported by the fact that the only component with a value more than two standard deviations from the mean for these two phases is 316-Ph4, a Ninupi phase household.

In summary, the initial appearance and subsequent use of Texcoco molded censors at Calixtlahuaca is not correlated to the Aztec rule of the site. The censors appear prior the Aztec conquest of the site, and do not differ dramatically in frequency or inter-household distribution between the Ninupi and Yata phases.

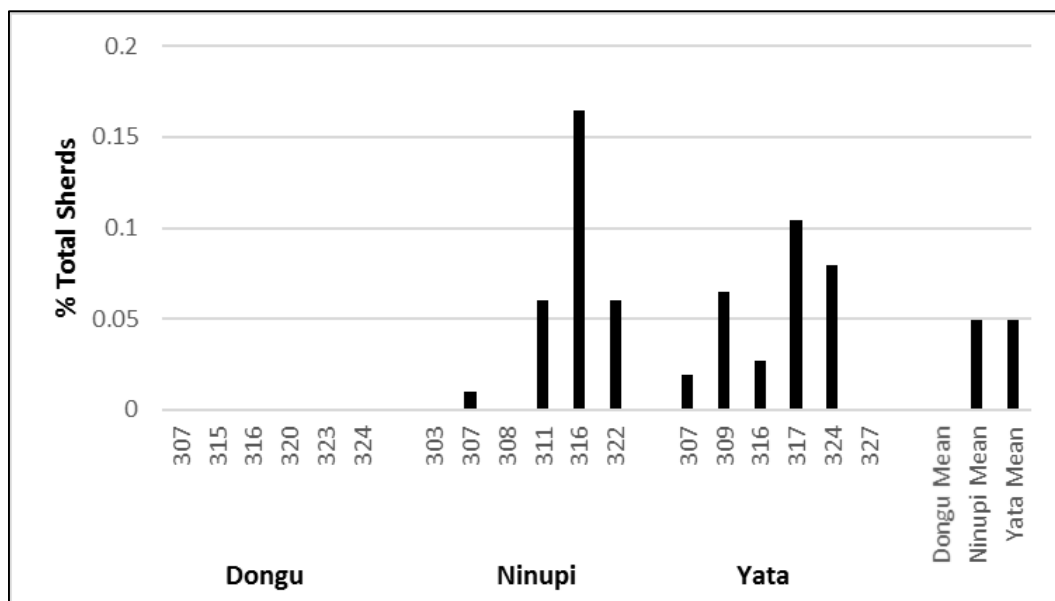


Figure 7.8 Frequency of Texcoco Molded-Filleted Sahumadors at Calixtlahuaca as a percentage of total sherds, by household component

Censer Analyses: Results

The analyses of censers pertain primarily to the first two of the three questions presented for this chapter: the degree of local variation and its relation to rulership strategies, and the degree to which prior patterns of use and variation changed under Aztec rule. As the answers to these two questions demonstrate that there was little change over time, the third question for the chapter, concerning the specific causes of variation, does not apply.

First, in terms of local variation, censer use at Calixtlahuaca was relatively homogenous during the periods when the site was under local rule, indicating that censer-based ritual was likely integrative at a community level. Based on censer form categories, there are no strong, ongoing divisions in censer use at the site which might correspond to multiple social identities. The level of intra-phase variation remains relatively steady between the Dongu and Ninupi phases. When a new, imported censer type, the Texcoco sahumador, was introduced at the site during the Ninupi phase, it appeared in the majority of the households for the phase, indicating widespread access to and interest in the type. However, total sahumador frequencies for the Ninupi frequencies are comparable to those from the preceding Dongu phase, indicating the imported Texcoco sahumadors were likely simply used to replace some local versions of the same functional censer form. The high degree of interhousehold similarity over time, including in the adoption of a new type, supports the argument for a relatively collective form of local governance at Calixtlahuaca prior to Aztec rule.

Second, in terms of changes under Aztec rule, incorporation into the empire also produced little change in censer use at Calixtlahuaca. Despite the presence of regional

variation in censer use in Postclassic Central Mexico, the Yata phase overall sitewide frequencies of functional censer categories at Calixtlahuaca remain comparable to those from both preceding phases at the site. Additionally, the levels of interhousehold variation in both censer form and use of imported censers remain comparable during the Ninupi and Yata phases. The appearance of Texcoco *sahumadors* prior to the Aztec conquest and their integration into local patterns of censer use strongly suggests that their adoption was on local terms, for local practices, rather than evidence for the spread of any sort of state cult. The overall lack of change in censer use under Aztec rule is consistent with both relatively indirect rule by the Aztec Empire, and the continuation of relatively collective local practices.

Conclusions

In this chapter, I looked at the evidence for the social organization of local and Aztec rule at Calixtlahuaca through changes in ritual practices over time. My analyses focused on three questions introduced at the beginning of this chapter: the pre-Aztec organization of rule, based on the trajectory of change and degree of inter-household variability, the Aztec organization of rule, also based on the trajectory of change and variability, and whether the observed Aztec-rule patterns better correspond to models of local emulation or the arrival immigrants from the Aztec core.

		Figurines			Censers		
		Total Quantity	Imported pieces	Subject Matter	Total Quantity	Imported pieces	Form category
Dongu-Ninupi							
	Shift toward Basin-pattern	No shift	No shift	No shift	No shift	Modest increase	No shift
	Evenness of variation	low variation both phases	Low variation both phases	Low variation both phases	Low variation both phases	Moderate unevenness	Low variation both phases
Ninupi-Yata							
	Shift toward Basin-pattern	Moderate shift	Moderate increase	Moderate-high shift	No shift	No further increase	No shift
	Evenness of variation	Increased variability	No increase in variability	No increase in variability	Low variation both phases	No further increase	No shift

Table 7.10 Summary of results of analyses of ritual practices showing shifts in interhousehold variation and local vs. Basin of Mexico cultural patterns under local and Aztec imperial rule

I analyze two particular forms of ritual objects, figurines, which are relatively low visibility and used primarily within households, and censers, which are higher visibility and used in both household and community level ritual settings. The results of these analyses are summarized in Table 7.10. Due to the lower visibility of figurines, I expected them to reflect more pronounced cultural changes than those that would be reflected in censer use. I also employed a dual consideration of both use of non-local goods, and the use of non-local practices. People may adopt foreign items but integrate them into local practices. An adoption of both objects and practices suggests a higher degree of interaction between cultural groups and contexts of display where foreign use-knowledge matters.

First, in terms of local variations prior to Aztec rule, ritual practices at Calixtlahuaca were both relatively similar among households and relatively similar over time. They were also distinctive relative to ritual practices from contemporaneous sites in

adjacent regions of Central Mexico, for both of the artifact types studied. The total quantities of both figurines and censers used by households are statistically equivalent between the Dongu and Ninupi phases. There are minor changes in figurine content between these two phases, but no significant changes in the relative proportions of major functional classes of censers. One non-local censer type, the Texcoco molded/filleted *sahumador*, first appears at Calixtlahuaca during the Ninupi phase, but the overall lack of change in total *sahumador* frequencies suggests that it was simply replacing local *sahumadors* in preexisting local contexts of use. Interhousehold variability is also relatively low for both households during both time periods, both in terms of practices and access to foreign goods. The same functional subtypes (figurine subjects, censer forms) dominate almost all household assemblages during these two periods. Similarly, overall access to non-local goods (Aztec-paste figurines, Texcoco censers) shows a small increase between the Dongu and Ninupi phases, but the increases are relatively evenly distributed across households within the Ninupi phase. This high degree of inter-households similarly within and between phases is consistent with a relatively collective form of local governance prior to the Aztec conquest of the site, particularly one which used collective participation in public ritual as a socially integrative force.

Second, in terms of changes under Aztec rule, the Aztec conquest and rule of Calixtlahuaca produced changes in figurine use at the site, but few changes to censer use. During the Yata phase, there is a significant increase in the average household frequency of figurines at the site, bringing them into line with the frequencies seen in other regions of Central Mexico, and an overall shift toward figurine subject matter more similar to that seen in other regions of Central Mexico. However, these shifts toward a more Aztec

pattern of figurine use are unevenly distributed among households; there is also an increase in the variation among households in the total quantity of figurines, and the proportion of Aztec paste figurines. This suggests that some (particularly 307-Ph6 and 309-Ph6), but not all, households at the site were adopting more characteristically Aztec practices of figurine use, accompanied by an increased use of imported figurines. In contrast, the total quantities of censers, the relative importance of different functional censer classes, the frequency of imported Texcoco *sahumadors*, and the amount of within-phase variation among households all remain consistent with those seen during preceding phases at the site. This contrast between the changes in figurine use and the lack of changes in censer use provides an interesting interpretive issue. The continuation of local practices of censer use, with their high internal homogeneity, suggests the continuation of relatively collective local practices of public ritual. The continuity of censer use is also consistent with relatively indirect rule by the Aztec Empire, with no effort to enforce widespread public participation in new imperial rituals. In contrast, the uneven changes in figurine use, which has been previously argued to have few ties to state religion, suggested more bottom-up reasons for the adoption of non-local practices in this area.

Third, in terms of specific causes for the cultural changes observed under Aztec rule, the changes in ritual practices observed under Aztec rule are most consistent with limited immigration from the Aztec core to Calixtlahuaca. The presence of non-local cultural practices in lower visibility domains (figurines), paired with the presence of apparently local practices in higher visibility domains (censers) is consistent with a “hidden immigration” pattern, where immigrants downplay their foreignness in public

settings. This pattern is characteristic of cases where immigrants are a late-coming minority arriving into an area and are at a power disadvantage relative to the larger host population. If this is the case at Calixtlahuaca, it remains consistent with an argument of strongly collective local institutions persisting under relatively indirect Aztec rule.

CHAPTER 8. “THE PRINCIPAL FOODS OF THESE WERE TAMALES, BEANS¹⁰”: CULTURAL CHANGES IN FOODWAYS

In this chapter I continue the discussion of change or continuity in cultural practices at Calixtlahuaca, using evidence from a variety of food preparation and serving practices. Particular rulership strategies have implications for both the diversity and potential for change in cultural practices. The directness of rule primarily relates to the magnitude of cultural change. More direct rule results in more interaction between the core and provincial areas, as well as increasing the probability that the use of imperial-style objects or practices will confer benefits in local interactions with imperial agents. The collectiveness of local and imperial rule both have implications for the degree of interhousehold variation in cultural practices, with more collective organizations of power being more likely to produce widely shared practices among households, especially public practices.

The biological necessity of eating, combined with the high diversity of potential foodstuffs and food preparation techniques, means that food can be an important component of creating and maintaining identities. The food preparation and serving practices of the Toluca Valley diverge noticeably from those associated with the Basin of Mexico during the Postclassic. As with the ritual activities discussed in the previous chapter, foodways include both private/low visibility aspects and public/high visibility

¹⁰ Florentine Codex: A General History of the Things of New Spain. Book 10: The People. Chapter 29, Section “The Quaquata, The Matlatzinca, The Toloque”.

aspects. The former are more likely to be a result of enculturation, while the latter are more likely to be subject to active manipulation. More specifically, I compare low visibility aspects of food preparation with high visibility aspects of food serving. I first examine food preparation techniques, with a focus on various ways of consuming maize, using ground stone and ceramic cooking vessel assemblages. These data are then compared to household variation in serving vessel form and decoration, based on the decorated portion of the ceramic assemblage from the households under study. I examine whether households with higher frequencies of imported ceramics are also choosing to use these ceramics in functionally different ways, as these are different dimensions of identity formation (See Mills 2016 for an example of different scales of interaction in different visibility levels of food-related practices)

The results of this chapter generally follow the same patterns seen in the preceding chapter on ritual practices. During the Dongu and Ninpui phases, households at Calixtlahuaca have relatively homogenous food preparation and serving practices, which can be distinguished from those characteristic of other parts of Central Mexico. During the Yata phases, both food preparation and serving practices shift toward patterns more characteristic of the Basin of Mexico, but these changes are highly unevenly distributed among households. Based on the distinction between low- and high-visibility practices, Yata phase households at Calixtlahuaca include cases of local identity maintenance (324-Ph6 and 327-P6), local emulation of Aztec practices (316-Ph6 and 317-Ph6), and either very strong cases of local emulation or ethnically mixed households (307-Ph6 and 309-Ph6). These results are most consistent with relatively collective local rule, paired with relatively indirect and non-collective Aztec imperial rule.

Food and Identity

The saying that “you are what you eat” is true on multiple levels. At its simplest, the phrase recognizes the basic biological conversion of food into human tissue and energy. However, the saying is true on an additional level, because eating is also a cultural practice. Anthropology has long recognized this, with several classic works dealing with foodways (e.g. Bourdieu 1984; Lévi-Strauss 1969). What we eat, how we prepare it, when we eat and who we eat with are all powerful markers of identity (Mintz and Du Bois 2002). Food can be used to mark a wide range of facets of identity, including ethnic or religious affiliation, gender, age, social status, and wealth (Johnson, et al. 2011; Jones 2007; Twiss 2012).

People use foodways – either what is eaten or how it is eaten – as identifiers for a variety of levels of group identity. Even at a band level of organization, many groups identify subgroups or out-groups by what they eat – piñon eaters, rabbit people, seed eaters, and so on (Steward 1938). This trend is also present in more complex societies, where dietary practices may continue to form an important component of group affiliation, such as kosher food laws in Judaism (Rosenblum 2010). In 20th century California, the archaeological remains of Chinese and European households can be distinguished by differences in the ways that they cooked the same raw foods (Langenwalter 1980). In pre-colonial India, regional cuisines remained highly distinctive, despite wide similarities in other cultural practices (Appadurai 1988). Similarly, foodways at the Peruvian site of Pedregal remained similar over time, despite economic shifts resulting from rule by the Chimú Empire (Cutright 2015). On the other side of the

food-and-empire relationship, during the Roman period, the distribution of a number of non-native plants across northern Europe closely matches the boundaries of the Empire, and they are rarely found outside of military or urban contexts (Livarda 2011). In Colonial Central Mexico, Sahagun's Nahuatl informants used food practices as an identifier of ten of the fifteen other cultural groups that they described for him (Berdan 2008). While these answers may have been solicited by a specific question about culinary practices, they still demonstrate a body of commonly held beliefs about the foodways of the "other" in the Aztec world.

Food practices may also mark variation within an ethnic group, such as age or gender. Many groups prohibit certain foods or involvement in certain food preparation practices to individuals of certain genders or life stages. For example, there are widespread taboos against what a new mother should or should not eat (Piperata 2008). Even in cases where such norms are not formalized as taboos, they often still exist as customary practice. In several Mesoamerican cases, bone chemistry shows differences in diet between men and women in the same population (White 2005). In Aztec society, excessive pulque (alcohol) consumption was limited to the elderly (Mendoza 1992 [1541]f. 71r).

Foodways may also mark wealth or status. Wealthy individuals are able to afford a wider diversity of food items and a higher frequency of foods of high nutritional or cultural value. In addition, wealthier individuals may also be able to invest more in elaborately prepared foods. In cases where wealth and high status overlap, the consumption of such highly valued or elaborately prepared foods may form an important part of demonstrating and maintaining one's status. In Mesoamerica, various lines of

evidence comparing elites and non-elites often show that elites consumed more meat and/or maize (Lentz 1991; Somerville, et al. 2013).

In addition to marking identities, food can serve as a means of manipulating or creating aspects of identities. The most well studied example of this is feasting, where the competitive feeding of others serves as a means of gaining status (Perodie 2001; Wiessner 2001). Feasts cover a spectrum from inclusive communal events characterized primarily by the quantity of food, to exclusive events distinguished by the elaborateness of the food (van der Veen 2003). Both extremes are means of creating of identities, though the type of identity being marked is quite different. The degree of inclusivity in feasting events corresponds well to the degree of collectiveness of rulership, with socially inclusive rulership strategies requiring widespread food provisioning during feasting events (Carballo 2015). In other scenarios, the relationship between food and identity can cause immigrants to adopt aspects of the cuisine of their host culture (Bradby 1997), or lower social classes to adopt dishes or cooking techniques from higher classes (Miller 1985).

Mesoamerican Foodways

In Mesoamerica, archaeologists are beginning to explore food as a means of expressing identity and most extant work focuses on food as a status marker in the Maya region or on feasting as a means of social advancement (e.g. Green 2010; Hendon 2003; Turkon 2004; White 2005). The following section describes previous work in

Mesoamerica on variations in general food consumption practices and dietary use of maize more specifically.

There is widespread within-site variation in food choices in highland Mesoamerica by the Classic Period. Most research to date has investigated dietary differences based on status, usually between commoners and elites. While status is undoubtedly an important factor in foodways, the lack of investigation of other variables means that the relative weight of status in food choice cannot be assessed at this time. At Formative-period Cahal Pech, and Classic-period Lamanai and Altun Ha, isotope studies of human remains from commoner and elite burials show status-based differences in the amounts of maize and types of protein consumed (White, et al. 2010). At Classic-period El Palmillo, faunal remains vary between households and some, but not all, of the variation correlates to other indicators of household wealth (Haller, et al. 2006). At Classic-period Copan, paleoethnobotanical remains show that higher-status households had access to a greater diversity of plant resources (Lentz 1991).

Despite this variation, maize in many forms serves as the backbone of the Mesoamerican diet. The first domesticated maize appears in Mesoamerica around 5500 BP (radiocarbon years), and was widely dispersed across the entire cultural region by 2500 BP (Blake 2010). While there are no existing isotope studies of the importance of maize in Postclassic Central Mexico directly, studies from the Maya region for the Postclassic (White 2005), and earlier time periods in Central Mexico (White, et al. 2004:184), demonstrate that maize was a major component of the diet across Mesoamerica. While maize might be heavily supplemented by manioc in lowland environments (Pope, et al. 2001; Sheets, et al. 2012) or by maguey products in arid,

highland environments (Evans 1992; Parsons and Darling 2000), such cases occur only where maize cultivation is less than environmentally ideal. This overall emphasis on maize corresponds well with an early colonial quantification of native children's food intake as increasing numbers of tortillas a day (Mendoza 1992 [1541]:f. 58r-60r), equating food with maize. This high dependence on maize produced a proliferation of ways of consuming the grain, including a wide variety of gruels, stews, tamales, and tortillas, at least some of which were described as characteristic of particular cultural groups. Changes in maize products are particularly archaeologically useful, because the production of several different end product food types may be visible archaeologically.

The Basin of Mexico and the Toluca Valley show only minor differences in the types of food crops that were consumed, but a wider divergence in how these crops were prepared. This is visible in both ethnohistoric documents, and the archaeology of the two regions. The Florentine Codex includes two passages on foodways specific to the Toluca Valley. The first is a general mention that strong pulque was considered characteristic of the area. The second is a longer quote about food and crops in general. "Nothing grew in the land of these Quaquata; only maize, beans, amaranth; no chili, no salt. The principal foods of these were tamales, beans; also their principal drink was fruit atole. Popcorn was produced right there in their land" (Sahagún 1950-82:Book 10: The People. Pp 182-183). Archaeologically, the Toluca Valley is characterized by a general lack of comals, supporting the written assertion that the region consumed maize as tamales rather than tortillas. This is in direct contrast to most other parts of the Central Mexican highlands, where comals make up at least 10% of domestic ceramic assemblages. In addition, the Toluca Valley has a longstanding tradition of decorated ceramic jars, which are quite rare

in the Basin of Mexico, suggesting differences in food serving practices. During the Yata phase at Calixtlahuaca, there are some shifts in food-related practices toward a more Basin of Mexico pattern. These changes are unequally distributed across households and investigation of their patterning makes up much of the analyses in this chapter.

Questions for Calixtlahuaca

As presented in the previous chapter, I frame my interpretations of the changes in these forms of material culture around three questions about local rulership strategies, Aztec rulership strategies, and possible explanations for the particular patterns of cultural change seen under Aztec rule.

1. *Pre-Aztec Cultural Diversity and Collectivity of Rulership:* How culturally diverse were households at Calixtlahuaca prior to the Aztec conquest of the site? More collective forms of social organization should generally produce more homogenous cultural identities, particularly in high-visibility practices and material culture. If there is substantial cultural variation at the site, I expect to see distinctive clusters of specific types of material culture, representing ethnically specific cultural practices, dividing the household components into two or more distinctive groups during multiple phases.
2. *Overall changes resulting from Aztec rulership:* What was the overall degree of cultural change at Calixtlahuaca following the Aztec conquest of the site and does

it likely relate to imperial rulership strategies? The magnitude of change toward activities more characteristic of the Basin of Mexico is a product of the directness of rule. The evenness of the distribution of any such changes among households measures the degree to which locally collective institutions persisted or formed under Aztec rule.

3. *Causes of changes under Aztec rule:* Can the mechanisms of cultural change in particular households be explained as either local emulation or foreign immigration? Cases of emulation are expected to be visible as the appearance of Aztec material culture primarily in high visibility contexts, conforming to the “Local Emulation” pattern. In contrast, cases of migration will be visible as the appearance of specific households featuring Basin of Mexico style household practices (and associated material culture) in low visibility contexts. These households may also use Aztec-style material in high visibility contexts, but this is not required to demonstrate the presence of immigrants. As a result, households in this category may conform to either the “Hidden Migration” or “Site Unit Intrusion” patterns of low and high visibility material culture.

Maize Preparation Practices

Maize processing is a low visibility activity. It occurs primarily within the household, for use within the household. It is a multi-step process, but the effects of prior

stages are not usually directly visible in the finished product. I examined maize grinding practices, which are likely to be almost completely enculturative, and cooking methods, which are a product of the desired form of maize consumption.

Because maize processing techniques have remained remarkably consistent since the Spanish conquest, a combination of historic (Landa 1941; Sahagún 1950-82) and ethnographic documents (González 2001; Pennington 1963; Tozzer 1907; Vogt 1969) can be used to create operational sequences and potential archaeological correlates for five maize products: pinole, posole, atole, tamales, and tortillas. These products do not represent the entire range of ways in which maize is consumed; the Tenejapa Tzeltal recognize thirty-two named maize foods (Stross 2010:205-206), and Fournier identifies seventeen possible forms of maize consumption (1998:20-21). They do, however, cover the most widespread, frequently consumed, and non-seasonally dependent choices of maize preparation. It should be noted that regional usage of the Spanish labels I am using is rather variable and that some terms (particularly atole) may be used in the literature to refer to a much wider range of products than I use them to describe here.

Like any multistep process involving learned skills, maize (or any other food) preparation practices can be viewed as a *chaîne opératoire*. A *chaîne opératoire*, or operational sequence, is the series of operations which transforms a substance from a raw material into a manufactured product (Cresswell 1976). It incorporates both physical and cultural constraints on manufacture and sees the resulting item as a combination of the interplay between the two (Lemonnier 1993). The reconstruction of an operational sequence allows the investigator to determine the allowable degree of variation within the production process, on a step by step basis. While in archaeology most commonly

applied to studies of lithic reduction (e.g., Sellet 1993), the concept is equally applicable to any process of manufacture involving decisions among possible alternatives. Jennings et al. (2005) provide a useful application of the chaîne opératoire concept to the study of food production in their comparison of the brewing methods of various ancient forms of alcohol. Because it incorporates both physical and social constraints, this method is highly suitable to address the linked social and technological sides of food production.

Each of the five maize products presented above can be seen as the result of a combination of three processing decisions: whether to soak the corn in an alkaline solution (nixtamalization), how finely to grind the corn, and what cooking methods to use (boiling, steaming, or toasting) (Figure 8.1). Each decision stage is indicated by potential archaeological markers.

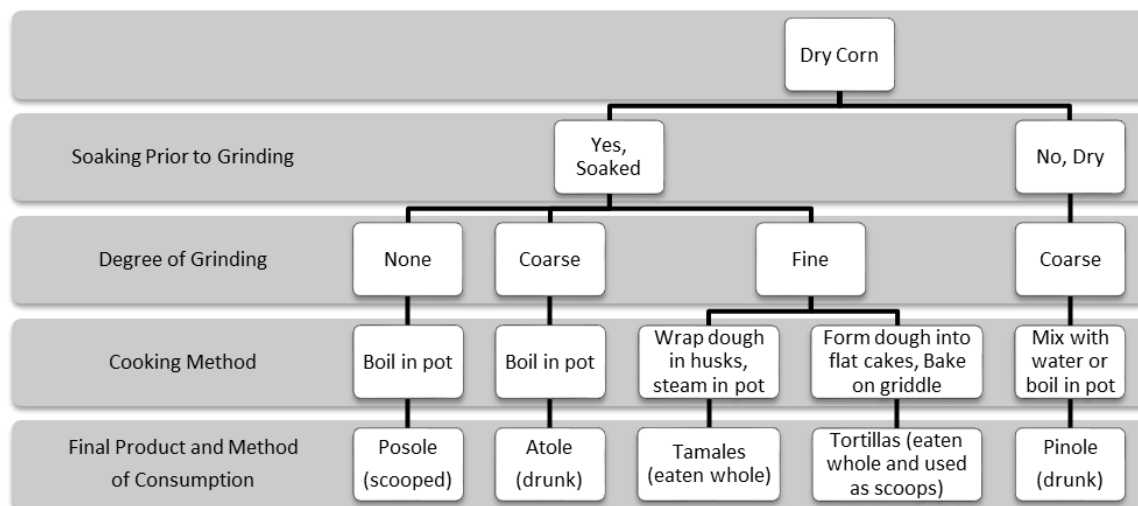


Figure 8.1 Stepwise processing decisions for five common maize foods

The first decision is whether to soak the corn in an alkaline solution. The practice of nixtamalization involves soaking dry corn kernels in an alkaline (usually lime or ash

based) solution to soften them and increase the availability of certain amino acids. This process may be archaeologically identifiable as a shift from basin metates, which are more efficient for grinding hard seeds, to legged metates, which are more useful for grinding soft or oily items (Adams 1999; Biskowski 2008). Legged metates are nearly ubiquitous in ethnographic studies of Mesoamerican households, and the only type still documented to be in production today. A single metate may last for more than one generation, even if in daily use, so stylistic change may be slow.

The second decision is how fine to grind the corn grains. It has been proposed that an increased fineness of grinding may be identifiable as a reduction in mano weight (either as thinner simple manos, or as thin manos with bulbous, overhanging handles) as means of reducing fatigue over extended periods of grinding (Biskowski 2000) , but this association has not been well established to date. Grinding choices range from no grinding for posole, to coarse grinding for atole or pinole, to medium grinding for tamales, to very fine grinding for tortillas. It should be noted that increasing fineness is primarily a result of increased grinding, rather than grinding differently.

The third decision is how to cook the corn. Boiling and steaming both involve the use of large cooking pots. In contrast, toasting requires a relatively unique vessel form, the comal or tortilla griddle. The distribution of comals is highly variable across time and space in Mesoamerica. While first appearing in the Oaxaca Valley during the Formative period, there were still large portions of West Mexico and the Maya lowlands that had not adopted the use of the comal prior to the Spanish conquest (Fournier Garcia 1998). There is no archaeological evidence for the use of stone baking surfaces, such as the piki stones of the southwestern United States.

Based on the decision-making process for maize foods described above, I use three indicators relating to maize processing decisions – overall quantities of ground stone, variation in mano form, and specific cooking vessel frequencies - to investigate changes in food processing and preparation at Calixtlahuaca. I use the overall ground stone frequencies and variation in mano form to address the second decision in maize processing – the fineness of grinding. I then use ceramic data on the frequency of comals and jars to address the third decision in maize processing – cooking method. For each of these lines of evidence, I consider the general direction of artifact frequencies at Calixtlahuaca, the interhousehold variation over time, and the similarity or difference of the assemblage at Calixtlahuaca compared to other sites in Central Mexico. Due to the small number of metates recovered at Calixtlahuaca, and the near ubiquity of wet-grinding in Postclassic Central Mexico, I do not investigate variation or temporal patterning related to the first decision making step.

Ground Stone

The dataset for ground stone analysis consists of mano and metate type counts and descriptions (Mortensen n.d.). While the project recovered a wide range of ground stone artifacts, only those relating to the grinding of food are discussed here. Because ground stone is a rare category, this analysis uses the DS-2 sample. I evaluate both the total frequencies of grinding tools, and more specific aspects of mano forms.

This expanded household sample includes 47 mano and 21 metate fragments. Grinding tools were recovered for 13 of the 18 contexts under consideration, and the dataset is summarized in Table 8.1. Stone grinding tools (manos and metates) occur at an

average frequency of about 1 per 2,580 sherds. Two of the four components where no grinding stones were excavated have far fewer than this number of sherds and the remaining three are in the bottom half of component sizes, suggesting that the lack of grinding tools in these units may be due to sample size rather than true absence.

Unit	Phase	N. Sherds	Metates	Manos	Grinding Stones/ 1000 sherds
307	Dongu	5,810			0.00
315	Dongu	16,775		5	0.30
316	Dongu	4,710	1	1	0.42
320	Dongu	12,189	3	1	0.33
323	Dongu	26,947	1	3	0.15
324	Dongu	914	2	5	7.66
303	Ninupi	9,043	2	3	0.55
307	Ninupi	22,330	3	2	0.22
308	Ninupi	4,359			0.00
311	Ninupi	7,838		1	0.13
316	Ninupi	22,563	1	5	0.27
322	Ninupi	1,855			0.00
307	Yata	10,257	3	6	0.88
309	Yata	4,217		2	0.47
316	Yata	10,091	3	4	0.69
317	Yata	10,860	2	9	1.01
324	Yata	3,438			0.00
327	Yata	1,266			0.00
Dongu Average					1.48 (.24) ^a
Ninupi Average					0.20
Yata Average					0.51
DS-2, All Phases			21	47	0.73 (.32) ^a

^a Including (Excluding) component 324-Ph2

Table 8.1 Mano and metate counts and frequencies per 1000 sherds by household component at Calixtlahuaca, DS-2 Sample

The average frequency of grinding tools drops dramatically from the Dongu phase to the Ninupi and Yata phases, but this is caused by 324-Ph2, a highly anomalous context (Table 8.1). (The reasons for high groundstone levels in this component have been previously discussed in Chapter 6.) If this context is excluded, the average grinding tool frequency is not significantly different (t-test of means, .90 level) between the Dongu and Ninupi phases. The differences between either of the first two phases and the higher Yata phase values are statistically significant at the .90 level, if small components (<2,500 sherds) are excluded. This latter pattern of comparable values during the Dongu and Ninupi phases, followed by an increase during the Yata phase is consistent with the results of ground stone frequencies in the broader, all phaseable contexts DS-3 sample, indicating that it is a more accurate representation of general temporal trends at the site. The range of variation in grinding tool frequencies among households (excluding small components) is relatively similar between the Dongu and Ninupi phases, before increasing during the Yata phase.

The overall frequencies of grinding stones at Calixtlahuaca and their increasing frequencies over time both conform to broader Central Mexican patterns (Table 8.2). The total range of variation in ground stone values seen over the course of Calixtlahuaca's occupation falls within the range seen in other regions of central Mexico. There do not appear to be regional trends in grinding stone frequencies; instead the primary axis of variation is urban/rural, with urban sites (Yautepec, Chalco) having lower frequencies of grinding stones. While the relatively small number of comparative sites makes any broader patterns of ground stone use over time somewhat tentative, it appears that there is a general trend toward increasing frequencies of grinding stones over the course of the

Postclassic. Given the broad intra-regional variation in grinding stone frequencies, as well as the macroregional trend toward increasing grinding stone use over time, the increases at Calixtlahuaca are more likely part of broader regional shifts toward more intensive maize-grinding than a conscious adoption of a specific non-local pattern of maize processing.

Site	Phase	N. Manos	N. Metates	Total GS	GS/100 Rims	GS/1000 Sherds	Source
<i>Toluca Valley</i>							
Calixtlahuaca	MPC	15	7	22	0.34	0.33	
Calixtlahuaca	LPC-A	11	6	17	0.23	0.25	
Calixtlahuaca	LPC-B	21	8	29	0.63	0.72	
Cerro Toloche	LPC	13	3	16		1.20	Jaramillo & De la
<i>Basin of Mexico</i>							
Cihuateopan	LPC	31	11	42		0.43	Peña 2012, p. 27, 59 Evans 1988, Table 1.2
Chalco	PC	3		3	0.05		Hodge 20008, Table B-3
<i>Morelos</i>							
Yautepec	MPC	4		4		0.07	Smith 2006a, Tables
Yautepec	LPC-A	17	5	22		0.17	C5-1,3
Yautepec	LPC-B	108	23	131		0.20	
Yautepec	COL	1		1		0.12	
Capilco	MPC			0		0.00	Smith 2006b, Tables
Capilco	LPC-A	13	2	15		0.85	B5-1,2,5,6
Capilco	LPC-B	12	5	17		1.04	
Cuexcomate	LPC-A	30	17	47		0.74	
Cuexcomate	LPC-B	59	25	84		0.48	

Note: Postclassic Central Mexican sites have approximately 1/10 rim-to-total sherd ratios, so the grinding stones per total sherds and grinding stones per rims are offset by a factor of ten to produce equivalent values between the two data types

Table 8.2 Grinding stone frequencies at Calixtlahuaca and comparative central Mexican sites

Manos. In addition to the general frequency of grinding stone, more specific attributes of manos can also be used to provide information about the intensity of maize processing. Manos, the mobile half of a pair of grinding stones, can be used to examine the fineness of grinding. There are two potential variables of interest related to the fineness of grinding: the form and thickness of the mano. In addition, I also consider the cross section of the manos, as this is a product of grinding practices, and may be a habitus-derived variable.

Regional comparisons of the Calixtlahuaca manos with those found at other Postclassic sites in Central Mexico are primarily subjective. This is due to the lack of sites with either adequate samples or comparably coded data. Both of the best analyzed collections of grinding stones in the Basin of Mexico are from sites with issues of temporal mixing, Otumba (survey collection) (Biskowski 2000), and Cerro Portezuelo (reconstructed historical excavations) (Biskowski and Watson 2013), which is why they are not included in the excavation-based frequencies in Table 8.2. These studies do provide a baseline for identifying the most common forms of manos and metates in the Basin of Mexico during the Middle-Late Postclassic period – legged metates and handled manos. However, they also likely underestimate the amount of variability in Middle-Late Postclassic grinding tool assemblages, as less finely finished pieces may be assigned to other chronological periods. The ground stone in Smith’s Morelos excavations are coded comparably to the data from Calixtlahuaca, but show very different distributions for all mano-related variables, meaning that comparisons divide the cases regionally (Smith 2006a, 2006c).

The general form of mano fragments was coded based on end form, with potential states ranging from no differentiation between the end and body, to differences in wear but not shape, to overhanging handles resulting from wear, to intentionally shaped handles (Figure 8.2, A-E).

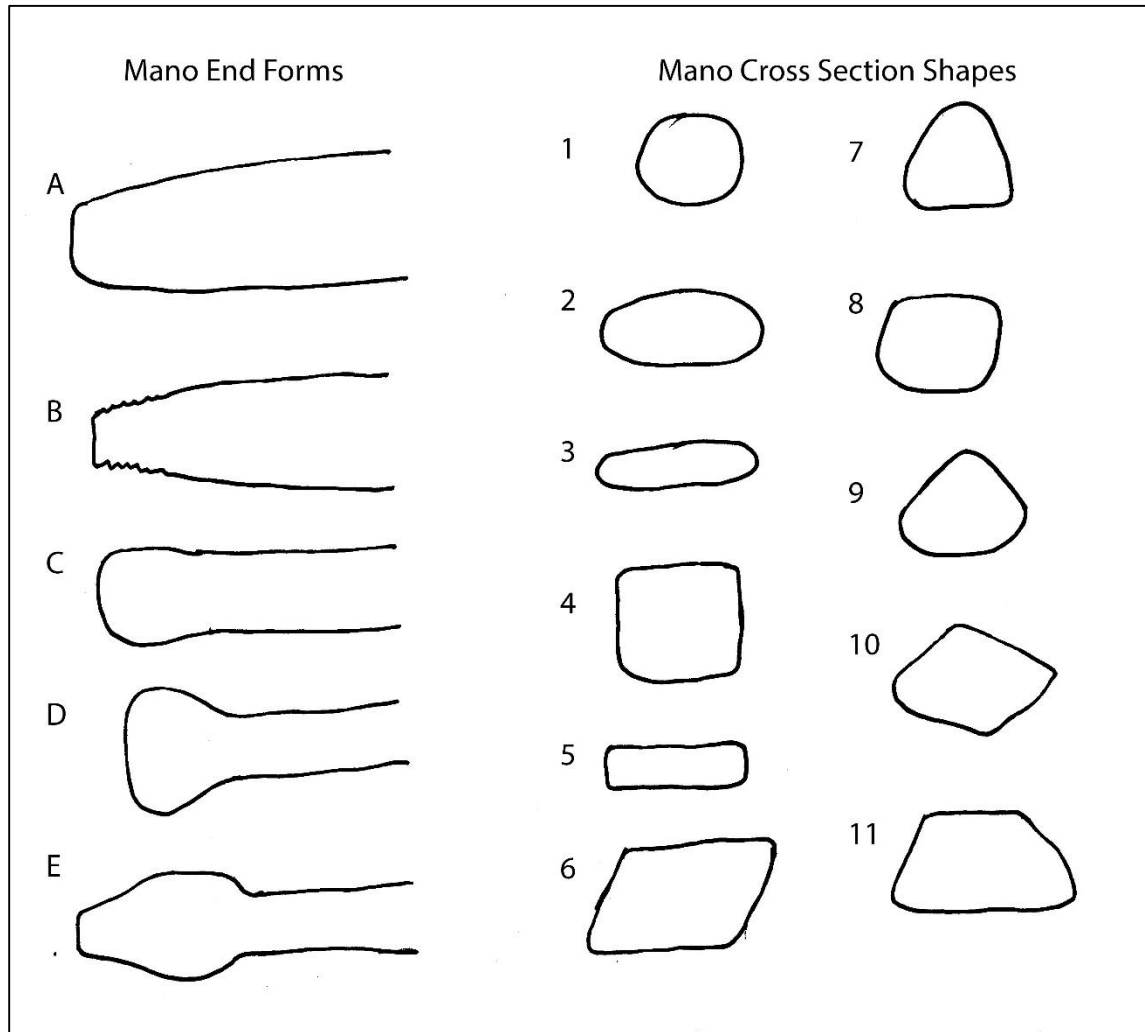


Figure 8.2 Mano handle (A-E) and cross-section (1-11) forms

At Calixtlahuaca, mano handle form shows very little variation (Table 8.3). Handle form could not be identified for 48% of mano fragments, primarily because they were medial sections. Of the remainder, the overwhelming majority in all phases are simple manos (A), with no visible transition in shape or wear between the handle and body. No manos had intentionally shaped handles, and only two examples show the pronounced overhang resulting from grinding with a mano wider than the metate.

Unit	Phase	Total	Unkn.	Handle Form		
				A	B	C
315	Dongu	5	2	3		
316	Dongu	1	1			
320	Dongu	1		1		
323	Dongu	3	2	1		
324	Dongu	5		5		
303	Ninupi	3	3			
307	Ninupi	2	2			
311	Ninupi	1	1			
316	Ninupi	5	1	2		2
307	Yata	6	4	2		
309	Yata	2	1		1	
316	Yata	4	2	2		
317	Yata	9	8	1		
Dongu		15	5	10		
Ninupi		11	7	2		2
Yata		21	15	5	1	

Table 8.3 Mano handle forms by household component at Calixtlahuaca, DS-2 sample. See Figure 8.2 for illustrations of handle forms.

This is in direct contrast with sites in the Basin of Mexico and Morelos, where mano forms E, and to a lesser extent C and D, are considered characteristic of the Middle-Late Postclassic (Biskowski 2000; Smith 2006c). In the previously mentioned

studies from Morelos, only these three latter forms were recorded. In a chronologically mixed Epiclassic-Postclassic ground stone assemblage from Cerro Portezuelo in the Basin of Mexico, approximately half of the manos have pronounced overhangs (Biskowski and Watson 2013).

Width (the larger of the two cross-section dimensions) and thickness (the smaller of the two cross-section dimensions) averages by phase show no consistent patterning (Table 8.4). The coefficient of variation for width drops steadily over time, primarily due to a decreasing standard deviation. However, the coefficient of variation for thickness remains approximately the same through all three periods. Based on two-tailed Kolmogorov-Smirnov tests, neither dimension's distribution of values differs significantly at the .10 level between any pair of phases. This indicates that the range and distribution of variation in Yata phase manos are not particularly different than those dating to earlier phases.

	Mean	St Dev	Co Var	Mean	StDev	Co Var
	Width	Width	Width	Thickness	Thickness	Thickness
Dongu	5.69	1.69	0.30	4.96	1.39	0.28
Ninupi	5.13	0.92	0.18	4.42	1.11	0.25
Yata	5.62	0.73	0.13	4.39	1.29	0.29
All Phases	5.52	1.16	0.21	4.58	1.29	0.28

Table 8.4 Means, standard deviations, and coefficients of variation for mano thickness and mano width by phase, DS-2 sample

Manos show a wide range of variation in cross section. Of the eleven possible cross section shapes (Figure 8.2, 1-11), only seven occur in this sample at Calixtlahuaca (Table 8.5). Either five or six of these seven are present during each phase. The most

common mano cross section is square (Form 4), followed by rectangular (5) and rounded-square (8), during all three phases. At the same time, the individual household components have diverse assemblages of cross sections; all components with more than one mano had examples of more than one cross section form. No cross section form that occurs more than once is present in only one phase. This wide range of variation in mano cross sections is comparable to other late Postclassic sites in Central Mexico (Smith 2006a, 2006c). However, the specifics of the forms do differ from most other sites. Manos from Postclassic sites in Morelos are generally dominated by manos with rounded-to-oval cross sections (Smith 2006a:Table B5-7; 2006c:Table C5-4), as compared to the square-to-rectangular pieces that dominate the assemblage at Calixtlahuaca.

Unit	Phase	Total	0	2	4	5	6	8	10	11
315	Dongu	5	1		1		1	1	1	
316	Dongu	1			1					
320	Dongu	1						1		
323	Dongu	3			1	2				
324	Dongu	5		1	4					
303	Ninupi	3			2	1				
307	Ninupi	2		1		1				
311	Ninupi	1			1					
316	Ninupi	5			1	1		2		1
307	Yata	6		1	3	2				
309	Yata	2						1	1	
316	Yata	4	1		1	1		1		
317	Yata	9		2	3	1	1	2		
Dongu		15	1	1	7	2	1	2	1	
Ninupi		11		1	4	3		2		1
Yata		21	1	3	7	4	1	4	1	

Table 8.5 Mano cross-section shapes by household component at Calixtlahuaca, DS-2 sample. For illustrations of cross-section shapes, see Figure 8.2.

In summary, maize grinding tools at Calixtlahuaca show few changes over time. While there is a significant increase in the frequency of grinding tools during the Yata phase, this is part of a broader regional trend toward increased maize processing during the Late Postclassic, rather than a shift toward imitating the practices of a particular region. This position is supported by the lack of adoption of the overhanging manos characteristic of the Late Postclassic in the Basin of Mexico and Morelos. There are no significant changes in mano forms or dimensions at Calixtlahuaca over time. As manos wear out faster than metates, any pronounced changes in grinding practices should be more evident in manos than metates. The degree of interhousehold variability in grinding stones also remains consistent over time.

Cooking Ceramics

The third step of maize processing is cooking, which requires a comal to make tortillas, and large cooking pots for the other four maize foods. I consider two lines of evidence for this stage. The first is the frequency of comals, measured both as a percentage of the total ceramic assemblage and as a percentage of rims. The second artifact type I consider is interior-incised jars, measured as a percentage of total jars. Interior incised jars are large, wide-mouthed jars, which makes them especially good candidates for tamale cooking pots. All three analyses use the DS-1 sample.

Comals. While the overall frequency of comals at Calixtlahuaca is very low compared to most other Postclassic Central Mexican sites, comal frequencies do increase by an order of magnitude from each phase to the next at the site (**Error! Reference source not found.**, Table 8.6). Based on t-tests of means, both increases are statistically significant at the .90 level. The increases in comals also result in decreasing jar/comal ratios at the site over time. There were only six comal sherds recovered from Dongu phase contexts in the DS-1. This low of a quantity could easily have been introduced by stratigraphic mixing or excavated lots that included small corners of later contexts. As a result, I consider the inhabitants of Calixtlahuaca to generally not have used comals – or as a result, eaten tortillas – during the Middle Postclassic. By the Ninupi phase, comals are present in all household components, though at low levels in most households. By the Yata phase, comals are present in all households and the sitewide average frequency has increased. Behaviorally, this represents the introduction of a new form of maize food preparation, and by the Yata phase, its semi-regular use. Learning the physical skills to

successfully make tortillas by hand is fairly difficult and was taught to girls during later childhood in Postclassic Mesoamerica (Mendoza 1992 [1541]):f.60r.

Evaluating the degree of interhousehold variation in comals over time is complicated by the rapidly increasing mean values. In one sense, the coefficients of variation for comals actually decrease from each phase to the next, due to the increases in mean values. In contrast, the ranges of variation in values increase over time, and in this case, is probably a better measure of behavioral variability.

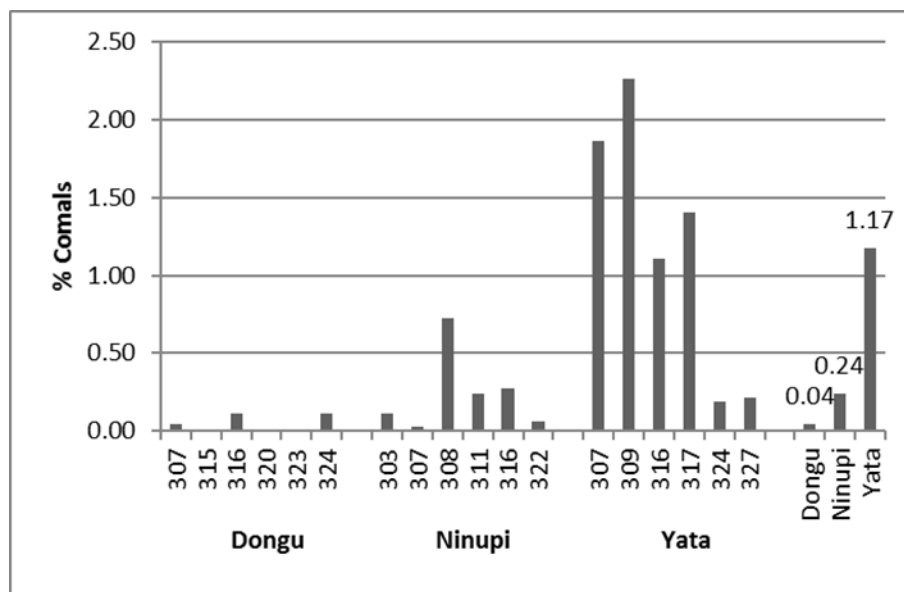


Figure 8.3 Comal frequencies as a percentage of total sherds by household component

Unit	All Sherds			Rims Only		
	Total Sherds	Total Comals	% Comals	Total Rims	Comal Rims	% Comals
<i>Dongu</i>						
307	4,756	2	0.04	411	2	0.49
315	13,772	0	0.00	1,374	0	0.00
316	2,684	3	0.11	290	0	0.00
320	3,951	0	0.00	395	0	0.00
323	8,827	0	0.00	834	0	0.00
324	892	1	0.11	77	1	1.30
<i>Ninupi</i>						
303	8,991	10	0.11	824	2	0.24
307	20,259	6	0.03	2,127	3	0.14
308	3,724	27	0.73	329	9	2.74
311	4,986	12	0.24	570	9	1.58
316	15,794	43	0.27	1,851	11	0.59
322	1,668	1	0.06	211	0	0.00
<i>Yata</i>						
307	10,225	191	1.87	1,130	60	5.31
309	3,096	70	2.26	332	11	3.31
316	7,492	83	1.11	921	24	2.61
317	9,616	135	1.40	1,114	38	3.41
324	3,754	7	0.19	373	5	1.34
327	945	2	0.21	97	0	0.00
Dongu Mean			0.04	0.30		
Ninupi Mean			0.24	0.88		
Yata Mean			1.17	2.66		
Dongu SD			0.05	0.53		
Ninupi SD			0.26	1.07		
Yata SD			0.85	1.83		
Dongu CoVar			1.24	1.77		
Ninupi CoVar			1.07	1.21		
Yata CoVar			0.73	0.69		

Table 8.6 Comals as percentages of per total sherds and rim sherds by household component at Calixtlahuaca, with summary statistics by phase.

On a regional scale, the low overall frequency of comals at Calixtlahuaca (and its sister Toluca Valley site of Cerro Toloche) is anomalous for Postclassic Central Mexico. At most other contemporaneous sites in the broader region, comals make up 10-15% of all the sherds, or 15-30% of ceramic rims in an assemblage (Table 8.7). The few cases with values below this range (Cihuatecpan and Tepexpan) were both smaller sites in Teotihuacan Valley, where maize production was marginal and many inhabitants focused on maguey cultivation instead. The low frequencies of comals at these sites may be indicative of a lower reliance on maize in general, rather than a choice to prepare maize in forms other than tortillas. In contrast, comals are a rare vessel form at Calixtlahuaca, accounting for an average of .49% of household total classified ceramics and an average of 1.28% of household classified rims. The appearance of comals at Calixtlahuaca, and their increasing values during the Yata phase, does represent the introduction of a new practice at Calixtlahuaca. However, given their relatively low frequencies, it is likely that tortilla production was either limited to special events, such as feasts, or was adopted by households as simply one additional way to prepare maize, rather than replacing prior maize foods.

Site	Period	% Rims	% All Sherds	Source
<i>Toluca Valley</i>				
Calixtlahuaca	MPC	0.3	0.04	
Calixtlahuaca	LPC-A	0.9	0.2	
Calixtlahuaca	LPC-B	2.7	1.2	
Cerro Toloche	M-LPC		0.9	Jaramillo & De la Peña 2012, Table 2
<i>Basin of Mexico</i>				
Xaltocan	EPC	16.3		Brumfiel 2005a, Tables 4.2, 4.3, Phases revised per Overholtzer 2014
Xaltocan	MPC	28.7		
Xaltocan	LPC	29.2		
Cihuatecpan	LPC		4.7	Evans 1988, Tbl. 1.2-4
Oxtotipac	MPC	20.0		Parsons 1966, Table 28
Tepexpan	LPC	9.4		
Maquixco	LPC	20.9		
Teacalco	LPC	17.6		
Xometla	LPC	11.0		
Tlateloco	LPC		13.7	Gonzalez Rul 1988a
Zacatenco	LPC		13.7	Gonzalez Rul 1988b
Chalco, Unit A	PC	17.3		Hodge 2008, Tables 9.2-7
Chalco, Unit B	EPC	23.1		
Chalco, Unit B	LPC	25.1		
<i>Morelos</i>				
Yautepec	MPC		15.2	Smith 2006c, Table C2-3
Yautepec	LPC-A		14.6	
Yautepec	LPC-B		12.7	
Yautepec	COL		16.1	
Capilco	MPC		16.7	Smith 2006a, Table B2-2
Capilco	LPC-A		16.0	
Capilco	LPC-B		14.1	
Cuexcomate	LPC-A		11.3	Smith 2006a, Table B2-2
Cuexcomate	LPC-B		15.2	
<i>Puebla</i>				
Cholula (Well 3)	EPC	22.0		McCafferty 2001, Table 5.12
Cholula (Midden)	EPC	20.0		
Cholula (Well 1)	LPC	25.0		
Cholula (Well 2)	COL	28.0		

Table 8.7 Comal frequencies as percentages of total sherds and rim sherds at Calixtlahuaca and comparative Postclassic sites in Central Mexico, arranged by region.

In addition to providing evidence for adoption of a non-local method of serving maize, comals were themselves sometimes non-local items. Based on the results of INAA and petrography, the comals found at Calixtlahuaca include both imported and locally produced vessels (Table 8.8). Of the sixteen comal sherds submitted for INAA, five were assigned to primary or secondary local groups, three were assigned to Basin of Mexico groups, and eight were unassigned. No other major ceramic type has this high a rate of unassigned samples, suggesting that comals required a unique blend of materials. Given that comals are a fragile vessel form, which is then subjected to repeated heating and cooling, an unusual composition is not overly surprising. The petrographic results are similar, with seven sherds assigned to local groups, three to Basin of Mexico groups, and two remaining unassigned. About half of the petrographic samples were selected from the INAA unassigned sherds, and were successfully placed into petrographic groups, suggesting that these are mildly anomalous local pastes rather than a unique source group not otherwise represented in the INAA samples. All of the comal sherds recovered at Calixtlahuaca are consistent in rim form with Postclassic comals from the Basin of Mexico (squared rim), rather than Postclassic comals from the Otomi areas in the northern portion of the Toluca Valley (rounded rim). Even with sourcing results in hand, I could not visually distinguish between sherds assigned to local and imported groups, which suggests a highly accurate transfer of specialized knowledge. This in turn suggests that the appearance of local-sourced comals at Calixtlahuaca does represent the movement of individuals with potting knowledge from the Basin of Mexico, whether they lived at Calixtlahuaca or at another site in the region.

	Total	Local	Aztec	Unknown
INAA	16	5	3	8
Petrography	12	7	3	2

Table 8.8 INAA and petrography sourcing results by geographic macroregion for comals

Interior-Incised Jars. Interior-incised jars are very large, wide-mouthed, plain jars, which were deeply scored on the interior of the body prior to firing (Figure 8.4). While this scoring is generally loosely patterned into parallel or crossed zig-zag lines, these patterns would not have been visible when the vessels were intact. This indicates that the scoring was functional rather than decorative. The type also does not occur in any of the whole vessels in museum collections analyzed from the surrounding area (Smith 2003e, 2005), indicating that it is likely a utilitarian type which was rarely included in burial assemblages. This vessel form is apparently unique to the Toluca Valley, as it has not been reported at sites in the Basin of Mexico or Morelos, but does occur at the Postclassic Toluca Valley site of Cerro Toloche (Jaramillo Lunque and De la Peña Virches 2014:Table 21).



Figure 8.4 Interior-incised jar sherds

The general form of these vessels, combined with the ethnohistoric descriptions of tamale consumption in the Toluca Valley, make these vessels likely candidates for tamale steaming pots. The incisions could have helped prevent the lattice of sticks supporting the tamales above the water in the base of the jar from slipping. The other possible use would be as pulque brewing vessels, such as occur ethnographically in the Mezquital region (Fournier Garcia 2007). However, these modern vessels do not have interior scoring, likely because it would be difficult to clean it between batches of pulque.

Interior-incised jar sherds are rare throughout Calixtlahuaca's history, making up about 0.5% to 1.5% percent of plain and eroded jar sherds for all households (Table 8.9). These percentages are almost certainly an undercount of the proportion of plain jars

which had interior incising in the original vessel assemblage. Sherds from the un-incised portions of incised jars would be coded as plain and the plain-and-eroded category also includes sherds from the undecorated portions of decorated jars, which would have been serving rather than cooking vessels. Despite this systematic undercounting, incised jar sherds are present in all households during all phases. The low overall frequency suggests that these sherds do not represent a maize preparation activity on the scale of tortilla preparation (as represented by comals at other Postclassic sites).

The average frequency of interior-incised jar sherds increased between the Dongu and Ninupi phases, before decreasing to its lowest overall level during the Yata phase. Based on the t-tests of means, both the earlier increase and later decrease are statistically significant at the .90 level.

Unit	Total Sherds	Eroded & Plain Jars	Interior Incised	% Incised, Total	% Incised, Plain Jars
<i>Dongu</i>					
307	4,756	3,900	46	0.97	1.18
315	13,772	10,779	123	0.89	1.14
316	2,684	2,027	16	0.60	0.79
320	3,951	3,166	24	0.61	0.76
323	8,827	7,024	36	0.41	0.51
324	892	732	10	1.12	1.37
<i>Ninupi</i>					
303	8,991	7,000	74	0.82	1.06
307	20,259	14,443	189	0.93	1.31
308	3,724	2,917	34	0.91	1.17
311	4,986	3,717	54	1.08	1.45
316	15,794	11,956	167	1.06	1.40
322	1,668	1,162	17	1.02	1.46
<i>Yata</i>					
307	10,225	6,752	55	0.54	0.81
309	3,096	1,980	6	0.19	0.30
316	7,492	5,544	48	0.64	0.87
317	9,616	7,529	50	0.52	0.66
324	3,754	2,754	20	0.53	0.73
327	945	724	12	1.27	1.66
Dongu, Mean				0.77	0.96
Ninupi, Mean				0.97	1.31
Yata, Mean				0.62	0.84
Dongu, St. Dev				0.27	0.32
Ninupi, St. Dev				0.10	0.16
Yata, St. Dev.				0.35	0.45
Dongu CoVar				0.35	0.34
Ninupi CoVar				0.10	0.13
Yata CoVar				0.58	0.53

Table 8.9 Interior-incised jars as percentages of total sherds and of plain/eroded jar sherds by household component at Calixtlahuaca, DS-1 sample, with summary statistics by phase.

There are also some differences in the amount of intra-phase variation over time, and this is still of interest. Based on both the range of values and the coefficients of variation, interhousehold diversity begins at an intermediate level during the Dongu phase, drops during the Ninupi phase and increases again during the Yata phase. Interestingly, none of the Yata phase values are within two standard deviations of the preceding Ninupi phase mean, with one case (327-P6) falling above this range, and the remainder falling below it. This does suggest a fairly widespread reduction in whatever practice involved interior-incised jars, though one that occurred at different rates in different households. In addition, the household frequency of incised sherds is basically independent of the frequency of comals during the Dongu and Ninupi phases, but shows a strong negative correlation during the Yata phase (Pearson's $r = -.72$) (Figure 8.5). One possible interpretation of this correlation is that after comals appear in significant quantities at the site, comals and interior-incised jars represent alternative strategies for producing maize foods for special events.

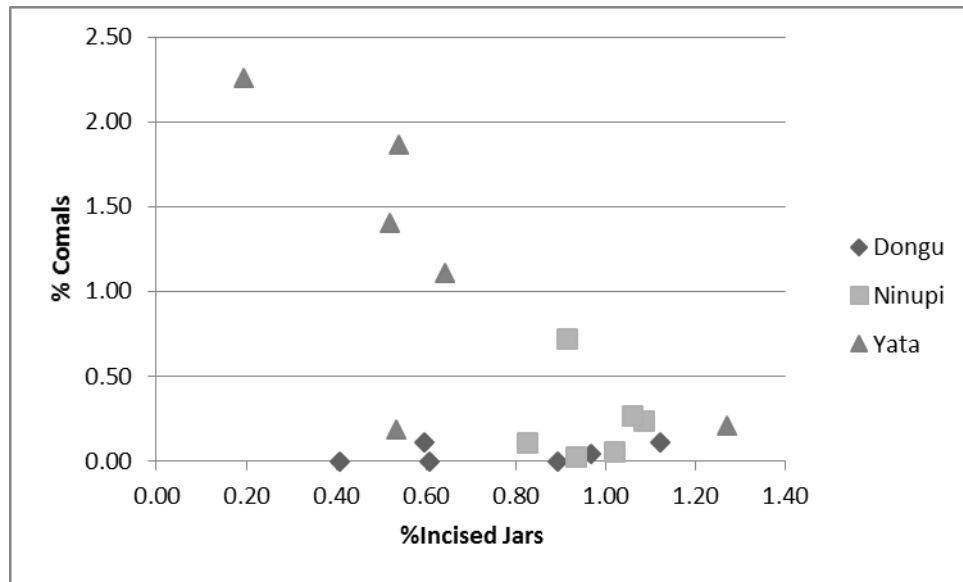


Figure 8.5 Scatterplot of comal and interior-incised jar sherds, as percentages of all vessel sherds. Each point is a household component.

Maize Preparation Practices: Results

The analyses of maize preparation practices at Calixtlahuaca provide information about low visibility aspects of food preparation. The results can be used to address the three questions for this chapter: local patterns of social organization, changes under Aztec rule, and the probable causes of any changes under Aztec rule.

First, in terms of local social organization, pre-Aztec maize preparation practices at Calixtlahuaca are both regionally distinct from those seen in other parts of Central Mexico, and relatively stable over time. There are relatively few changes in maize processing at Calixtlahuaca between the Dongu and Ninupi phases. There are no significant changes in the total quantity of grinding stones or in the forms of manos between these two phases. There are statistically significant increases in the frequencies of both comals and interior-incised jars between these two phases, but due to the small overall quantities of both, the total magnitude of these changes is relatively small. The

degree of interhousehold variability also remains similar for artifact types related to maize processing during these two phases. As would be expected from a basic household necessity, households (with the exception of the possible special-purpose deposit in 324-Ph2) during these phases have relatively similar frequencies of grinding stones. They also have relatively similar frequencies of comals and interior-incised jars with ranges of variation of less than .75% of the total ceramics among all of the households dating to these phases. This is consistent with a single, relatively uniform set of food preparation practices among households dating to these two phases at Calixtlahuaca. Low visibility practices, such as maize preparation, are not likely to be actively targeted by rulership strategies. However, the homogeneity in maize preparation practices among households and over time at Calixtlahuaca suggests a relatively homogenous pre-Aztec population at the site.

Second, the period under Aztec rule did see some shifts in maize consumption practices at Calixtlahuaca. There are statistically significant increases in the overall quantities of grinding stone and comals, and a significant decrease in the quantity of interior-incised jars, relative to the preceding phases. The increase in grinding stone frequencies at Calixtlahuaca is part of a broader Central Mexican trend toward increased quantities of grinding tools over the course of the Postclassic. The increase in comal frequencies moves Calixtlahuaca toward a more characteristically Aztec pattern of comal use, but even the highest-frequency households at Calixtlahuaca remain substantially below the comal quantities seen at sites in other parts of the Basin of Mexico. The shifts toward more characteristically Aztec patterns of maize processing are unevenly distributed among the Yata phase households, with larger ranges of overall variation for

comal and interior-incised jars driven by some household values outside of the previously observed ranges of variation, while others remain at levels characteristic of the preceding local phase. As a relatively low visibility activity, changes in maize processing are not likely to be the direct result of imperial strategies. The small, but significant shifts toward more Aztec maize preparation techniques, paired with the increasing ranges of variation suggest that individual households at Calixtlahuaca experimented with culinary practices in different ways. This pattern is consistent with some breakdown in conformity to local collective social norms and household attempts to individually negotiate their positions relative to the Aztec Empire's more network oriented rulership strategies.

Third, the specific causal factors behind the Yata phase changes at Calixtlahuaca are ambiguous. Generally, maize processing is a low-visibility activity, which would make changes more indicative of immigration than of emulation. However, within the various lines of evidence for maize processing, those associated with the least conscious decision-making – mano cross-section and end form – show the most stability over time. Additionally, while there is a trend toward more Basin of Mexico-style practices during the Yata phase, these never reach the level that one or more of the household components could be confused with one from the Basin. The relatively limited adoption of comals, and their inverse relationship with the frequency of interior-incised jars, suggests that tortillas were added to the repertoire of ways of serving maize, rather than replacing prior ways. The relatively low quantities of both forms of cooking ceramics suggests that both may have been used for maize preparation for special events such as feasts. Based on negative evidence, two Yata phase households at Calixtlahuaca, 324-Ph6 and 327-Ph6, which remain firmly within the preceding Ninupi phase frequency ranges for both comals

and incised jars, can be considered cases of neither local emulation nor migration. However, the presence of locally produced comals, which could not be distinguished from imported pieces without technical analyses, strongly suggests the migration of some specialized comal-producers into the area around Calixtlahuaca, though they are probably not represented in the sample of excavated households.

In general, the lack of change in groundstone forms may be due to their longer use life, smaller transportation radius, and increased potential for specialized production. While new ceramic forms could circulate over longer distances and from new producers, ground stone production may simply have remained in the hands of the same group of producers throughout the site's history, thereby limiting the potential for the appearance of new forms after the Aztec conquest.

Food Serving Practices

As in the previous chapter on ritual, I contrast two aspects of food serving: serving practices (based on serving vessel form) and potential group affiliation (based on the use of different local and non-local decorative groups). These are largely independent classifications, as the primarily local decorative groups occur in multiple vessel forms at Calixtlahuaca. The analysis of vessel form allows me to identify households that are serving food in non-local ways. The analysis of decoration identifies both the level of inter-household variation in decorated ceramic use over the site's history, as well as specific households with substantial amounts of non-local ceramics. I use the combination of these two dimensions of food serving to determine the degree to which

ideas about food serving practices are travelling in conjunction with imported serving wares.

In general, the analyses in this section show that households at Calixtlahuaca were relatively homogenous during the Dongu and Ninupi phases, with no evidence for multiple local cultural groups. The analyses of vessel form did not produce consistent groupings of household components, and the analyses of decoration divided households primarily by phase. Because food serving is a high visibility activity, households diverging from the local pattern may be either cases of emulation or immigration.

Serving Vessel Form Variability at Calixtlahuaca

Serving vessel form is a medium-high visibility trait, given that it involves public aspects of food consumption, but one with less overt opportunities for information signaling than the decoration on ceramics. Decorated ceramics usually convey stylistic information, but food serving practices are only visible when they are actively taking place.

Unit	Rim Sherds				All Sherds			
	N. Sherds	Bowls	Jars	Copas	N. Sherds	Bowls	Jars	Copas
<i>Dongu</i>								
307	231	97.84	2.16	0.00	632	83.54	16.46	0.00
315	725	96.28	3.59	0.14	2,129	76.61	23.34	0.05
316	165	94.55	5.45	0.00	505	74.26	25.74	0.00
320	226	93.81	5.75	0.44	607	83.53	16.31	0.16
323	507	92.11	7.69	0.20	1,358	72.39	27.54	0.07
324	47	93.62	6.38	0.00	124	66.13	33.87	0.00
<i>Ninupi</i>								
303	524	96.37	3.63	0.00	1,406	87.20	12.80	0.00
307	1,382	95.08	4.78	0.14	3,986	75.21	24.71	0.08
308	209	96.17	3.83	0.00	595	80.84	19.16	0.00
311	315	94.92	4.76	0.32	908	86.01	13.88	0.11
316	1,029	94.75	5.25	0.00	2,678	80.92	18.97	0.11
322	119	94.12	5.88	0.00	363	68.32	31.68	0.00
<i>Yata</i>								
307	703	96.59	3.13	0.28	2,010	86.07	13.83	0.10
309	207	92.27	3.38	4.35	570	84.74	13.68	1.58
316	534	94.57	3.56	1.87	1,359	81.02	17.88	1.10
317	699	95.99	2.72	1.29	1,496	82.55	16.38	1.07
324	187	97.86	2.14	0.00	482	83.40	16.60	0.00
327	54	98.15	1.85	0.00	171	76.02	23.98	0.00
Dongu Mean		94.70	5.17	0.13		76.08	23.88	0.05
Ninupi Mean		95.24	4.69	0.08		79.75	20.20	0.05
Yata Mean		95.90	2.80	1.30		82.30	17.06	0.64
Dongu SD		2.05	1.99	0.17		6.74	6.77	0.07
Ninupi SD		0.87	0.85	0.13		7.05	7.06	0.06
Yata SD		2.21	0.69	1.68		3.53	3.77	0.69
Dongu CoVar		0.02	0.38	1.35		0.09	0.28	1.37
Ninupi CoVar		0.01	0.18	1.70		0.09	0.35	1.13
Yata CoVar		0.02	0.25	1.29		0.04	0.22	1.08
Dongu Range		5.73	5.53	0.44		17.42	17.56	0.16
Ninupi Range		2.26	2.26	0.32		18.88	18.88	0.11
Yata Range		5.88	1.71	4.35		10.05	10.29	1.58

Table 8.10 Relative serving vessel form (Bowl, Jar, Copa) frequencies by rims sherds and total sherds, by household component at Calixtlahuaca, with summary statistics by phase

Food serving assemblages in Postclassic Central Mexico can be broadly grouped into three categories of vessels: open vessels, restricted vessels and copas. Open vessels include simple bowls, tripod bowls, dishes, plates, and basins. They can be used to serve dry foods (tamales, tortillas), or semi-liquid foods, such as stews or salsas. Restricted vessels include necked jars, pitchers, and tecomates (very rare!). Restricted vessels would have been used primarily to serve liquids, such as atole, pulque, or cacao-based beverages. Because many restricted vessels were used for purposes other than serving, such as cooking or storage, I only include decorated restricted vessels in my analyses. Copas are specialized goblets used for drinking liquids, such as those listed for restricted vessels. I use these generalized vessel form categories to allow for both comparisons among households at Calixtlahuaca and among sites in Central Mexico more broadly.

At Calixtlahuaca, there is little change in the relative frequencies of the three categories of serving vessel forms over time, with open vessels always making up the majority of serving vessels (Table 8.10). While both the rim and total sherd based data sets show a small decrease in the frequencies of jars relative to both bowls and copas over time, only the rim-based Ninupi-to-Yata phase difference for jars is statistically significant at the .90 level, based on t-tests of means. This indicates that the majority of the changes seen over time could easily be due to random chance. There is also little change in the amount of variation among households over time. The coefficients of variation either remain both low and very similar (open vessels) or are inconsistent between the rim and total sherd based frequencies for the form (restricted vessels and copas). Based on this analysis, food serving practices likely served a socially integrative

function at Calixtlahuaca, promoting the maintenance of a collective identity based on shared practices in both private and public food consumption.

Regional Variation in Serving Vessel Frequencies

In order to determine whether the lack of change in the serving vessel assemblage over time at Calixtlahuaca is consistent with the maintenance of local practices of food serving, I compare the serving vessel form frequencies at Calixtlahuaca with those from other sites in the Basin of Mexico, Morelos, and Puebla. This comparison serves to establish whether food serving practices were similar across all of Postclassic Central Mexico, or whether there were alternative, regionally distinctive practices which were not adopted by the residents of Calixtlahuaca. I compare the serving vessel assemblage at Calixtlahuaca to those from the Toluca Valley site of Cerro Toloche (Jaramillo Lunque and De la Peña Virches 2012), the Basin of Mexico sites of Tlateloco (González Rul 1988a), Iztatlan and Hualquilla (González Rul 1988b), Xaltocan (Brumfiel 2005b), Chiconautla and Nonoalco (Elson and Smith 2002), and the rural Teotihuacan Valley sites excavated by Parsons (1966), as well as the Morelos sites of Yautepec (Smith 2006c), Cuexcomate and Capilco (Smith 2006a) and the UA-1 compound at Cholula (McCafferty 2001). These comparative cases include a mix of commoner and elite contexts, but Smith et al. (2003) demonstrated that there is little difference between commoner and elite households in the proportions of vessel forms within serving assemblages at sites in Morelos. Due to the way the data are reported for the various sites, I perform two sets of comparisons, one based on rim sherd counts (Table 8.11) and one based on total sherd counts (Table 8.12). While the regional split is not exact, the rim

sherd based values generally involve comparisons with the northern Basin of Mexico and Puebla, and the total sherd count based values generally involve comparisons with the southern Basin of Mexico, Morelos, and other Toluca Valley sites.

In both Calixtlahuaca and all of the comparative cases, open vessels make up the majority of the serving assemblage. There is a general trend for Toluca Valley sites (Calixtlahuaca and Cerro Toloche) to have the highest frequency of restricted serving vessels, followed by the sites in Morelos, the Basin of Mexico, and finally Puebla. The frequencies of copas are generally lowest in the Toluca Valley, followed by overlap for the Northern Basin of Mexico, Morelos, and Puebla, and the highest values occurring in the Southern Basin of Mexico. Copa frequency may be related to a site's relative ranking as larger, more urban sites tend to have higher proportions of copas than rural sites in the same region.

In the rim-sherd based analysis the cases divided strongly geographically, in both the hierarchical and k-means cluster analyses (Table 8.11, Figure 8.6). The two methods also produce similar lower-level clustering. The primary division occurs between the cases from Calixtlahuaca and all of the comparative cases, and the second division is between the first two and the third phase at Calixtlahuaca. The comparative cases then divide along roughly urban/rural lines with a general division between the rural Teotihuacan Valley sites and urban Xaltocan and Cholula. This suggests that Late Postclassic-B Calixtlahuaca does represent a relatively large shift in serving vessel use, on a regional scale, but not one that specifically matches a comparative region.

					K-Means Clusters				
	Period	Bowls	Jars	Copas	2	3	4	5	Source
<i>Toluca Valley</i>									
Calixtlahuaca	MPC	94.70	5.17	0.13	1	1	1	1	
Calixtlahuaca	LPC-A	95.24	4.69	0.08	1	1	1	1	
Calixtlahuaca	LPC-B	95.90	2.80	1.30	1	3	3	3	
<i>Basin of Mexico</i>									
Xaltocan	EPC	99.60	0.00	0.40	2	2	4	4	Brumfiel 2005a,
Xaltocan	MPC	98.69	0.00	1.31	2	2	2	5	Tables 4.2-3,
Xaltocan	LPC	98.32	0.00	1.68	2	2	2	5	Phases per
Oxtotipac	MPC	99.73	0.27	0.00	2	2	4	4	Overholtzer 2014
Tepexpan	LPC	98.34	0.91	0.76	2	2	2	2	Parsons 1966,
Maquixco	LPC	99.37	0.56	0.07	2	2	4	4	Tables 28-40
Teacalco	LPC	99.36	0.56	0.08	2	2	4	4	
Xometla	LPC	99.51	0.24	0.24	2	2	4	4	
<i>Puebla</i>									
Cholula (Well3)	EPC	98.20	0.00	1.80	2	2	2	5	McCafferty 2001,
Cholula (Midden)	EPC	98.29	0.00	1.71	2	2	2	5	Table 5.12
Cholula (Well1)	LPC	99.55	0.00	0.45	2	2	4	4	

Table 8.11 Serving vessel form (Bowl, Jar, Copa) frequencies from rim sherd counts at Calixtlahuaca and comparative sites, with K-means clustering results for 1-5 clusters. Bowls include both plain and decorated vessels, Jars include decorated vessels only.

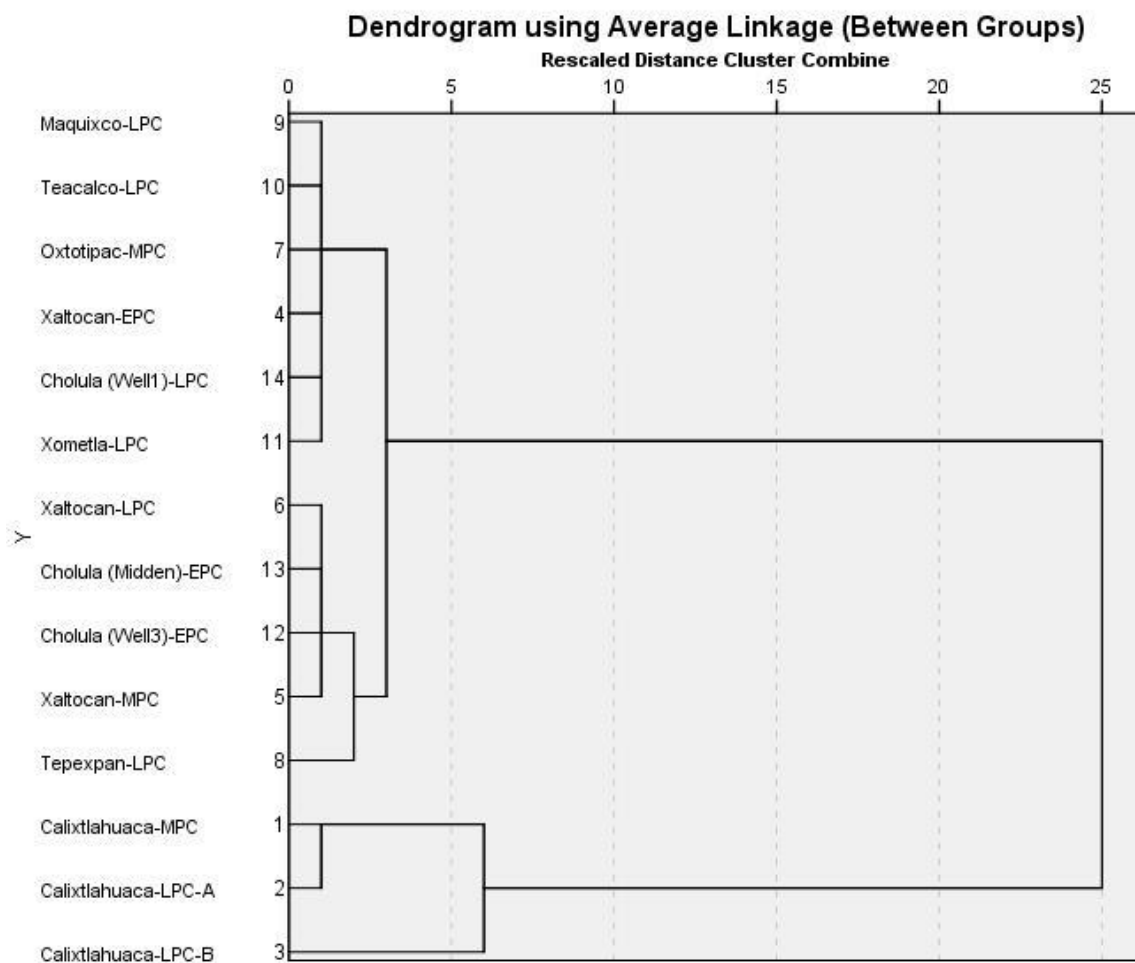


Figure 8.6 Rim sherd based hierarchical clustering results for serving vessel forms at Calixtlahuaca and comparative sites

In the total sherd based analysis (Table 8.12, Figure 8.7), the hierarchical and k-means cluster analyses produce the same general pattern. Both methods first divide sites in the Toluca Valley (Calixtlahuaca and Cerro Toloche) from all of the comparative cases. Both methods then generally divide cases from the Basin of Mexico from those in Morelos, though this is not a perfect division.

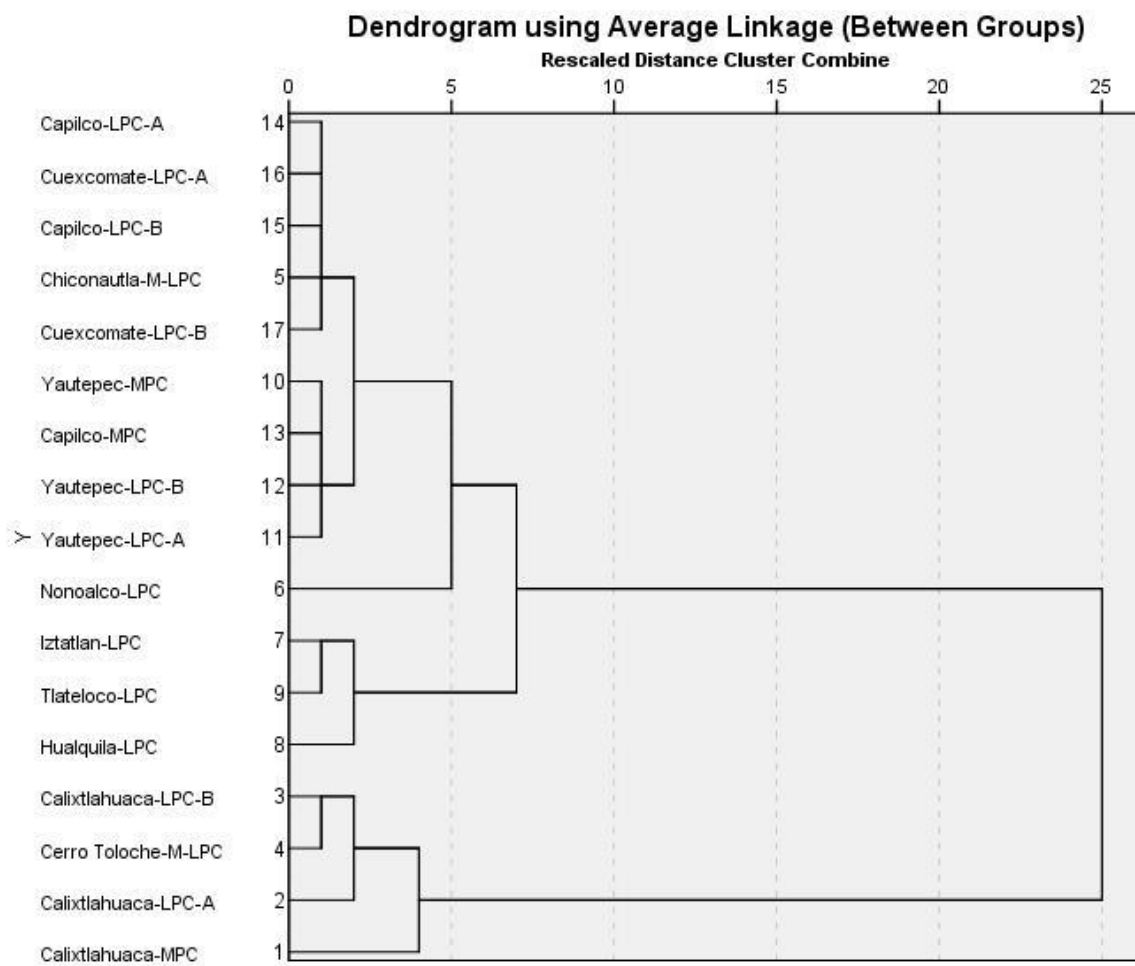


Figure 8.7 Total sherds count based hierarchical clustering results for serving vessel forms at Calixtlahuaca and comparative sites

					K-Means Clusters				Source
	Phase	Bowls	Jars	Copas	2	3	4	5	
<i>Toluca Valley</i>									
Calixtlahuaca	MPC	76.08	23.88	0.05	1	1	1	1	Jaramillo & De la Peña 2012, Table 2
Calixtlahuaca	LPC-A	79.75	20.20	0.05	1	1	1	1	
Calixtlahuaca	LPC-B	82.30	17.06	0.64	1	1	1	1	
Cerro Toloche	M-LPC	83.28	16.72	0.00	1	1	1	1	
<i>Basin of Mexico</i>									
Chiconautla	MPC-LPC	95.33	2.84	1.84	2	3	4	5	Elson & Smith
Nonoalco	LPC	88.09	8.03	3.88	2	2	3	4	2002, Table 2
Iztatlan	LPC	89.13	0.00	10.87	2	2	2	3	Gonzalez Rul
Hualquilla	LPC	92.32	1.24	6.43	2	2	2	2	1988b, Tbl 1
Tlateloco	LPC	90.00	0.20	9.80	2	2	2	3	Gonzalez Rul
<i>Morelos</i>									
Yautepec	MPC	93.32	6.55	0.14	2	3	4	5	1988a, p 186-7
Yautepec	LPC-A	94.84	4.71	0.45	2	3	4	5	Smith 2006c, Table
Yautepec	LPC-B	92.89	6.33	0.77	2	3	3	4	C2-3
Capilco	MPC	93.66	6.10	0.24	2	3	4	5	Smith 2006a, Table
Capilco	LPC-A	96.21	3.11	0.68	2	3	4	5	B2-2
Capilco	LPC-B	96.52	3.04	0.44	2	3	4	5	
Cuexcomate	LPC-A	96.34	3.13	0.53	2	3	4	5	Smith 2006a, Table
Cuexcomate	LPC-B	97.61	1.93	0.45	2	3	4	5	B2-2

Table 8.12 Serving vessel form frequencies from total sherd counts at Calixtlahuaca and comparative sites, with K-means clustering results. Bowls include both plain and decorated vessels, Jars include decorated vessels only.

Serving Vessel Form Analysis: Results

The results of the analyses of serving vessel form relate to activities at a medium level of visibility – higher than food preparation, but lower than ceramic decoration. The results of these analyses demonstrate that serving vessel use at Calixtlahuaca was similar over time, both in terms of the relative proportions of different forms of serving vessels, and in the low amount of variation among contemporaneous households. This pattern is consistent with a relatively collective local organization of power, which was not substantially affected by Aztec rule.

On a regional level, serving vessel use does vary noticeably among major regions of Central Mexico, though site rank may be a confounding variable. Serving vessel use at Calixtlahuaca is distinctive throughout the site's history, with the only case ever grouped with Calixtlahuaca in any of the cluster analyses being the nearby Toluca Valley site of Cerro Toloche. However, while the Yata phase changes in serving vessel use at Calixtlahuaca were not statistically significant due to the small number of households in the sample, the shifts are toward a pattern more characteristic of other regions of Central Mexico, though not necessarily the Basin of Mexico in particular. This is again consistent with highly locally-driven decisions about which aspects of Aztec culture to adopt and how.

Analysis of Decorative Groups

Decorated ceramic serving vessels are the highest visibility form of material culture under consideration in this chapter. Because of this, they are the most likely to be consciously used to create and manipulate identities, such as Bowser (2000) demonstrates in her study of pottery decoration in Amazonian groups. I analyze decorated ceramics at Calixtlahuaca to determine the degree of interhousehold variation over time, and the degree to which individual households were displaying connections with non-local regions. The discussion of non-local groups draws heavily on the prior analysis of exchange in Chapter 4. This consideration of decoration complements the preceding analysis of vessel form, as decoration and form are cross-cutting categories at Calixtlahuaca.

Due to the flexibility of the ceramic classification system used at Calixtlahuaca, the ceramic types used in actual classification can be combined in several ways. One of these is to group types into decorative families, which approximate the way “ware” is used as a category in some other systems. All types grouped into a decorative family have stylistically similar decoration in similar colors. Decorative families cross-cut vessel forms; most occur in both bowl and jar forms, and some also include miscellaneous other vessel forms. Strictly speaking, decorative families do not take paste into consideration, though the correlation between decoration and paste mean that most decorative families only include pieces from one INAA or petrographic macroregion (Local, Basin of Mexico, S/SW of the Toluca Valley, Other).

The decorated serving ceramics at Calixtlahuaca can be divided into eleven decorative families on the basis of surface decoration (Table 8.13, Figure 8.8, Figure 8.9). These are local families A, B, C, and E, Aztec families Aztec Black-on-Orange, Aztec Black-on-Red, and Other Aztec, and S/SW Toluca Valley families D, Incised Red, Negative, and a miscellaneous other non-local decorated types category. While these decorative families generally parallel the source regions discussed in Chapter 4, there is a moderately higher degree of geographic mixing within decorative families due to local imitations (which are sorted with their model type here) and families where types fell into multiple source regions (Families C, D). Table 8.14 presents the percentage of each group out of the total decorated ceramics for that household component. Because these values only include the decorated portion of the ceramic assemblage, they minimize any variation due to household crafting activities involving plainwares (which would decrease decorated percentages across the board) or wealth (which might increase the proportion

of decorated ceramics relative to the assemblage as a whole). As a result, it measures how households chose to divide their servingware purchases among stylistic options, relative to their purchasing ability.

Family	Description	Forms
<i>Local</i>		
A	Red-rim on buff	Bowls
B	Local redwares. Black or Black and White on Red. Excludes B-types sourced to other regions.	Bowls, Jars, Pitchers
C	Local polychrome. Red/Black/Brown on White	Bowls
E	Local Red on Buff with line segments	Bowls, Jars, Copas
<i>Basin of Mexico</i>		
Black on Orange	Aztec-style B/O regardless of paste source	Bowls
Black on Red	Aztec-style guinda polished redwares	Bowls, Pitchers, Copas
Other Aztec	Misc. other Aztec decorative styles, mostly polychromes	Bowls, Jars
<i>South/Southwest of Toluca Valley</i>		
D	Red or Red/Brown on White, various styles	Bowls, Pitchers
Incised Red	Incised Redwares (B-5 and B-11 types)	Bowls, Jars, Pyriform Vessels
Negative	All types with negative decoration (Neg/Buff, Neg+Red/Buff, Neg+Red/White)	Bowls, Jars
<i>Other</i>		
Other Imported	All other non-local and non-Aztec decorative types	Bowls, Jars

Table 8.13 Major ceramic decorative groups and associated vessel forms at Calixtlahuaca

The general trend in interhousehold variation is toward decreasing variation between the Dongu and Ninupi phases, followed by an increase in variation between the Ninupi and Yata phases. The coefficients of variation reduce for eight out of the eleven decorative families between the first two phases of the site's history, and nine out of eleven then increase between the final two phases of the site's occupation. The decrease in diversity between the first two phases is primarily driven by increased access to non-local types. All households dating to the Dongu and Ninupi phases have all of the local

decorative families present, but are strongly dominated by local E family ceramics, with the local B family as the second most common group. However, the ubiquity of the Aztec-associated ceramic families increases between the two phases, and access to imports from other regions remains about the same. The increase in variation between the Ninupi and Yata phases is driven both by more variation in the relative importance of local groups – two households reverse the positions of B and E family frequencies – as well as more uneven access to imports from all regions. This pattern of increasingly uneven access to imports has been previously discussed in Chapter 4.

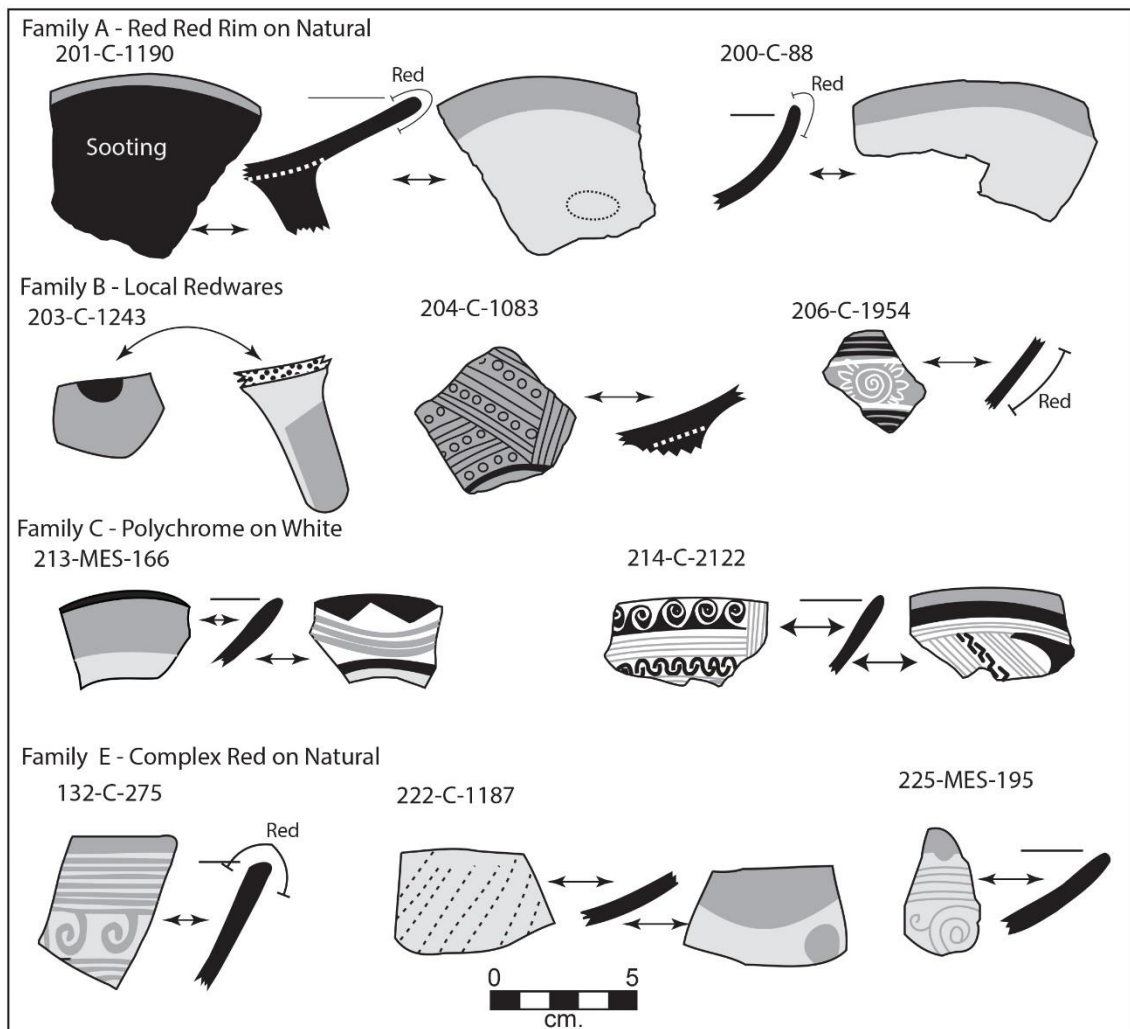


Figure 8.8 Primarily Local Ceramic Decorative Families

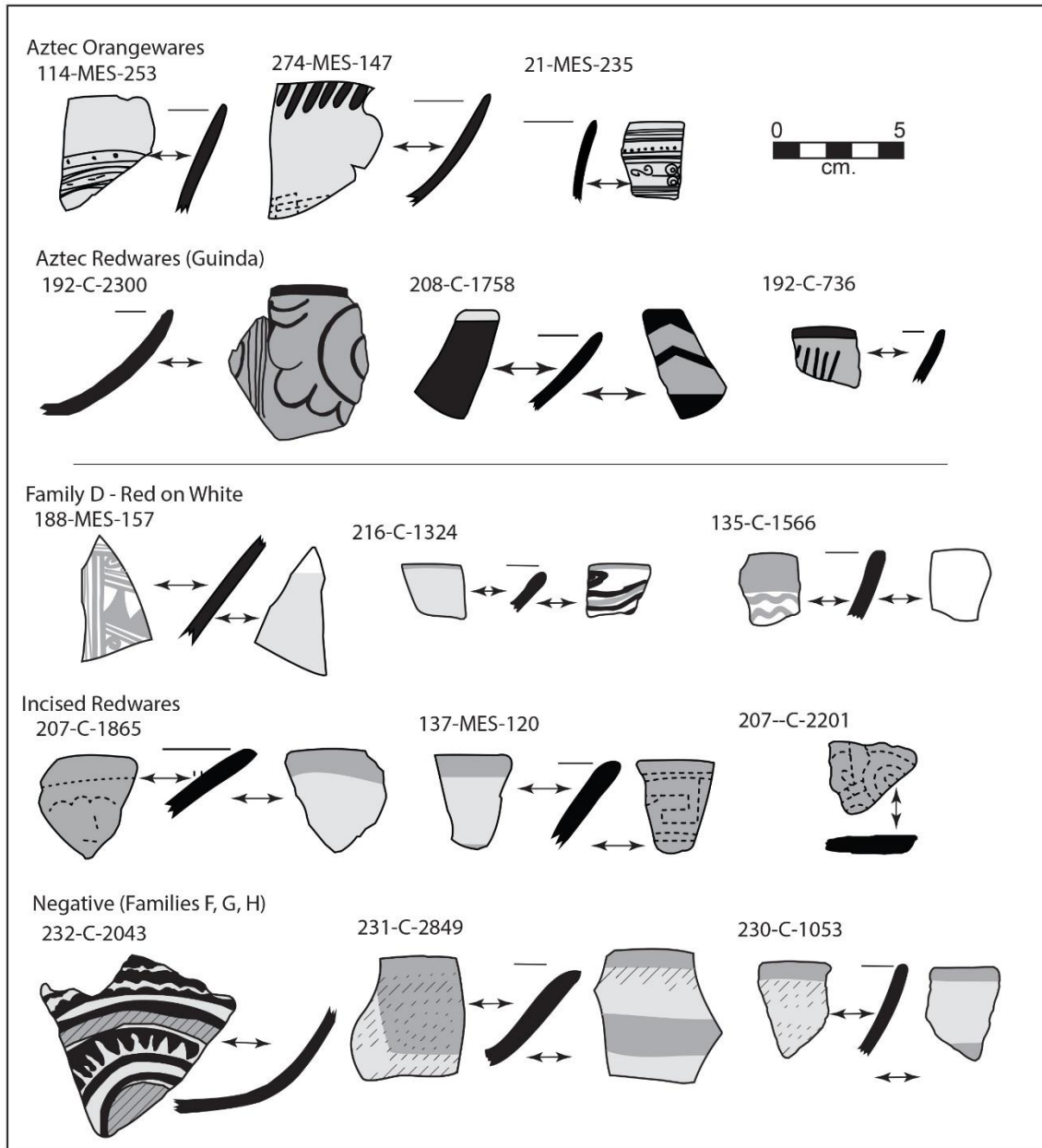


Figure 8.9 Primarily Non-Local Ceramic Decorative Families

The major decorative family groups were clustered using hierarchical (Figure 8.10) and k-means (Table 8.14) clustering procedures, to identify whether there were longstanding group divisions within the households and/or whether there were specific

outlier households driving the increased variability during the Yata phase. No comparative cases from outside of Calixtlahuaca were included in this analysis. Decorative ceramic assemblages in the Toluca Valley and the Basin of Mexico are highly distinctive. As no case at Calixtlahuaca even approaches 50% Aztec decorated ceramics, any attempt to include comparative cases would simply divide them based on region of origin.

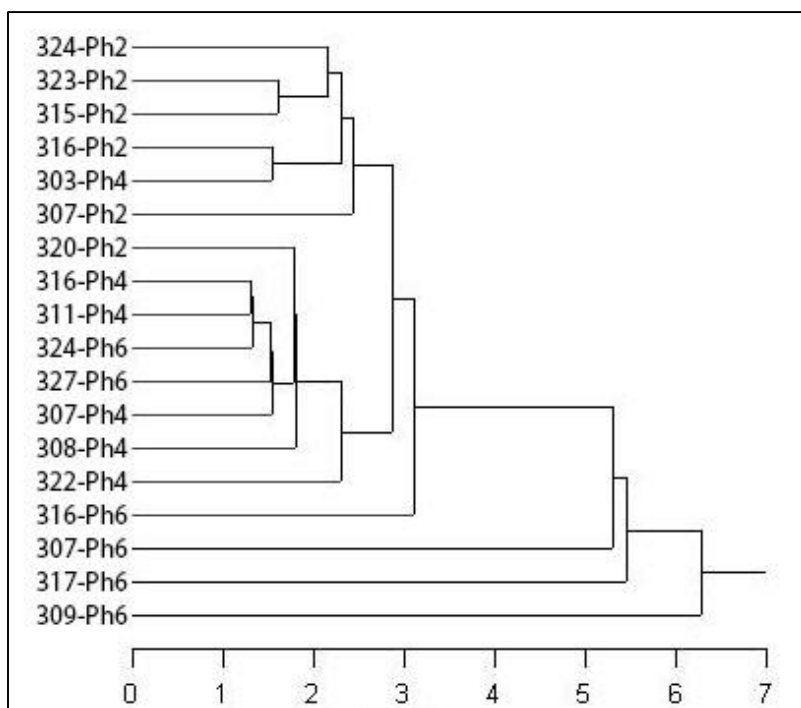


Figure 8.10 Hierarchical Clustering Results for Ceramic Decorative Family Frequencies

The two clustering methods produced similar results. Both methods first separate four of the Yata phase households (307-Ph6, 317-Ph6, 309-Ph6, and 316-Ph6), though the hierarchical clustering removed the cases one by one, in the order listed, while K-means separates them as a single group. Both methods also divide the remaining cases

along roughly temporal lines, generally separating the Dongu (MPC) cases from the Ninupi (LPC-A) and remaining Yata (LPC-B) cases at higher cluster solutions. In the k-means clustering, one of the previously separated cases, 316-Ph6 flips back to join the other LPC-A and B cases. Both clustering methods temporally flip the same pair of cases; 303-Ph4 is placed in the Dongu cluster, and 320-Ph2 is placed in the Ninupi/Yata cluster. At higher numbers of clusters, k-means splits off one or two cases at a time from the Ninupi/Yata cluster, while otherwise leaving the existing clusters intact. The further subdivisions produced by the hierarchical clustering do not provide additional useful information; the first two cases separated out of the primarily Ninupi cluster are the cross-grouped Dongu cases, and one of the two Yata cases. The hierarchical clustering divisions below this level do not split along similar variable lines in the primarily Dongu and primarily Yata clusters suggesting that longstanding group affiliations prior to Aztec rule are not visible in this analysis.

The results of the cluster analysis parallel those produced by the general considerations of inter-phase variability. The Dongu and Ninupi phase cases are relatively uniform within each phase. In the Yata phase cases there is a more pronounced division between the three cases which form a distinctively Aztec-oriented group and the two cases which continue along predominately local lines.

Unit	Local				Basin of Mexico			S/SW St. Mex.			Other	K-Means Clust.			
	A	B	C	E	AzOR	AzRED	OTH	IncRED	D	NEG	Import	2	3	4	5
<i>Dongu</i>															
307	8.37	16.33	2.39	68.13	0.40	0.80	0.00	0.40	0.80	1.99	0.40	1	3	3	3
315	1.62	12.67	1.38	81.15	0.08	0.08	0.24	0.89	1.06	0.16	0.65	1	3	3	3
316	3.31	17.17	3.31	74.10	0.00	0.30	0.00	0.00	0.90	0.60	0.30	1	3	3	3
320	2.06	31.56	1.18	61.95	0.29	1.47	0.00	0.29	0.88	0.29	0.00	1	1	1	1
323	1.20	11.74	2.51	77.60	0.00	0.00	0.00	0.96	1.20	3.83	0.96	1	3	3	3
324	4.30	6.45	1.08	77.42	0.00	0.00	0.00	1.08	3.23	6.45	0.00	1	3	3	3
<i>Ninupi</i>															
303	1.52	17.65	2.66	71.54	0.76	0.76	0.00	3.80	0.57	0.00	0.76	1	3	3	3
307	5.24	23.96	3.52	63.72	0.27	1.41	0.12	0.35	1.06	0.20	0.16	1	1	1	1
308	8.80	23.59	4.58	59.15	0.70	2.11	0.00	0.00	0.35	0.35	0.35	1	1	1	1
311	3.23	27.05	1.24	61.29	3.47	0.25	0.25	0.99	0.74	0.74	0.74	1	1	1	1
316	2.86	26.96	3.99	58.79	2.93	2.00	0.07	0.27	1.40	0.00	0.73	1	1	1	1
322	5.85	26.83	3.90	52.68	5.85	3.41	0.00	0.00	0.00	0.49	0.98	1	1	4	4
<i>Yata</i>															
307	4.32	35.26	1.37	37.58	15.58	5.05	0.00	0.11	0.42	0.32	0.00	2	2	2	2
309	2.20	40.66	0.37	20.15	18.32	15.75	1.83	0.00	0.73	0.00	0.00	2	2	2	5
316	8.83	22.20	2.86	46.90	10.74	7.52	0.00	0.12	0.60	0.00	0.24	2	1	4	4
317	7.80	27.23	1.43	26.11	20.06	6.69	0.00	0.00	0.80	0.00	9.87	2	2	2	2
324	3.15	24.77	0.45	64.41	4.05	1.35	0.00	1.80	0.00	0.00	0.00	1	1	1	1
327	3.03	25.25	2.02	67.68	1.01	1.01	0.00	0.00	0.00	0.00	0.00	1	1	1	1
Dongu Mean	3.48	15.99	1.98	73.39	0.13	0.44	0.04	0.60	1.34	2.22	0.38				
Ninupi Mean	4.58	24.34	3.32	61.20	2.33	1.66	0.07	0.90	0.69	0.30	0.62				
Yata Mean	4.89	29.23	1.42	43.80	11.63	6.23	0.31	0.34	0.42	0.05	1.69				
Dongu SD	2.65	8.53	0.90	7.12	0.17	0.59	0.10	0.43	0.93	2.49	0.37				
Ninupi SD	2.61	3.63	1.20	6.26	2.16	1.12	0.10	1.46	0.50	0.29	0.30				
Yata SD	2.76	7.16	0.95	19.57	7.78	5.38	0.75	0.72	0.35	0.13	4.01				
Dongu CoVar	0.76	0.53	0.46	0.10	1.35	1.33	2.45	0.72	0.69	1.12	0.97				
Ninupi CoVar	0.57	0.15	0.36	0.10	0.93	0.68	1.37	1.62	0.73	0.98	0.49				
Yata CoVar	0.56	0.24	0.67	0.45	0.67	0.86	2.45	2.13	0.83	2.45	2.38				
Dongu Rng	7.17	25.11	2.24	19.21	0.40	1.47	0.24	1.08	2.43	6.29	0.96				
Ninupi Rng	7.28	9.40	3.34	18.85	5.58	3.17	0.25	3.80	1.40	0.74	0.82				
Yata Rng	6.63	18.46	2.50	47.53	19.05	14.74	1.83	1.80	0.80	0.32	9.87				

Table 8.14 Ceramic decorative group frequencies by household component, with K-Means clustering results and summary statistics by phase. For decorative group descriptions see Table 8.13.

Analysis of Decorative Groups: Results

These analyses of major decorative grouping of ceramics provide information about the trajectories of cultural change under both local and Aztec rulership at Calixtlahuaca. As an analysis of very high visibility material culture, it provides information on how the residents of the households at Calixtlahuaca chose to present themselves to the world around them.

First, there were not pronounced divisions in social identity spanning the site's entire history. Time is by far the most significant factor in producing the clustering pattern seen in the results. In addition, subdivisions within the major temporal clusters do not consistently divide the clusters based on the same set of variables. This suggests that either there were not strongly marked social groups at the site, or that there were enough groups that many of them are represented by single households in the excavated sample. For the majority of types, the interhousehold variability decreases between the Dongu and Ninupi phases. This is consistent with a relatively collective local organization of power resulting in the benefit of increased interregional access being relatively evenly distributed across the population, and individual households seeking to demonstrate similar, rather than distinctive, foreign ties.

Second, Aztec rule during the Yata phase saw changes in both the content and interhousehold variation in decorated ceramics. On average, Yata phase households have less local E family ceramics and imports from the south-southwest State of Mexico, and more local B family ceramics and imports from the Aztec area. The increase in local B family ceramics may be linked to the rise in the use of Aztec wares, as of all the local decorative families, B is the closest to types produced in the Basin of Mexico. This

overall shift toward an increased use of Aztec-affiliated decorative groups is unevenly distributed across households, which creates an increased degree of interhousehold variation for most types relative to the preceding Ninupi phase. Of the Yata phase household components, two remain firmly grounded in the pattern characteristic of the preceding phases (324-Ph6, 327-Ph6), three trend very strongly toward the new high-Aztec pattern, though in individually distinctive ways (307-Ph6, 309-Ph6, and 317-Ph6), and one is an intermediate case (316-Ph6). Due to the high visibility of decorated ceramics, households showing an increased preference for Aztec ceramics may be doing so either due to emulation or immigration. However, in either case, the increase in diversity in decorated ceramics indicates less homogenous social identities at the site, as individual households pursued different strategies vis-à-vis the Aztec Empire.

Conclusions

This chapter has presented data on food related practices at Calixtlahuaca over time, particularly maize processing and general food serving practices, with the goal of evaluating how changes in local identities related to broader changes in rulership at the site. This evaluation was framed around three questions: the pre-Aztec pattern of rulership and trajectory of cultural change at the site, the pattern of cultural change under Aztec rule and its implication concerning rulership, and potential specific mechanisms of change under Aztec rule. In this section, I combine the evidence on foodways with that on ritual practices from the previous chapter. The results of the analyses in this chapter

are summarized in Table 8.15 and can be compared to the results of the prior chapter in Table 7.10.

		Ground Stone		Cooking Ceramics	Serving Vessels	
		Quantity	Use	Use	Use	Decoration
Dongu-Ninupi						
	Shift toward Basin-pattern	No shift	No shift	Yes, small increase in comal use	No shift	Increasing non-local ceramics
	Evenness of variation	n/a	No shift?	Moderately uneven	Low variation both phases	Increased evenness
Ninupi-Yata						
	Shift toward Basin-pattern	Increases, but no	No shift	Yes, additional increase in comal use	No shift	Increasing stylistically
	Evenness of variation	n/a	No shift?	High degree of variability	Low variation both phases	Increasing variability

Table 8.15 Summary of results of analyses of foodways showing shifts in interhousehold variation and local vs. Basin of Mexico cultural patterns under local and Aztec imperial rule

First, in terms of local patterns of rulership, while Calixtlahuaca was under local rule, foodways were both stable over time and relatively homogenous among households. In terms of maize processing, general grinding stone frequencies and more specific aspects of mano form remain comparable. Comal and interior-incised jars both show small increases in frequency between the Dongu and Ninpui phases. Serving vessels show some minor shifts in preferred decorative families, particularly among imported wares, but continue to be used in similar ways, based on vessel form ratios. The degree of interhousehold variation is low for most variables, and either remains comparable between the two phases (total ground stone, mano forms, comals, serving vessel forms), or reduces (interior-incised jars, decorative families). There is no evidence for multiple

local subgroups during these phases, based on the lack of similar subdivisions among households over time or across multiple artifact types within a phase.

Multiple aspects of food processing and serving, including different mano shapes, a general lack of comals, and high proportions of jars in serving vessel assemblages, differentiate the Toluca Valley from other parts of highland Central Mexico during these phases. As a result, temporal and interhousehold stability in foodways in the Toluca Valley occurred despite the knowledge of other potential patterns of maize preparation and food serving in adjacent areas, with whom the residents of Calixtlahuaca were trading. The patterns seen in foodways over time match well with the results of the previous chapter which found that ritual practices also had few inter-phase differences, low interhousehold variability, and distinctive regional practices during the Dongu and Ninupi phases. The low interhousehold variability and the trend toward increasingly even access to non-local ceramics as these became more widely available, suggests a relatively collective social organization of power at the site prior to the Aztec conquest.

Second, in terms of changes in rulership under Aztec rule, the Yata phase does see some changes toward more Aztec foodways and an increase in interhousehold variability at the site. Some aspects of foodways (increased comals, reduced use of decorated serving jars, more use of Aztec-style ceramics, possibly total grinding stone frequencies) move toward patterns more characteristic of the Basin of Mexico, while others remain similar to the local patterns characteristic of the preceding phases (mano forms and dimensions, interior-incised jar use). However, the changes fall far short of reaching levels where the values seen at Calixtlahuaca could be confused with those from the Basin of Mexico. The changes toward more Aztec foodways are also unevenly

distributed among households at Calixtlahuaca, leading to increased interhousehold variation during the Yata phase. Both the pattern of shifts toward a more Aztec pattern of use in some but not all aspects of material culture, and the increase in interhousehold variability, are the same as the patterns seen in ritual items in the preceding chapter. The incomplete nature of the shift toward Aztec practices at Calixtlahuaca is consistent with relatively indirect rule by the Aztec Empire. The increasing interhousehold variation is consistent with a less collective imperial rulership strategy, where households could seek individual gains from fostering particular imperial connections.

Third, in terms of specific causal mechanisms for change under Aztec rule, the uneven distribution of Aztec practices and objects among Yata phase households at Calixtlahuaca can be used to evaluate the potential causes for their appearance, particularly local emulation and the immigration of people from the Basin of Mexico. Of the practices considered in this chapter, visibility increases from maize grinding to maize cooking to food serving practices to food serving vessels. In cases of migration, a non-local pattern should be present in relatively low visibility practices and may also be present in higher visibility activities. The maintenance of high visibility traits among migrants will be more common where distinct group identities benefit either the host or immigrant groups. In contrast, in cases of local emulation, local households should adopt primarily high visibility aspects of non-local culture and/or use foreign object in local ways. In the previous chapter on ritual practices, three households (307-Ph6, 309-Ph6, and 317-Ph6) had practices consistent with immigrants downplaying their differences from the local population (Aztec low visibility practices, but relatively local high visibility practices), two households remained consistent with prior local practices (324-

Ph6 and 327-Ph6), and one household was intermediate between the two groups, potentially interpreted as either an ethnically mixed household or a case of local emulation.

However, the picture presented by the foodways based evidence is less clear. The general division remains between households that have relatively high shifts toward Aztec style practices or objects in some domains and those that do not show shifts in any domains. Which cases assign to which group are almost identical to those produced by the analyses of ritual items. However, the lines of evidence which do show changes are not cleanly divided along lines of low versus high visibility or objects versus practices. In food preparation practices, maize grinding does show increases in overall intensity, but these are not associated with changes in mano form. Some households partially replace interior-incised jars, likely used for tamale production, with comals for tortilla production, but the latter remains at levels far below what is seen in other parts of Central Mexico. In terms of food serving, some households shift toward using substantial amounts of Aztec style ceramics and their closest local analogs, but this shift is not accompanied by a change in the food serving practices that these vessels were used for. As a result, when food serving practices are considered in conjunction with ritual practices, there are two households that retain local practices and generally have low levels of Aztec style objects as well (324-Ph6 and 327-Ph6). These are best interpreted as traditionalist local households that actively avoided integrating Aztec practices into their daily lives. Additionally, there are two households that have more mixed use of Aztec objects and practices, with either intermediate adoption of Aztec practices, or the adoption of some practices but not others (316-Ph6 and 317-Ph6). These are interpreted

as cases of local emulation, with Aztec objects and practices integrated into local contexts. Finally, there are two households which consistently show the most Aztec practices and the most Aztec objects, for markers where there is any shift toward a Basin pattern (307-Ph6 and 309-Ph6). The interpretation of these two cases is ambiguous, as they may be either aggressive cases of local emulation, well integrated cases of immigration, or ethnically mixed households. In terms of implications for rulership, the variability among households suggests relatively indirect rulership, as some households successfully avoided almost all changes toward more Aztec lifestyles. Both highly variable local emulation or highly integrated immigrants would support an argument for relatively network oriented rule by the Aztec Empire. Either local households were variably successful in maintaining patronage relationships, or the empire was not sufficiently concerned with immigrants that they felt comfortable maintaining distinctive identities.

The variability among the Yata phase households at Calixtlahuaca demonstrates the complexity of social processes operating in Postclassic Central Mexico. While there is an overall trend toward increased interaction with the Basin of Mexico over time, such interaction varied widely on a household-by-household level. Some households may have been occupied by immigrants from the Basin of Mexico who brought Basin-style practices and social connections with them. Among the local residents of the site, some chose to integrate some Basin-style practices into their lifestyles. Others chose to actively reject Basin-style practices, emphasizing local practices with strong ties to preceding periods at the site. As a result, it is overly simplistic to speak of cultural changes at

Calixtlahuaca as being strictly driven by immigration or emulation or resistance, as all three processes were occurring simultaneously.

CHAPTER 9. CONCLUSIONS

In this dissertation I set out to determine the effects of Aztec rule on provincial commoners, using the site of Calixtlahuaca as a case study. The Aztec empire has traditionally been considered a hegemonic state, which interfered little with the day-to-day lives of its members (Hassig 1988). Under this perspective, the effects of Aztec rule can generally be characterized as slightly negative due to an increased tax burden. More recently, this perspective has been challenged by comparative studies of collective action in ancient states (Blanton and Fargher 2008; Fargher and Blanton 2007), which found that the Aztec Empire was relatively collective, with associated services provided to the greater population. Archaeologists have also argued whether the presence of the Aztec Empire was exploitative, imposing imperial ideology along with taxes, or positive, providing increased economic opportunities and cultural connections (Nichols, et al. 2009). Much of the difficulty in addressing these questions has been due to the issue of separating the effects of Aztec rule from those of broader processes of cultural and economic integration occurring during the Postclassic.

I structured my investigation of the effects of rulership at Calixtlahuaca along two axes of variation: the directness and the collectiveness of rule. The directness of rule measures the degree to which rulers chose to directly administer the lives of the ruled, as opposed to working through proxies (Gerring, et al. 2011; Hassig 1988). In the Aztec case, the empire had a choice between establishing its own bureaucracy in provincial areas and leaving local rulers in place as proxies. The directness of rule was generally

expected to correlate with the magnitude of changes occurring after the Aztec conquest of Calixtlahuaca.

The collectiveness of rule measures the degree to which leaders were accountable to their subjects (Blanton and Fargher 2008; Fargher and Blanton 2007; Fargher, et al. 2011). Under more collective rulership, rulers build powerbases by inclusion, promoting group solidarity across social classes, and providing public services. More collective rulership may be linked to economic development, as taxes are often collected in staple goods, leading the state to have a vested interest in the development of a market system. In contrast, in less collective (network-oriented) rulership strategies, leaders' power is based on exclusive control of material or spiritual sources of power and patron-client social networks. At Calixtlahuaca, I expect the collectiveness of rule, both local and Aztec, to be visible as the degree of variation among contemporaneous households, with more collective rulership resulting in greater interhousehold similarity. More collective rule is also expected to result in a general trend toward economic growth and increased market integration.

Based on the factors which these two dimensions of rulership share, there is likely to be some degree of correlation between the two dimensions. Relatively indirect rule is almost always relatively non-collective, depending heavily on provincial elites. In contrast, more direct rule can occur along a continuum of collectiveness. Additionally, the preexisting local organization of power may differ from imperial strategies of rulership, leading to mixed strategies at different levels of control. I argue that this was the case at Calixtlahuaca, with relatively collective local rulership overlaid by an additional layer of relatively indirect, non-collective imperial rulership.

I address these two dimensions of variation more specifically by examining the economic and cultural impacts of the Aztec conquest at Calixtlahuaca separately, before combining the two lines of evidence. I compared the periods prior to the formation of the Aztec Empire (Dongu phase/Middle Postclassic), prior to the Aztec conquest of Calixtlahuaca (Ninupi phase/Late Postclassic-A) and after the Aztec conquest of the site (Yata phase/Late Postclassic-B), with a sample of six excavated households from each phase. The comparisons of the first two phases provide a pre-Aztec baseline for the social organization of power and general trajectories of change under local rule. The comparisons of the final phase to this baseline provide a measure of the changes resulting from Aztec rule.

My results show that the Aztec Empire did have a noticeable effect on conquered populations, independent of broader, preexisting Postclassic trends toward macroregional economic and cultural integration. Prior to Aztec rule, regional economic integration and commoner wealth levels were increasing at Calixtlahuaca and this growth was relatively evenly distributed among households. The economic effects of Aztec conquest generally resulted in a cessation of further economic growth and an increase in interhousehold variation. Cultural change at Calixtlahuaca shows a similar pattern. Prior to Aztec rule, households at the site were gradually shifting toward more pan-Central Mexican cultural practices, as opposed to practices distinct to the Toluca Valley, but maintained a high degree of interhousehold similarity. Following the Aztec conquest of the site, the degree of Aztec and/or more generally Central Mexican practices increases. However, these cultural changes become increasingly unevenly distributed among households during this phase. Both the economic and cultural trends are consistent with relatively collective

local rule prior to the conquest of the site by the Aztec Empire. The relatively small changes under Aztec rule and their uneven distribution among households are most consistent with both moderately indirect and relatively non-collective imperial rule.

Economic Hypotheses and Expectations

Based on previous case studies of Aztec provincial sites, I initially proposed two scenarios for the economic effects of Aztec rule at Calixtlahuaca: 1) less direct, more network oriented rule by the Aztec Empire, 2) more direct, more collective rule by the Aztec Empire. I recognized that these two positions represented positions on a continuum, that intermediate positions were quite possible, and that some current models of Aztec economics include elements of both scenarios (i.e., Fargher 2009). The first scenario proposed less direct, more network-oriented rule by the Aztec Empire, conforming to traditional models of Aztec rule (Hassig 1985). Archaeologically, it is generally characteristic of the evidence seen in the outer provinces of the empire. The second scenario proposed both more direct and more collective rule by the Aztec Empire, in keeping with Blanton and Fargher's (2008) argument for more collective governance. In past archaeological research, this second scenario is generally best supported by sites in the Basin of Mexico.

In the first scenario, Aztec rule at Calixtlahuaca was relatively indirect, with a network-oriented rulership strategy focused on co-opting local elites. Under these conditions, I expect the conquest by the Aztec Empire to have had little effect on existing economic patterns, which were generally toward increasing market integration over the

course of the Postclassic. I expect to see the continuation or intensification of pre-conquest patterns of local craft production and market exchange, and a relatively low frequency of artifacts from the Basin of Mexico which would have served simply as one foreign trading partner among many. Overall wealth should remain steady or follow pre-Aztec trajectories. This pattern of minimal change has been observed at Totogal (Venter 2012) in Veracruz and Coixtlahuaca (Kowalewski, et al. 2010) in Oaxaca. Calixtlahuaca might be expected follow this pattern because, while part of a tributary rather than strategic province, the Toluca Valley still formed a significant segment of the buffer zone between the Aztec and Tarascan empires.

In the second scenario, Aztec rule was more direct, with a more collective rulership strategy that worked to incorporate both commoners and elites directly into the imperial system. In this case, I would expect to see more extensive changes in the local economic system under Aztec rule, as is seen at sites in the Basin of Mexico. I expect the Basin of Mexico (or even the imperial capitals more specifically) to dominate the local economic system. This would be expected to result in a reduction in either the diversity or total quantity of local craft production, and an increased volume of trade with the Basin. Overall wealth should decrease. Previous case studies falling toward this end of the economic continuum include Huexotla (Brumfiel 1980), and Xaltocan (Brumfiel 2005b) in the Basin of Mexico, and Yautepec, Cuexcomate and Capilco in Morelos (Smith 2003c, 2004b, 2010). Calixtlahuaca might be expected show this pattern due to its geographic proximity to the Basin of Mexico, the post-conquest rearrangement of local power known from the codices (Chimalpahin 1965 [1606-1631]:105), and the importance

of the region in supplying maize to the Basin of Mexico (Paso y Tronasco 1905-1906:7[2]:6-7).

Economic Findings

Chapters 4 through 6 of this dissertation focused on the economic aspects of life at Calixtlahuaca, with emphases on characterizing the pre-Aztec pattern and its relationship to local strategies of rulership and on the changes that occurred after the Aztec conquest and incorporation of the Toluca Valley into the Triple Alliance Empire. The three chapters focused on evidence for exchange, craft production, and wealth, respectively. They generally show similar temporal patterns to those seen in other parts of Central Mexico during the Middle and Late Postclassic, though the overall levels of economic integration into the Postclassic World System are lower than at contemporaneous sites in the Basin of Mexico and Morelos. The general pattern is one of increasing integration into the Postclassic Mesoamerican world system prior to Aztec rule, with a lack of interhousehold variation consistent with relatively collective local rule. This is followed by a levelling-off of economic growth and an increase in interhousehold variation under Aztec rule during the Yata phase. This is consistent with moderately direct but primarily network oriented rule by the Aztec Empire.

In chapter 4, I analyzed ceramic and lithic evidence for trade patterns over time at Calixtlahuaca. Ceramic exchange was evaluated using INAA, petrography, and type-based classifications. Lithic exchange was evaluated using a combination of INAA and XRF sourcing. Both artifact classes showed an increasing quantity and diversity of

imports between the Dongu and Ninupi phases, prior to the Aztec conquest, with access to non-local goods relatively evenly distributed among households. During the Yata phase, the diversity of both obsidian and ceramic sources decreases, and sources become more unevenly distributed among households. However, the quantity of obsidian reaching the site decreases, while the total frequency of imported ceramics increases. For both artifact types, there is a shift in the source regions of foreign goods over time, with an increasing proportion of imported goods coming from the Basin of Mexico.

In chapter 5, I examined evidence for craft production in the form of ceramic production, direct lithic production using various technologies, and textile production. Textile production increases over time, while most other forms of craft production decrease, though overall levels of craft production are all low for all crafts during all phases. Local ceramic production remains stable over time, measured both as the percentage of local source groups in the INAA sample and as the degree of standardization of common vessel forms. Evidence for blade-core and bifacial lithic production decreased over time, while evidence for bipolar lithic production increased during the Yata phase. When these trends are compared to the evidence for overall lithic imports at the site over time, they suggest that bipolar lithic production is primarily a reaction to a scarcity of obsidian. In contrast, multiple lines of evidence for textile production (cotton and maguey spindle whorls, and basalt maguey scrapers) increase over time. This shows an increase in both cotton and maguey textile production over time, especially during the Yata phase. Interestingly, higher levels of cotton spinning occur primarily in households displaying higher levels of other Aztec practices, while both Aztec and locally oriented households show higher levels of maguey textile production.

The timing of the most dramatic increase in textile production suggests that the increase in production levels was driven primarily by increased levels of taxation, rather than increased market opportunities. The overall levels of evidence for all forms of craft production at Calixtlahuaca are both low and unspecialized when compared to other regional sites, which is unexpected considering that it was the dominant city-state in the Toluca Valley prior to the area's conquest by the Aztec Empire.

In chapter 6, I presented various measures of wealth at Calixtlahuaca and discussed these within a broader context of their implications for the quality of life at the site over time. Most of the measured wealth markers increased between the Dongu and Ninupi phases. Following the Aztec conquest of the site, the overall pattern is toward a levelling-off in households' wealth with levels remaining similar to those seen during the preceding Ninupi phase. I also calculated a combined wealth index, with various artifact classes (ceramics, lithics, ground stone, and jewelry/rare items) assigned relative values based on the prices listed in historic Nahuatl wills and other documents. Based on this combined index, the average household's wealth increased between the Dongu and Ninupi phases, before remaining statistically equivalent during the Ninupi and Yata phases. The range of variation in household wealth, measured as the coefficient of variation or as absolute range, increased from each phase to the next, suggesting that inequality among households was increasing over time. During the Yata phase, this inequality is largely driven by the two most heavily culturally-Aztec households, which are substantially wealthier than the other contemporaneous households at the site, based on a wide range of artifact classes. This indicates that the Yata phase saw a decrease in

the standard of living under Aztec rule, both in terms of the household averages, but likely even more so in terms of local households' perceptions of inequality.

Taken together, the findings in these three chapters paint a picture of increasing economic and social integration into the Postclassic Mesoamerican World System (Kepecs and Kohl 2003) over time, partially interrupted and redirected by Calixtlahuaca's incorporation into the Triple Alliance Empire. During the Dongu phase, Calixtlahuaca was culturally and economically isolated. The material culture of the Toluca Valley diverges from that of the Basin of Mexico during the Early Postclassic and does not obviously fit within that of any other surrounding region. (As an illustration of this increasing divergence from regional trends, compare Epiclassic/Early Postclassic Santa Cruz Atizapán (Kabata 2010) to Early/Middle Postclassic Huamango (Piña Chán 1981), to Middle/Late Postclassic Calixtlahuaca.) Trade in both key necessities (obsidian) and luxury goods (imported ceramics, bronze items) was relatively limited, but geographically ecumenical, extending to the east, west, and south. Corresponding to this lack of evidence for imported goods, there is also no evidence that anything was being produced for export from Calixtlahuaca at this time. Interhousehold variation is at its lowest during this phase, largely due to the lack of anything to vary.

During the subsequent Ninupi phase, the site reached its economic peak. Imported ceramics from a diversity of sources are present in all households. Obsidian and copper, relatively high-value/low-weight goods, occur in their highest frequencies during this phase. At the same time, evidence for craft production remains relatively low, suggesting that increased market opportunities did not provoke dramatic changes in the organization or intensity of local craft production. This may be due to a lack of potential trade goods in

the Toluca Valley; the area lacks a high quality obsidian source, salt springs, or a climate appropriate for cotton cultivation. The increased foreign goods that do appear at the site are evenly distributed among households, both in terms of access to the full range of source regions and in terms of relatively comparable frequencies of most goods in most households. This broad-based economic growth is consistent with relatively collective local rule providing economic opportunities to a wide portion of the commoner population. The timing of the primary period of economic growth prior to Aztec rule also demonstrates the independence of the market system developing in Postclassic Central Mexico and the political development of the Triple Alliance.

During the Yata phase, and the associated Aztec rule of Calixtlahuaca, economic growth at the site was interrupted, to the detriment of the residents of the site. Foreign connections were re-oriented toward the Basin of Mexico, at the expense of trade with other parts of Central Mexico. This finding contrasts with the argument that the Aztec tax (tribute) requirements and/or a general “Pax Azteca” promoted lateral market development (Blanton 1996; Hicks 1987). The associated reduction in obsidian at the site curtailed an already very limited amount of local lithic production. In contrast, textile production increases, likely to meet tribute requirements. The net effect of these economic shifts is mildly negative, with no further growth in average household wealth and a pronounced wealth difference between culturally local and culturally Aztec households. Local households decrease to almost Dongu-phase wealth levels, while households featuring higher levels of Aztec cultural practices have wealth levels at least 50% higher, driven by higher values for almost all artifact classes examined. The net effect is consistent with a medium directness of rule based on the magnitude of economic

changes; prior patterns of exchange modified toward the Basin of Mexico (though no former trading partner-regions were completely lost), resulting in a cessation of further economic growth, despite the modest increase in textile production. The Yata phase trends are also consistent with relatively non-collective rule by the Aztec Empire, as they were almost uniformly negative for the residents of Calixtlahuaca.

Cultural Hypotheses and Expectations

Empires may seek to reduce the cost of controlling provincial areas via the promotion of shared ideologies. This is well documented Aztec strategy for co-opting provincial elites into supporting the empire (Berdan, et al. 1996; Stark and Chance 2012), but the degree to which it effected commoners is less understood (Brumfiel 1998). At the same time, provincial peoples may choose to adopt or reject foreign symbols or objects as a means of bolstering their own social or economic positions within local contexts of power. There is a distinction between using foreign objects, which may be manipulated in a number of ways, and adopting foreign practices, which take a greater degree of knowledge. The study of local choices concerning the adoption of foreign culture can also be complicated by immigration from culturally distinctive areas. As a result, in addition to considering evidence for the directness and collectiveness of rule at Calixtlahuaca, I also consider the likelihood of emulation and immigration as alternative explanations for the observed cultural changes.

Generally speaking, more direct rule should provide both greater top-down pressure to adopt imperial practices and more opportunities for bottom-up interaction

between residents of the provinces and the imperial core. The collectiveness of rule will also influence the adoption of non-local culture. The higher degree of regional interaction produced by collective rule will result in more overall exposure to foreign cultural practices. However, the patron-client relationships used in network-based rulership are likely to produce more uneven adoption of foreign items and practices as individual households acquire these from patrons, or use them to bolster specific relationships with members of the imperial state.

In looking at more specific explanations for cultural changes under Aztec rule, I used a framework of high- and low-visibility traits, based on Clark (2001) and related work (Cowgill 2013; Ortman 2012) to differentiate between potential explanations for the observed changes in material culture under Aztec rule. In this model, low-visibility traits, such as pottery forming techniques or butchering practices, are learned from members of one's own community and are not likely to be subject to conscious manipulation, making them good markers of immigrant populations. In contrast, high-visibility traits, such as pottery decoration, are much more likely to be actively manipulated, whether as markers of group identity (Clark, et al. 2013), local emulation of foreign locations, or immigrant references to a distant homeland (Manzanilla 2004). In market based economies, such as Postclassic Central Mexico, the use of objects in low/high visibility contexts is expected to be a more useful marker than production techniques in identifying cultural origins.

I framed my investigation of cultural change at Calixtlahuaca around three questions. First, how much cultural diversity was there at Calixtlahuaca prior to Aztec rule and what can be inferred about local rule from this? More collective rule is generally expected to produce more strongly shared cultural practices, due to both more inclusive

state-sponsored practices, and stronger social norms concerning sanctioning. Based on the ethnohistoric documentation of multiple linguistic groups in the Postclassic Toluca Valley, I considered it possible that there would be multiple cultural groups present throughout Calixtlahuaca's history. If this was the case, I expected there to be similar dimensions of variation in particular forms of material culture that continued across the two periods prior to Aztec rule, and the same household components would group together based on multiple lines of evidence. I did not find evidence for multiple distinctive cultural groups at Calixtlahuaca prior to Aztec rule; the homogeneity of cultural practices at the site is consistent with a single cultural group under relatively collective rule.

Second, what cultural changes occurred at Calixtlahuaca while it was under Aztec rule and what can be inferred about Aztec rulership practices from these changes? What is the overall magnitude of change toward the use of more Aztec style objects and practices and how evenly are these distributed among households? As with the previously discussed economic topics, I expect the directness of rule to be visible in the magnitude of changes at the site, and the collectiveness of Aztec rule (and the degree to which it interrupted prior local rulership) to be visible in the interhousehold variability in the adoption of Aztec objects and/or practices. I found that there were some moderate changes toward more Aztec cultural patterns and an increased use of Aztec style items during the Yata phase. However, these changes were highly unevenly distributed among households. This would be consistent with a moderately direct rule but primarily non-collective rulership strategy on the part of the Aztec Empire.

Third, can the changes seen under Aztec rule be explained by particular mechanisms, namely local emulation or foreign immigration, for particular households? It is possible that households at Calixtlahuaca could have actively emulated Aztec culture, both in the form of goods and practices. This would likely be the result of a combination of imperial and local choices, with both sides seeing advantages to the local adoption of Aztec culture. This scenario would be visible archaeologically as an appearance of Aztec practices in high visibility contexts, as well as a likely increase in the use of Aztec style objects. In contrast, it is also possible that Aztec settlers from the Basin of Mexico moved into Calixtlahuaca, bringing their traditional practices and stylistic tastes with them. Ethnohistoric sources for the Toluca Valley do indicate some degree of population replacement after the Aztec conquest, including both Matlatzincas fleeing across the frontier to the Tarascan Empire, and immigrants from the Basin of Mexico moving into the Toluca Valley (García Castro 1999). This would be visible as the use of Aztec practices in low visibility contexts. Depending on the relationship between the Aztec settlers and the local population, Aztec settlers might also emphasize their non-local origins in high visibility contexts, though this is not an essential component of this scenario. A high degree of population replacement would also be expected to be accompanied by a disruption of preexisting market networks and local craft production. I found that households at Calixtlahuaca covered the full range of causal mechanisms, from households that remained strongly culturally local, to those that adopted some Aztec objects or practices in piecemeal ways, to those that adopted a wider range of Aztec style goods and practices and could be strong local emulators, well integrated immigrants, or ethnically mixed households.

Cultural Findings

Chapters 7 and 8 focused on the identification of cultural changes at Calixtlahuaca over time. My analyses centered on questions of local rulership, the implications of cultural change for Aztec rulership, and potential specific causes for the observed cultural changes. Chapter 7 examined evidence for these social processes in ritual activities, and Chapter 8 did the same using food preparation and serving methods. I selected these two cultural domains because both have the potential to serve in both inclusive (inclusive public ritual, inclusive feasting) and exclusive (exclusive feasting, exclusive rituals) leadership strategies (Carballo 2015), and both include lower- and higher-visibility aspects.

Chapter 7 addressed questions of cultural identity as expressed in ritual practice, with a focus on two artifact types: figurines and censers. Figurines are a low-visibility artifact type used almost exclusively in domestic contexts. Censers are medium visibility artifact type, used in both domestic and state ritual activities (Huster, et al. 2015; Smith 2002). For both artifact types, the presence of non-local items (based on paste type) was analyzed separately from the presence of non-local practices (based on figurine subject matter and general censer form). Both artifact types were examined for patterns of variation within Calixtlahuaca and for broad similarities with other contemporaneous Central Mexican sites, using hierarchical and k-means clustering analyses. Prior to Aztec rule, ritual practices at Calixtlahuaca were distinct from those seen in most other parts of Central Mexico and relatively homogenous among households. Following the Aztec conquest of the site, the analyses show far more Aztec influence in figurines, both in

terms of imported items and in terms of use, than in censers. They also showed mismatches between households with physically Aztec items and some of those with practices consistent with other parts of Central Mexico, which would be consistent with local households integrating foreign objects into local frameworks of use on one hand and immigrant households making due with locally available items on the other. The appearance of Aztec objects and practices primarily in low-visibility domains not associated with state policy is best explained through bottom up processes either of migration or local adoption for reasons other than state sponsorship.

Chapter 8 looked at issues of cultural identity through food preparation and serving methods. Food preparation is a low-visibility activity, while food serving practices range from medium to high visibility, depending on the context of the meal. The examination of food preparation focused on methods for preparing maize, including grinding stones and cooking ceramics. Food serving methods were examined using serving vessel form and decoration. Two of the datasets, ground stone and ceramic decoration, could not be compared to regional datasets due to a lack of comparably coded data (ground stone) or fundamental regional differences (ceramic decoration). The remaining two datasets, cooking and serving vessel forms, were compared to other contemporaneous sites in surrounding areas of Central Mexico, using the same hierarchical and k-means clustering methods applied in the previous chapter. The results of these analyses of foodways were less cleanly divided along low and high visibility lines than those for ritual items. Some Yata phase households had somewhat non-local patterns of both maize cooking vessels and serving vessel decoration, while the other lines of evidence do not include any especially non-local cases.

On a phase-average level, the results of both of these chapters parallel the general economic trends seen in the previous set of chapters. Evidence for cultural interaction – both in terms of objects and in terms of practices - with the Basin of Mexico increases over time. This is visible both in terms of the quantity of Aztec style material culture entering circulation at Calixtlahuaca, and in the increasing use of the Aztec style, in both local and imported objects. Cultural practices at the site are distinctive from those in most of Central Mexico during these phases, indicating a distinct local cultural tradition. During the final Yata phase, the site average for most traits remains more similar to preexisting local practices than to non-local ones, but there is evidence for small shifts toward a pattern of material culture more similar to the Basin of Mexico across a wide range of lines of evidence.

Interhousehold variation also increases during Aztec rule. Together, the analyses in these two chapters demonstrated that Dongu and Ninupi phase households were relatively homogenous within phases. The ceramic phase usually, though not perfectly, determined the primary cluster assignments for households dating to these two time periods. In contrast, the Yata phase households did not consistently cluster as a single group in most of the analyses, with individual households fluctuating between clustering with earlier local cases, some contemporaneous local cases, and the foreign comparative cases. The patterning in this variation is consistent with two households actively maintaining a local identity (324-Ph6 and 327-Ph6), two local households emulating some Aztec practices (316-Ph6 and 317-Ph6), and two households which were either very strong cases of emulation, ethnically mixed, or well-integrated immigrants (307-Ph6 and 309-Ph6).

This patterning has implications for considerations of both immigrants and locals at the site. First, if there were immigrants at Calixtlahuaca, they were a well-integrated minority. The majority of the items in the immigrant households were consistent with items made in the preexisting local tradition, indicating that the majority of suppliers of basic goods in the local market system remained local peoples. However, despite this, immigrant or ethnically mixed households chose to continue visibly marking their cultural differences, using Aztec items in both some high and low visibility contexts. The potential Aztec immigrant or strong emulator households were significantly wealthier than any of the other contemporaneous local households at the site. This suggests it was both safe and socially advantageous for immigrants to maintain and display social ties to the Basin of Mexico.

Second, the local population could choose to opt in or out of emulating Aztec practices. This can be seen in the contrast between the emulator and locally focused households during the Yata phase. The presence of both imported and locally produced versions of Aztec ceramics, especially figurines and Black-on-Orange ceramics, in local households indicates that there were few cultural restrictions on the acquisition of such goods. Neither were households missing Aztec goods restricted by economic causes. One of the households which shows a rejection of Aztec culture is comparably wealthy to the two households that did emulate aspects of Aztec culture, demonstrating that it was not an inability to purchase such goods that limited the household's access. At the same time, the uneven distribution of different types of Aztec goods in individual households indicates that there was no master promotion of such goods as an overall cultural complex, to be adopted in full. The intermediate-level emulator households use a subset

of the same items and practices used by the Aztec immigrant/strong emulator households at the site. Thus it is a reasonable possibility that these cases of intermediate-level local emulation were primarily influenced by bottom-up non-state interactions with people from the Basin of Mexico, such as their immigrant commoner neighbors, rather than by official state policy or even local elites.

Cultural practices at Calixtlahuaca are most consistent with a relatively collective form of pre-Aztec rulership. Most cultural traits show relatively low levels of interhousehold variation prior to Aztec rule, and while access to non-local goods increases, they are incorporated into local frameworks of use. Under Aztec rule, cultural practices show a modest shift toward more Basin of Mexico practices, but also show much higher levels of interhousehold variation. Given that many of the cultural practices which shift toward more Aztec-characteristic patterns are not those that would be expected to be associated with imperial cult activity (e.g. figurines), these shifts are more likely the result of bottom-up processes than official Triple Alliance imperial policy. As a result, the cultural shifts under Aztec rule are most consistent with moderately indirect rule, and with a network-oriented rulership strategy.

Methodological Implications

In analyzing the data for this dissertation, I have identified three methodological points of particular importance. These are the value of reasonable sample sizes, the importance of comparing multiple lines of evidence, and the need to publish basic

excavation data for comparative purposes. While none of these are particularly new or unique points, they do benefit from a brief discussion here.

First, in an era of reduced funding for archaeological research, there is a tendency to excavate a relatively small sample of contexts at any given site, and extrapolate extensively from them. This may be seen in any number of recent projects in Mesoamerica, where two or three houses are taken to be representative of the site as a whole. While archaeological interpretation will always be based on a sample, this trend seems to be increasing. My analysis of households at Calixtlahuaca demonstrates the flaws in such a method, as a random subsample of two or three of the excavated household contexts from each phase (let alone two or three total contexts), would have had a reasonably high probability of producing differing overall patterns of exchange, craft production, or ethnic diversity over time simply due to the amount of variation in the dataset as a whole. One example of this can be seen in the comparison of INAA (17 components) and petrography-based analyses (6 components) of imported ceramics over time, where petrography showed the majority of the increase in imports earlier than the INAA samples did. However, a comparison of the specific household components selected for petrography showed that they did correspond with the INAA results from the same contexts, but that these were not necessarily representative of the broader, sitewide pattern. I am aware that, as a dissertation, the scope of my research would not have been possible without access to the data produced by the greater Calixtlahuaca Archaeological Project. However, this does point to the value of returning to a previously excavated site, or coordinating multiple dissertation-level projects in order to provide a reasonable sample of contexts.

Second, in a similar vein, my analyses also demonstrated the need to compare the results of multiple lines of analysis. There is often a tendency for specialists associated with a larger project to publish their results more or less independently of each other. In a best-case scenario, this leads simply leads to similar conclusions weakened by not considering supporting evidence, while in the worst-case scenario this leads to active conflicts of interpretation based on what should be a single body of evidence. The data from Calixtlahuaca could easily have produced the latter pattern, if the analyses had been divided upon more traditional lines. For example, the evidence for the total quantity of lithic and ceramic imports during the Yata phase show drastically different patterns, with the former dropping and the latter rising.

Finally, my work on this dissertation has led me to emphasize the value of publishing basic data, such as artifact counts, either in print or in a widely accessible digital repository. This is not the sort of sexy publishing of hot theoretical ideas that will get you talked about, but it is good, practical archaeology. If archaeology seeks to move beyond the descriptive level, with explanations based on single sites, then it is imperative that comparative data be widely available. As a fairly basic example, I compiled comparative data on a number of items in this dissertation, including lithic/sherd ratios, spindle whorl frequencies, and percentages of imported ceramics at various sites. In each case, these comparative data allowed me to contextualize the results at Calixtlahuaca in a regional context. For example, while the amount of evidence for textile production at Calixtlahuaca goes up quite across the three study phases, even the final, highest levels are far below what is seen at most contemporary sites. Given the amount published on many of the sites for which I collected data, it was surprisingly hard to compile basic

data. The publication of such information allows for the analyses that the original researcher may not have anticipated, and that are often not possible from summary statistics alone.

Implications for Understanding the Aztec Empire

Based on the rulership strategies identified at Calixtlahuaca, this dissertation provides three insights about the relationship between the Aztec Empire and the commoner households which made up the majority of its population. First, as a general characterization, local rule at Calixtlahuaca was relatively collective, while imperial Aztec rule was both moderately indirect and primarily non-collective. This provides a means of resolving the apparent contradiction between the characterizations of the Aztec Empire provided by Hassig (1988) and Blanton and Fargher (2008). The former is focused primarily on actions taken by the Triple Alliance proper, acting above the level of the city-state. The latter conflates actions at the level of the city-state, which in the Basin of Mexico highly overlapped the imperial hierarchy, with those of the Triple Alliance. In shifting the focus of research to outside of the Basin, this distinction becomes more apparent.

Second, as a result of this relatively indirect rule outside of the Basin of Mexico, the Aztec Empire was not particularly accountable to its provincial subjects. Based on the data from Calixtlahuaca, the Aztec Empire did not act for the benefit of the majority of its population, especially the provincial commoner majority. (As a caveat, the commoner population of the Basin of Mexico may have been a separate case.) Aztec rule curtailed

the growth of foreign trade connections and caused a cessation in economic growth at the site. This is not a particularly new insight, as the Triple Alliance has traditionally been characterized as predominately hegemonic in nature, more interested in what could be extracted from its provinces than what could be invested in them (Hassig 1988). This net negative effect of Aztec rule helps account for the frequent revolts against the Aztec Empire, as commoners would have seen benefits in participating in attempts to free their community from imperial control.

Third, while the Aztec empire did not act for the benefit of its provincial population, neither did it actively oppress them. The combination of the economic and cultural changes at Calixtlahuaca demonstrate that—at least in this case—the changes felt by commoner households were more likely to be the secondary consequences of Aztec imperial actions, rather than the direct result of policies targeting commoners themselves. The loss of diversity in trading partners was likely a secondary consequence of the establishment of the frontier between the Aztec and Tarascan Empires (Silverstein 2000). In addition to official policies limiting trade across the border, ongoing conflict between the two empires likely limited how much people living near the border felt comfortable travelling. Both empires limited official cross-border trade and given the more centralized nature of the Tarascan state (Pollard 2016), it may have applied the more successful barriers to trade. Commoner access to non-local goods at Calixtlahuaca may also have been affected by Aztec efforts to remove control of the local market system from local political authorities (Berdan, et al. 1996; Hirth 2013). Similarly, there does not appear to have been any attempt to introduce Aztec culture into commoner lifeways as a means of political control. Some local households did adopt specific aspects of Aztec culture, but

these are idiosyncratic among households and often involve the incorporation of Aztec style objects into local use practices. In addition, all of the emphasized items are part of stylistic traditions that predate the Aztec Empire in the Basin of Mexico.

Future Research Directions

This work provides valuable insight into the effects of Aztec rule on provincial commoners at Calixtlahuaca. The insights produced in this research demonstrate the value of a nuanced consideration of the effects of imperial-provincial interaction. As a result, case studies of Aztec imperialism should move beyond simply finding evidence for an Aztec presence in provincial areas. This is an important first step, and the distribution and types of evidence of interaction can provide valuable information about the types of interaction occurring between the two regions. However, the next logical step is to ask what the particular imperial and provincial strategies that produced this pattern were, and how these combined to produce the observed effects of the interaction. There may be cases, especially beyond the relatively highly integrated market network of Central Highland Mexico, where Aztec rule had far fewer economic effects than at Calixtlahuaca because there was less previous economic development to interrupt. In looking at the directness and collectivity of rule, this dissertation provides a useful framework for looking at the interplay between imperial and local organizations of power. It should be extended to sites in other settings, particularly rural sites and sites where there is little evidence for interaction, in order to further develop our understanding of the Aztec Empire.

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APPENDIX A

CERAMIC TYPE LIST AND CODING SHEET

This section provides basic classification coding information for the Calixtlahuaca Archaeological Project's general ceramic typology. It includes a master list of type codes and descriptions, with vessel forms, source regions, and decorative families used for analysis, and a copy of the project ceramic classification form. A copy of the project ceramic database and a more detailed project ceramic typebook will be available on tDAR as part of the general CAP dataset (tDAR ID: 401248).

Table A.1 Source region codes used for regional ceramic provenience assignments

Source	
Region Code	Source Region
(blank)	Not Postclassic or Not a Vessel
1	Local Toluca Valley
2	Basin of Of Mexico
3	Morelos
4	South or Southwest State of Mexico
5	Mixed Local/Basin of Mexico
6	Other Non-Local Region

Table A.2 Ceramic type codes used by the Calixtlahuaca archaeological project. For a listing of primary vessel form code meanings, see Table B.1. For source regions, see Table A.1. For decorative family descriptions, see Table 8.13. Total Sherds Classified include all classified excavated material (DS-5 Sample).

Code	Type Description	Primary Vessel Form	Source Region	Decorative Family	Total Sherds Classified
<i>Unknown</i>					
0	Eroded uncertain	21	1		14,296
<i>Bowls</i>					
10	Eroded uncertain	4	1		10,398
11	Plain	4	1		10,674
200	Red rim - fragment	4	1	A	799
201	Red-rim bowl-plato - Vessel	4	1	A	8
172	A-3: R rim w/cross	4	1	E	80
278	Plain with incision	4	1	BINCS	3
202	B-0: Red, frag / uncert	4	1	B	4,646
203	B-1: Plain red	4	1	B	191
204	B-2: BW/R w/ rows of motifs	4	1	B	142
205	B-3: BW/R, white zone (#64)	4	1	B	1
206	B-4: BW/R, cont. band w/ motif #32	4	1	B	23
207	B-5: Incised red (V. Bravo)	4	4	BINCS	86
192	Guinda, variant B	4	2	AZRED	83
208	B-6: Other B Mex looking red	4	2	AZRED	406
209	B-7: B/R, 3 curving panels w/ scroll	4	4	B	4
210	B-8: B/R, contin. band w/ vert. lines	4	1	B	4
211	B-9: Wide-band graphite red	4	2	B	3
270	B-10: Complex dec w/orange	4	1	B	16
137	B-11: Red-or incised	4	4	BINCS	70
212	B-xx: Red vessel, untyped	4	4	B	12
265	C-0: frag / uncert	4	1	C	56
213	C-1	4	1	C	545
214	C-2	4	4	C	37
272	B / C: fragment, bowl	4	1	C	11
215	D-0: Red, frag / uncert	4	4	D	86
216	D-1: Malinalco polychrome	4	4	D	6
188	D-3 or 4	4	4	D	9
219	D-5: Cmplx geom thin-line R/white	4	4	D	6
135	D-6: Horiz bands, sloppy dec	4	1	D	7
221	E-0: R/buff, frag / uncert	4	1	E	3,300
269	E-0: Black/buff, bowl	4	1	E	4
222	E-1: Wide-band red	4	1	E	202
223	E-3: Mostly red, concentr designs	4	1	E	77
224	E-4: Jagged triangles designs	4	1	E	94
225	E-5: 3 panels w/ frames	4	1	E	714

			Primary		Total
			Vessel	Source	Sherds
Code	Type	Description	Form	Region	Classified
Bowls (Continued)					
226	E-6:	red stripes around band of R/B	4	1	E 283
227	E-7:	2 panels, hourglass motif	4	1	E 10
228	E-8:	wavy-line R/B	4	1	E 41
277	E-9:	Wide horizontal bands	4	1	E 507
132	E-10:	Thin par. Lines	4	1	E 3,397
133	E-11:	Par lines, dif. Direcions	4	1	E 841
173	E-12:	R/bf, int & ext	4	1	E 96
174	E-13:	sun motif	4	1	E 90
185	E-14:	large circles	4	1	E 39
184	E-16:	Red int, R/B ext	4	1	E 33
229	E-xx:	R/buff vessel, untyped	4	1	E 5
264	B/E:	Red fragment	4	1	2,939
230	G-0:	Neg R/B, frag / uncert	4	4	G 81
231	G-1:	3 patches, busy spiral neg.	4	4	G 4
232	G-2:	Geom neg, red bands (SM lx)	4	4	G 9
234	G-xx:	Neg R/B vessel, untyped	4	4	G 4
189	D or H,	uncertain	4	4	H 6
235	H-0:	Neg R/white, frag / uncert	4	4	H 1
236	H-1:	3 patches, busy negative	4	4	H 5
237	H-xx:	Neg R/wh vessel, untyped	4	4	H 1
25	Painted,	eroded	4	1	25
109	Stamped	base	4	1	BoM 4
122	Other	Decorated Types	4	6	OI 97
1	Aztec	orange, untyped	4	2	AZOR 9
24	Aztec I	black/orange	4	2	AZOR 6
108	Aztec II	black/orange	4	2	AZOR 1
21	Aztec III	black/orange	4	2	AZOR 295
114	Aztec III/IV	black/orange	4	2	AZOR 44
271	Aztec III,	Local A	4	5	AZOR 445
274	Aztec III/IV,	Local A	4	5	AZOR 31
181	Aztec III,	Local, B	4	2	AZOR 405
182	Aztec III/IV,	Local B	4	2	AZOR 65
177	Aztec IV		4	2	AZOR 2
22	Chalco-Cholula	Polychrome	4	2	BoM 13
12	Mor: C-2		4	3	OI 1
26	Mor: I		4	3	OI 2
17	Mor: Tla poly,	fragments	4	3	OI 1
166	Coyotlatelco?		4	4	8

Code	Type Description	Primary Vessel Form	Source Region	Decorative Family	Total Sherds Classified
<i>Jars</i>					
30	Eroded	5	1		119,128
31	Plain	5	1		103,168
32	Painted, eroded	5	1		78
38	Other decorated	5	4	OI	84
253	B-0: Red, frag / uncert	5	1	B	1,010
254	B-2: BW/R w/ rows of motifs	5	1	B	18
255	E-0: R/buff, frag / uncert	5	1	E	2,114
268	E-0: Black/buff	5	1	E	16
256	E-2: R/B jar w/ parallel lines	5	1	E	3,980
266	B / E: fragment, olla	5	1		1,418
263	D-0: Red, frag / uncert	5	1	D	118
258	G-4: Neg, wide red band # 45	5	4	G	5
257	F-1: Vertical stripes & dots	5	4	F	2
123	Aztec III black/or jar	5	2	AZOR	10
33	Tlahuica polychrome	5	3	OI	1
34	Xochimilco polychrome	4	2	BoM	2
39	Black-on-white	5	6	OI	4
275	Incised olla	14	1	BINCS	6
145	Coarse orange	5	2		29
146	Coarse orange, cream slip	5	2		70
<i>Basins</i>					
40	Eroded	6	1		41
41	Plain	6	1		45
42	Thin-walled Basin	6	2		69
<i>Comals</i>					
45	Eroded	7	5		600
46	Plain	7	5		560
<i>Other Vessel Forms</i>					
60	Fragment / uncertain	21	1		97
262	Sahum, Tol Valley form	12	1		683
64	Sahum, ValMex/Morelos form	12	2		117
267	Basin censer	13	1		4,050
65	Large brazier	13	1		89
101	Deeply incised censer	13	1		423
44	Hanging censer	13	2		1
170	Other censer	13	1		313

Code	Type Description	Primary Vessel Form	Source Region	Decorative Family	Total Sherds Classified
<i>Other Vessel Forms (Continued)</i>					
170	Other censer	13	1		313
69	Pitcher, guinda	10	2	AZRED	32
259	D-2: Pitcher, "Techialoyan"	10	4	D	1
72	Pitcher, other dec	10	1	E	87
70	Copa, fragment	8	1	E	14
112	Copa, flaring	8	1	AZRED	3
110	Copa, Cholula	8	2	BOM	10
113	Guinda vase	8	2	AZRED	82
273	Pyriform incised vase	14	4	BINCS	27
131	Tlaloc jar	16	1		1
179	Tlaloc vessel	16	1		8
66	Spinning bowl, local	18	1		4
67	Spinning bowl, Aztec	18	2		39
186	Spin bowl, local Az-B	18	2		21
68	Texcoco fabric marked	20	2		612
71	Miniature vessel	11	1		170
115	Stirrup vessel	5	1		7
168	Asymmetrical bowl	20	1		12
167	Thick-rim vessel	5	1		1,377
180	Odd composite object	12	1		164
134	Crude unfinished	11	1		1,037
178	Ring base bowl	20	1		43
100	Ladle	17	5		54
74	Other form	20	1		15
169	Hollow support/handle		1		1,014
<i>Non-Vessel Ceramics</i>					
80	Fragment / uncertain				164
81	Spindle whorl, small				35
82	Spindle whorl, large				131
84	Figurine				355
83	Sherd disk				2,830
91	Sherd disk, perforated				3
92	Worked sherd				31
86	Water-worn sherd				52
85	Stamped base				4
87	Pipe				32

			Primary		Total
			Vessel	Source	Sherds
Code	Type	Description	Form	Region	Classified
Non-Vessel Ceramics (Continued)					
90	Ball				36
98	Cylinder (solid)				81
95	Bead				8
175	lip plug				2
97	Tube				7
102	Relief				13
130	Sculpture				3
183	Adorno				15
171	Ceramic cone				7
99	Mold for figurines				5
105	Mold, other				4
96	Lump				28
138	Cer production-misc				2
49	Net weight				1
187	Spike				20
280	Music-Wind				82
281	Music-Rattle				37
Non-Postclassic Ceramics					
501	Formative				2
502	Classic				37
504	Epiclassic				3
505	Colonial				1
116	Colonial glazed earth.		21	6	2
506	Glazed earthenware, unph				270
507	Other modern/colonial				2
508	Modern vessels				4

Figure A.1 Calixtlahuaca Archaeological Project Ceramic Lot Classification Form.

Diagram illustrating the relationship between Locus, Lot, and Ltyp. The diagram shows four rectangles arranged horizontally. The first three rectangles are labeled 'Locus' and the fourth is labeled 'Ltyp'. A vertical line separates the 'Locus' group from the 'Ltyp' group.

[illegible][illegible][illegible]

Total Eroded:				
Grand Total: →				

[illegible]

Size:

APPENDIX B

ATTRIBUTE CODES, CODING SHEETS, AND CONTEXTS SAMPLED

This appendix provides coding and sample information for the ceramic attribute analysis. It includes a list of codes, sample coding sheets, and a list of specific proveniences sampled. Copies of the database of attribute results will be provided upon request to the author.

Table B.1 List of ceramic attributes recorded, with a full list of attribute codes.

Excavated Ceramic Attribute Codes		Huster -19/8/2011	
Provenience		5 Concavo	
Anota el numero de bolsa		6 Ovulado	
		7 Recto-divergente	
General		8 Azteca	
Numero de A - anota el numero de A, con cuatro digitos numericos (A-0001).		9 Globular	
		11 Asa Hueco	
		12 Fragmento de Asa	
Tipo -Codigo de tipo de cerámica, de la lista que usan para la clasificación general.		48 Fragmento de Soporte	
		33 Jarra, forma importada	
		36 Jarra, forma local	
Parte - Parte de vasija (borde, cuerpo, soporte/asa, molcajete). Si el tepalcate incluye más que un parte, anótalas todas.		14 Olla cuello alto, curvado	
		15 Olla cuello baja, curva profunda	
		17 Olla cuello recto, hacia afuera	
1 Borde		49 Olla cuello hacia adentro	
2 Cuerpo		58 Olla cuello recto, vertical	
3 Asa/Soporte		59 Olla cuello outflared	
4 Molcajete		60 Olla cuello forma de S (BA)	
		46 Cuenco delgado	
Forma		61 Comal, plano	
Categoria de Vasija (Cat de V)		62 Comal, borde elevado	
1 Tripode (o tripode/molcajete incierto)		63 Comal, borde grosor variable	
2 Molcajete		18 Mini olla	
3 Cajete sencillo		19 Mini cajete	
4 Cajete, general (si no se sabe si es cajete o tripode)		20 Mini sahumador	
5 Olla		21 Mini jarra	
6 Cuenca/Cazuela		22 Mini tripode	
7 Comal		23 Mini molcajete	
8 Copa		24 Mini plato tripode	
10 Jarra		25 Mini incensario	
11 Vasija Miniatura		26 Mini, otro	
12 Sahumidor		27 Sahum Estilo Valle de Toluca	
13 Incensario		28 Sahum Estilo Valle de Mexico/Morelos	
14 Vasija Piriforma		53 Sahum con cortados	
16 Vasija Tlaloc		47 Incensario forma vaso	
17 Cucharon		29 Incensario Biconico	
18 Cajete de hilar		30 Anafre	
20 Otra forma		31 Incensario Rayado	
21 Quien sabe		32 Incensario Colgada	
		54 Incensario tripode	
		55 Braserio Grande	
Forma Especifica de Vasija		38 Vasija de sal	
1 Plato		39 Asa estribillo	
2 Conico		40 Vasija Asimetrico	
3 Hemisferico		55 Copa, biconico	
4 Recto		56 Copa, vaso de vino	

Forma Especifica de Vasija, cont.	% de borde que está presente: usa las líneas rayando en cartón con tamaños de círculos	
57 Copa, globo		
42 Otro		
44 Quien sabe	Ancho del borde (A de B) - mide el ancho máximo de la borde con los calibradores	
Formas de Bordos (F de B)		
1 Curvado/Curved	Decoracion	
2 Ahusado/Tapering	Engobe	
3 Cuadrado/Square	1 Erosionado	
4 Triangular/Triangular	2 Sin engobe	
5 Bolito interior/Ball on interior	3 Negro	
6 Bolito exterior/Ball on exterior	4 Blanco	
7 Curvado al interior/Curved interior only	5 Crema	
8 Curvado al exterior/Curved exterior only	6 Café clara	
9 Cíncel interior/Chisel in-facing	7 Café oscura	
10 Cíncel exterior/Chisel out-facing	8 Naranja clara	
11 Enlargado interior/Bulge to interior	9 Naranja fuerte	
12 Enlargado exterior/Bulge to exterior	10 Naranja en molcajete	
13 S pequeña/Small S curve	11 Rosa/Rojiza	
14 Cuadrado interior, redondo	12 Otro	
15 exterior/Square interior, rounded	13 Quien sabe	
16 exterior (comals)		
17 Indentada/Indented (comals)	Motivos: Cuales de los motivos de la lista de motivos aparecen en el tepalcate? Puede marcar más que una.	
18 BA, top > bottom, shallow, pointed		
19 BA, bottom longer than top, rounded		
20 BA, top/bottom ~equal		
21 Other	Barro	
Angulo de Borde (A de B) - Ollas	Pastas: Ve la lista de tipos de pastas de Julie	
1 Continuous from neck angle		
2 Mildly outflaring relative to neck,		
3 smooth angle		
4 Mildly outflaring relative to neck, sharp		
5 angle		
6 Strongly outflaring relative to neck,		
smooth angle		
7 Strongly outflaring relative to neck,		
sharp angle		
8 Other		
Diámetro de vasija (D de V) - usa el cartón con tamaños de círculos. Mide al centimetro mas cerca		

Support and Molcajete Codes			
Tipo de Soporte/Asa		Forma de Soporte/Asa (F de S)	
1 Soporte solido		1 Cilindrico	
2 Soporte hueco		2 Ahusado	
3 Soporte hueco con sonaja		3 Aplanizado	
4 Soporte Annular		4 Almena	
5 Asa lazada vertical		5 Almena cortada	
6 Asa lazada horizontal		6 Hueco, compuesto (angulos rectas)	
7 Asa de ceja, horizontal		7 Forma de patita	
8 Asa vertical en borde, pequena		8 Soporte, estilo arana (curvado y	
9 Asa vertical en borde, larga		ahusado)	
10 Asa vertical en borde y otra asa		9 Bolito	
11 Asa de estribillo		10 Soporte, forma de cincel	
12 Asa de jarra (larga, vertical)		11 Ahusado, curva hacia afuera	
13 Asa de jarra, hueca		12 Bulboso	
14 otro soporte		13 Cylindrico, curva hacia afuera	
15 Soporte de pedestal		15 Filamentos retorcidos	
16 varias diversas asas		17 Termino de Espiral	
17 Soporte lazada		18 Termino bifurcado	
18 Asa lazada vertical, vas. Desconocida		19 Asa Almena	
19 Asa lazada en borde, vas. Desconocida		14 Otro	
20 Asa de ceja, horizontal, vas. Desconocida		16 Quien sabe	
21 Asa lazada horizontal, vas. Desconocida			
22 incierto		Diseno de Soporte/Asa (D de S)	
23 asa lazada, incierto		1 Decoracion muy erosionado	
24 Asa hueco		2 Sencillo	
		3 Todo de un color	
Altura de Soporte/Asa (Alt): Si es completo, mide el soporte o asa en su dimensión máxima al milimetro		4 Una linea vertical de color	
		5 Circulo	
		6 Mancha	
		7 Complejo	
		8 Fronte de soporte todo pintado	
Diseno de Molcajete (D de M) - Usa la lista de imagenes de tipos de rayadura		Fronte y atras de soporte con disenos	
		9 diferentes	
		10 Mitad de abajo de soporte todo pintado	
		11 Rayas horizontales	
		12 Erosionado	
		13 No aplica	

Figure B.1 Ceramic attribute recording forms for rim sherds (p.1) and appendage or molcajete sherds (p.2)

[illegible]

Table B.2 List of household context lots sampled for ceramic attribute analysis, with total sherd counts and number of sherds included in attribute sample. Arranged by household component.

Phase	Unit	Locus	Lot	Total Sherd Count	N. Attribute Samples	Phase	Unit	Locus	Lot	Total Sherd Count	N. Attribute Samples
2	307	2	3	691	64	2	320	5	5	55	5
2	307	2	4	900	57	2	320	10	3	687	53
2	307	5	2	1275	54	2	320	10	4	197	1
2	307	5	3	318	20	2	320	10	5	518	68
2	307	12	3	274	8	2	320	14	3	196	15
2	307	12	4	1312	76	2	320	16	4	524	38
<i>Total</i>				<i>4770</i>	<i>279</i>	2	320	17	4	180	15
						2	320	17	6	424	30
2	315	12	10	487	27	2	320	22	3	662	54
2	315	13	9	118	4	<i>Total</i>				<i>3443</i>	<i>279</i>
2	315	13	12	120	39						
2	315	13	13	178	9	2	323	2	8	267	11
2	315	14	5	147	10	2	323	2	9	310	24
2	315	14	8	844	27	2	323	2	12	1434	79
2	315	15	2	23	1	2	323	2	13	848	28
2	315	17	6	69	1	2	323	13	2	2373	101
2	315	17	7	205	13	2	323	13	3	901	37
2	315	21	10	760	32	<i>Total</i>				<i>6133</i>	<i>280</i>
2	315	22	10	1566	61						
2	315	22	11	1165	16	2	324	16	3	408	40
2	315	22	13	389	15	2	324	16	4	454	61
2	315	28	1	761	26	2	324	16	5	52	7
<i>Total</i>				<i>6832</i>	<i>281</i>	<i>Total</i>				<i>914</i>	<i>108</i>
2	316	4	4	495	22	4	303	1	6	692	33
2	316	4	5	211	20	4	303	1	7	1255	57
2	316	5	4	216	24	4	303	1	8	1399	70
2	316	5	5	215	23	4	303	6	7	2219	119
2	316	5	6	143	12	4	303	6	9	1097	144
2	316	5	7	22	3	<i>Total</i>				<i>6662</i>	<i>423</i>
2	316	6	5	235	33						
2	316	7	4	238	21	4	307	8	7	2094	40
2	316	7	7	549	58	4	307	20	8	10182	212
2	316	15	4	618	59	4	307	20	9	1610	24
<i>Total</i>				<i>2942</i>	<i>275</i>	<i>Total</i>				<i>13886</i>	<i>276</i>

				Total	N.					Total	N.
				Sherd	Attribute					Sherd	Attribute
Phase	Unit	Locus	Lot	Count	Samples	Phase	Unit	Locus	Lot	Count	Samples
4	308	2	3	1444	110	6	309	7	2	149	15
4	308	2	4	927	73	6	309	10	2	119	17
4	308	2	5	126	10	6	309	11	3	74	7
4	308	3	2	824	59	6	309	14	2	696	80
4	308	3	3	408	32	6	309	14	3	38	6
<i>Total</i>				3729	284	6	309	14	4	66	7
						6	309	18	2	1252	83
4	311	1	4	489	35	6	309	18	3	233	20
4	311	1	6	745	111	6	309	25	3	467	37
4	311	1	7	420	48	<i>Total</i>				3094	272
4	311	2	8	352	22						
44	311	5	5	444	35	6	316	5	2	403	19
44	311	5	6	407	59	6	316	6	1	1421	88
4	311	5	7	170	29	6	316	7	2	1055	54
4	311	11	5	127	15	6	316	15	1	996	49
4	311	11	6	212	38	6	316	15	2	1017	64
4	311	18	1	1068	106	<i>Total</i>				4892	274
4	311	20	1	137	8						
4	311	21	3	417	41	6	317	7	3	556	40
<i>Total</i>				4988	547	6	317	12	8	401	21
						6	317	13	4	428	25
4	316	4	9	639	17	6	317	14	6	533	30
4	316	5	3	521	23	6	317	25	6	632	24
4	316	6	4	412	1	6	317	25	8	581	1
4	316	8	5	844	51	6	317	28	6	818	51
4	316	8	8	413	15	6	317	34	4	420	20
4	316	15	3	674	25	6	317	35	4	695	35
4	316	16	2	705	33	6	317	35	5	638	32
4	316	17	2	936	46	<i>Total</i>				5702	279
4	316	17	3	520	20						
4	316	25	2	912	50	6	324	1	5	468	40
<i>Total</i>				6576	281	6	324	1	6	117	10
						6	324	1	8	231	19
4	322	1	2	316	59	6	324	4	4	869	63
4	322	2	2	713	120	6	324	4	5	441	30
4	322	2	3	484	92	6	324	6	4	1312	115
<i>Total</i>				1513	271	<i>Total</i>				3438	277
6	307	8	3	94	5						
6	307	9	2	904	29						
6	307	10	2	518	23						
6	307	20	2	3081	125						
6	307	20	3	1811	95						
<i>Total</i>				6408	277						

APPENDIX C
INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS (INAA) SAMPLE LISTS
AND LAB REPORT

This appendix provides additional information on the ceramic samples submitted to MURR for INAA analysis. It includes catalogs of samples submitted by Huster and Smith, with excavation context, phase, and ceramic type information. It also includes a copy of the analysis report provided by MURR. A full copy of the INAA elemental concentration results will be posted to tDAR and on the MURR Archaeometry website. They are also available upon request to the author.

Table C.1 Catalog of random household sample ceramic sherds submitted for INAA, with project chemical source group assignments and macroregional matches. For a full list of ceramic type descriptions, see Table A.2.

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp

1	303	6	9	4	11	Plain Bowl	Simple bowl	CAL_F
2	303	6	9	4	11	Plain Bowl	Simple bowl	CAL_F
3	303	6	9	4	11	Plain Bowl	Simple bowl	CAL_F
4	303	6	9	4	11	Plain Bowl	Bowl, legs unknown	CAL_F
5	303	6	9	4	10	Eroded Bowl	Simple bowl	CAL_F
6	303	6	9	4	10	Eroded Bowl	Simple bowl	CAL_F
7	303	6	9	4	221	Matlatzinca Red-on-Buff (variant unknown)	Bowl, legs unknown	CAL_F
8	303	6	9	4	185	Matlatzinca Red-on-Buff (red circles variant)	Bowl, legs unknown	CAL_F
9	303	6	9	4	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_F
10	303	6	9	4	277	Matlatzinca Red-on-Buff (wide band variant)	Molcajete	CAL_F
11	303	6	9	4	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_F
12	303	6	9	4	185	Matlatzinca Red-on-Buff (red circles variant)	Tripod bowl	CAL_F
13	303	6	9	4	207	Matlatzinca Incised Redware (interior)	Tripod bowl	CAL_F
14	303	6	9	4	11	Plain Bowl	Bowl, legs unknown	CAL_F
15	303	6	9	4	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_F
16	303	6	9	4	30	Eroded Jar	Jar	CAL_F
17	303	6	9	4	30	Eroded Jar	Jar	CAL_F
18	303	6	9	4	30	Eroded Jar	Jar	CAL_F
19	303	6	9	4	30	Eroded Jar	Jar	CAL_F
20	303	6	9	4	30	Eroded Jar	Jar	CAL_F
21	303	6	9	4	30	Eroded Jar	Jar	CAL_F
22	303	6	9	4	30	Eroded Jar	Jar	CAL_F
23	303	6	9	4	30	Eroded Jar	Jar	CAL_F

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
24	303	6	9	4	31	Plain Jar	Jar	CAL_F	
25	303	6	9	4	31	Plain Jar	Jar	CAL_F	
26	303	6	9	4	72	Matlatzinca Pitcher	Pitcher	CAL_F	
27	303	6	9	4	170	Other Censer	Frying Pan	CAL_F	
28	303	6	9	4	134	Crude Unfinished	Censer	CAL_F	
29	303	6	9	4	134	Crude Unfinished	Bowl, legs unknown	CAL_F	
30	303	6	9	4	134	Crude Unfinished	Bowl, legs unknown	CAL_F	
31	303	6	7	4	202	Crude Unfinished	Simple bowl	CAL_F	
32	303	6	7	4	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_A	
33	303	6	7	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_A	
34	303	6	7	4	10	Eroded Bowl	Simple bowl	CAL_F	
35	303	6	7	4	10	Eroded Bowl	Simple bowl	CAL_A	
36	303	1	8	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
37	303	1	8	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
38	303	1	8	4	166	Coyotlatelco	Bowl, legs unknown	CAL_E	
39	303	1	8	4	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_F	
40	303	1	6	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
41	303	1	6	4	10	Eroded Bowl	Tripod bowl	CAL_U	
42	303	1	6	4	11	Plain Bowl	Bowl, legs unknown	CAL_A	
43	303	1	7	4	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_A	
44	303	1	7	4	133	Matlatzinca Red-on-Buff (multiple sets of parallel lines)	Bowl, legs unknown	CAL_A	
45	303	1	7	4	11	Plain Bowl	Bowl, legs unknown	CAL_A	
46	303	1	7	4	11	Plain Bowl	Simple bowl	CAL_D	
47	303	6	7	4	30	Eroded Jar	Jar	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
47	303	6	7	4	30	Eroded Jar	Jar	CAL_A	
48	303	6	7	4	30	Eroded Jar	Jar	CAL_A	
49	303	6	7	4	30	Eroded Jar	Jar	CAL_U	
50	303	6	7	4	30	Eroded Jar	Jar	CAL_F	
51	303	1	8	4	30	Eroded Jar	Jar	CAL_C	
52	303	1	6	4	31	Plain Jar	Jar	CAL_U	
53	303	1	6	4	30	Eroded Jar	Jar	CAL_A	
54	303	1	7	4	167	Wide rim jar	Jar	CAL_A	
55	303	1	7	4	31	Plain Jar	Jar	CAL_F	
56	303	6	7	4	267	Biconical Spiked Censer	Censer	CAL_U	
57	303	6	7	4	168	Asymmetrical bowl	Asymmetrical Bowl	CAL_A	
58	303	1	6	4	42	Thin walled basin	Basin	CAL_B	
59	303	1	7	4	134	Crude Unfinished	Minature Vessel	CAL_A	
60	303	1	7	4	267	Biconical Spiked Censer	Censer	CAL_A	
61	307	2	4	2	11	Plain Bowl	Simple bowl Bowl,	CAL_A	
62	307	2	4	2	221	Matlatzinca Red-on-Buff (variant unknown)	legs unknown	CAL_A	
63	307	2	3	2	10	Eroded Bowl	Simple bowl	CAL_A	
64	307	2	3	2	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_A	
65	307	2	3	2	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_U	
66	307	5	2	2	202	Matlatzinca Red (variant unknown)	Tripod bowl Bowl,	CAL_U	
67	307	5	2	2	277	Matlatzinca Red-on-Buff (wide band variant)	legs unknown	CAL_A	
68	307	12	4	2	11	Plain Bowl	Bowl, legs unknown	CAL_U	
69	307	12	4	2	11	Plain Bowl	Bowl, legs unknown	CAL_U	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
70	307	12	4	2	10	Eroded Bowl	Simple bowl	CAL_A	
71	307	12	4	2	200	Red rim bowl	Tripod bowl	CAL_A	
72	307	12	4	2	1	Aztec I, Black on Orange	Bowl, legs unknown	CAL_D	
73	307	5	3	2	11	Plain Bowl	Simple bowl	CAL_U	
74	307	5	3	2	221	Matlatzinca Red-on-Buff (variant unknown)	Bowl, legs unknown	CAL_A	
75	307	12	3	2	264	Matlatzinca Red or Red-on-Buff fragment	Bowl, legs unknown	CAL_A	
76	307	2	3	2	30	Eroded Jar	Jar	CAL_A	
77	307	2	3	2	30	Eroded Jar	Jar	CAL_A	
78	307	2	3	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
79	307	5	2	2	30	Eroded Jar	Jar	CAL_A	
80	307	5	2	2	31	Plain Jar	Jar	CAL_A	
81	307	5	2	2	31	Plain Jar	Jar	CAL_A	
82	307	12	4	2	30	Eroded Jar	Jar	CAL_A	
83	307	12	4	2	30	Eroded Jar	Jar	CAL_U	
84	307	12	4	2	30	Eroded Jar	Jar	CAL_U	
85	307	5	3	2	30	Eroded Jar	Jar	CAL_A	
86	307	2	3	2	134	Crude Unfinished	Simple bowl	CAL_A	
87	307	5	2	2	42	Thin walled basin	Basin	CAL_U	
88	307	5	2	2	134	Crude Unfinished	Simple bowl	CAL_U	
89	307	12	4	2	134	Crude Unfinished	Simple bowl	CAL_U	
90	307	12	4	2	267	Biconical Spiked Censer	Censer	CAL_A	
91	307	8	7	4	11	Plain Bowl	Bowl, legs unknown	CAL_F	
92	307	8	7	4	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
93	307	20	9	4	11	Plain Bowl	Bowl, legs unknown	CAL_A	
94	307	20	9	4	11	Plain Bowl	Bowl, legs unknown	CAL_A	
95	307	20	8	4	11	Plain Bowl	Simple bowl	CAL_A	
96	307	20	8	4	11	Plain Bowl	Simple bowl	CAL_H	
97	307	20	8	4	11	Plain Bowl	Bowl, legs unknown	CAL_U	
98	307	20	8	4	11	Plain Bowl	Bowl, legs unknown	CAL_U	
99	307	20	8	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
100	307	20	8	4	200	Red rim bowl	Tripod bowl	CAL_H	
101	307	20	8	4	200	Red rim bowl	Tripod bowl	CAL_A	
102	307	20	8	4	204	Matlatzinca Red (black and white on red)	Tripod bowl	CAL_A	
103	307	20	8	4	222	Matlatzinca Red-on-Buff (simple red band variant)	Tripod bowl	CAL_U	
104	307	20	8	4	11	Plain Bowl	Bowl, legs unknown	CAL_U	
105	307	20	8	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
106	307	20	9	4	167	Wide rim jar	Jar	CAL_A	
107	307	20	8	4	31	Plain Jar	Jar	CAL_A	
108	307	20	8	4	31	Plain Jar	Jar	CAL_U	
109	307	20	8	4	31	Plain Jar	Jar	CAL_A	
110	307	20	8	4	167	Wide rim jar	Jar	CAL_A	
111	307	20	8	4	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
112	307	20	8	4	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
113	307	20	8	4	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_U	
114	307	20	8	4	167	Wide rim jar	Jar	CAL_A	
115	307	20	8	4	167	Wide rim jar	Jar	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
116	307	20	8	4	262	Toluca Valley Sahumador	Frying Pan	CAL_A	East Morelos
							Censer		
117	307	20	8	4	267	Biconical Spiked Censer	Censer	CAL_U	
118	307	20	8	4	267	Biconical Spiked Censer	Censer	CAL_A	
119	307	20	8	4	46	Plain Comal	Comal	CAL_B	
120	307	20	8	4	170	Other Censer	Frying Pan	CAL_U	
							Censer		
121	307	9	2	6	10	Eroded Bowl	Bowl, legs	CAL_U	
							unknown		
122	307	9	2	6	132	Matlatzinca Red-on-Buff (parallel line variant)	Tripod bowl	CAL_C	
123	307	9	2	6	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_A	
124	307	10	2	6	10	Eroded Bowl	Bowl, legs	CAL_A	
							unknown		
125	307	20	2	6	10	Eroded Bowl	Simple bowl	CAL_A	
126	307	20	2	6	10	Eroded Bowl	Simple bowl	CAL_A	
127	307	20	2	6	10	Eroded Bowl	Simple bowl	CAL_H	
128	307	20	2	6	10	Eroded Bowl	Bowl, legs	CAL_D	
							unknown		
129	307	20	2	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
130	307	20	2	6	264	Matlatzinca Red or Red-on-Buff fragment	Bowl, legs	CAL_U	
							unknown		
131	307	20	2	6	226	Matlatzinca Red-on-Buff (simple interior and exterior)	Bowl, legs	CAL_C	
							unknown		
132	307	20	3	6	10	Eroded Bowl	Bowl, legs	CAL_U	
							unknown		
133	307	20	3	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_E	
134	307	20	3	6	226	Matlatzinca Red-on-Buff (simple interior and exterior)	Tripod bowl	CAL_A	
135	307	20	3	6	181	Aztec III Black-on-Orange, local variant B	Tripod bowl	CAL_A	
136	307	20	2	6	30	Eroded Jar	Jar	CAL_G	
137	307	20	2	6	30	Eroded Jar	Jar	CAL_A	
138	307	20	2	6	30	Eroded Jar	Jar	CAL_U	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
139	307	20	2	6	167	Wide rim jar	Jar	CAL_B	
140	307	20	2	6	167	Wide rim jar	Jar	CAL_A	
141	307	20	2	6	167	Wide rim jar	Jar	CAL_U	
142	307	20	3	6	30	Eroded Jar	Jar	CAL_A	
143	307	20	3	6	30	Eroded Jar	Jar	CAL_A	
144	307	20	3	6	30	Eroded Jar	Jar	CAL_A	
145	307	20	3	6	31	Plain Jar	Jar	CAL_A	
146	307	9	2	6	45	Eroded Comal	Comal	CAL_U	
147	307	20	2	6	267	Biconical Spiked Censer	Censer	CAL_A	
148	307	20	2	6	168	Asymmetrical bowl	Asymmetrical Bowl	CAL_B	
149	307	20	3	6	42	Thin walled basin	Basin	CAL_A	
150	307	20	3	6	134	Crude Unfinished	Jar	CAL_U	
151	308	2	3	4	10	Eroded Bowl	Simple bowl	CAL_A	
152	308	2	3	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
153	308	2	3	4	10	Eroded Bowl	Tripod bowl	CAL_A	
154	308	2	3	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
155	308	2	3	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
156	308	2	3	4	11	Plain Bowl	Simple bowl	CAL_A	
157	308	2	3	4	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_A	
158	308	2	3	4	200	Red rim bowl	Tripod bowl	CAL_A	
159	308	2	3	4	200	Red rim bowl	Bowl, legs unknown	CAL_A	
160	308	2	4	4	11	Plain Bowl	Simple bowl	CAL_B	
161	308	2	4	4	11	Plain Bowl	Simple bowl	CAL_U	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
162	308	2	4	4	11	Plain Bowl	Simple bowl	CAL_H	
163	308	3	2	4	11	Plain Bowl	Simple bowl	CAL_A	
164	308	3	2	4	213	Matlatzinca Simple polychrome on white	Tripod bowl	CAL_A	
165	308	3	2	4	215	Matlatzinca red on white	Tripod bowl	CAL_U	
166	308	2	3	4	31	Plain Jar	Jar	CAL_B	
167	308	2	3	4	31	Plain Jar	Jar	CAL_U	
168	308	2	4	4	31	Plain Jar	Jar	CAL_A	
169	308	2	4	4	167	Wide rim jar	Jar	CAL_A	
170	308	2	5	4	167	Wide rim jar	Jar	CAL_A	
171	308	3	2	4	31	Plain Jar	Jar	CAL_A	
172	308	3	2	4	31	Plain Jar	Jar	CAL_A	
173	308	3	2	4	31	Plain Jar	Jar	CAL_A	
174	308	3	2	4	31	Plain Jar	Jar	CAL_H	
175	308	3	2	4	167	Wide rim jar	Jar	CAL_U	
176	308	2	3	4	45	Eroded Comal	Comal	CAL_U	
177	308	2	4	4	67	Aztec III, Black-on-Orange Spinning Bowl	Spinning Bowl	CAL_D	
178	308	2	4	4	267	Biconical Spiked Censer	Censer	CAL_U	
179	308	3	2	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
180	308	3	2	4	100	Spoon	Spoon	CAL_A	
181	309	7	2	6	271	Aztec III/IV, Black-on-Orange, Local variant A	Tripod bowl	CAL_A	
182	309	14	2	6	11	Plain Bowl	Simple bowl	CAL_H	
183	309	14	2	6	11	Plain Bowl	Bowl, legs unknown	CAL_H	
184	309	14	2	6	11	Plain Bowl	Bowl, legs unknown	CAL_A	

ACH	Context				Type	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
Samp. #	Unit	Locus	Lot	Phase	Code				
185	309	14	2	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
186	309	14	2	6	208	Guinda Black on Red	Simple bowl	CAL_Guinda	
187	309	14	2	6	132	Matlatzinca Red-on-Buff (parallel line variant)	Simple bowl	CAL_A	
188	309	14	2	6	181	Aztec III Black-on-Orange, local variant B	Tripod bowl	CAL_B	
189	309	18	2	6	10	Eroded Bowl	Tripod bowl	CAL_A	
190	309	18	2	6	10	Eroded Bowl	Simple bowl	CAL_A	
191	309	18	2	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
192	309	18	3	6	181	Aztec III Black-on-Orange, local variant B	Tripod bowl	CAL_U	
193	309	18	3	6	132	Matlatzinca Red-on-Buff (parallel line variant)	Tripod bowl	CAL_A	
194	309	25	3	6	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_U	
195	309	10	2	6	30	Eroded Jar	Jar	CAL_U	
196	309	10	2	6	30	Eroded Jar	Jar	CAL_A	
197	309	14	2	6	167	Wide rim jar	Jar	CAL_A	
198	309	18	2	6	30	Eroded Jar	Jar	CAL_A	
199	309	18	2	6	30	Eroded Jar	Jar	CAL_A	
200	309	18	2	6	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
201	309	18	2	6	167	Wide rim jar	Jar	CAL_A	
202	309	25	3	6	30	Eroded Jar	Jar	CAL_A	
203	309	25	3	6	167	Wide rim jar	Jar	CAL_A	
204	309	25	3	6	30	Eroded Jar	Jar	CAL_A	
205	309	10	2	6	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
206	309	14	2	6	67	Aztec III, Black-on-Orange Spinning Bowl Biconical	Spinning Bowl	CAL_U	
207	309	14	2	6	267	Spiked Censer	Censer	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
208	309	18	2	6	46	Plain Comal	Comal	CAL_A	
209	309	18	2	6	267	Biconical Spiked Censer	Censer	CAL_A	
210	309	14	2	6	21	Aztec III, Black-on-Orange	Tripod bowl	CAL_D	
211	311	1	6	4	10	Eroded Bowl	Simple bowl	CAL_C	
212	311	1	6	4	11	Plain Bowl	Simple bowl	CAL_A	
213	311	1	6	4	11	Plain Bowl	Simple bowl	CAL_A	
214	311	1	6	4	11	Plain Bowl	Simple bowl	CAL_A	
215	311	1	6	4	11	Plain Bowl	Simple bowl	CAL_A	
216	311	1	6	4	11	Plain Bowl	Simple bowl	CAL_A	
217	311	1	6	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Tripod bowl	CAL_A	
218	311	1	6	4	184	Matlatzinca Red-on-Buff (red interior, red-on-buff exterior)	Tripod bowl	CAL_A	
219	311	1	7	4	11	Plain Bowl	Bowl, legs unknown	CAL_A	
220	311	1	7	4	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
221	311	1	7	4	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_A	
222	311	5	7	4	11	Plain Bowl	Bowl, legs unknown	CAL_U	
223	311	11	6	4	11	Plain Bowl	Simple bowl	CAL_H	
224	311	11	6	4	213	Matlatzinca Simple polychrome on white	Molcayete	CAL_A	
225	311	21	3	4	200	Red rim bowl	Simple bowl	CAL_A	
226	311	1	6	4	31	Plain Jar	Jar	CAL_A	
227	311	1	6	4	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
228	311	1	7	4	31	Plain Jar	Jar	CAL_A	
229	311	1	7	4	31	Plain Jar	Jar	CAL_A	
230	311	1	7	4	31	Plain Jar	Jar	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
231	311	1	7	4	31	Plain Jar	Jar	CAL_A	
232	311	5	7	4	31	Plain Jar	Jar	CAL_A	
233	311	21	3	4	30	Eroded Jar	Jar	CAL_U	
234	311	21	3	4	30	Eroded Jar	Jar	CAL_A	
235	311	21	3	4	31	Plain Jar	Jar	CAL_A	
236	311	1	6	4	134	Crude Unfinished	Simple bowl	CAL_A	
237	311	1	6	4	134	Crude Unfinished	Simple bowl	CAL_U	
238	311	5	7	4	134	Crude Unfinished	Simple bowl	CAL_A	
239	311	11	6	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_U	
240	311	21	3	4	46	Plain Comal	Comal	CAL_U	
241	311	1	4	4	11	Plain Bowl	Simple bowl	CAL_A	
242	311	1	4	4	202	Matlatzinca Red (variant unknown)	Simple bowl	CAL_A	
243	311	2	8	4	221	Matlatzinca Red-on-Buff (variant unknown)	Bowl, legs unknown	CAL_U	
244	311	2	8	4	181	Aztec III Black-on-Orange, local variant B	Tripod bowl	CAL_A	
245	311	5	5	44	11	Plain Bowl	Bowl, legs unknown	CAL_A	
246	311	5	5	44	200	Red rim bowl	Simple bowl	CAL_A	
247	311	5	6	44	204	Matlatzinca Red (black and white on red)	Tripod bowl	CAL_A	
248	311	5	6	44	200	Red rim bowl	Simple bowl	CAL_U	
249	311	18	1	4	10	Eroded Bowl	Simple bowl	CAL_A	
250	311	18	1	4	10	Eroded Bowl	Tripod bowl	CAL_A	
251	311	18	1	4	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_A	
252	311	18	1	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_A	
253	311	18	1	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Tripod bowl	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
254	311	18	1	4	264	Matlatzinca Red or Red-on-Buff fragment	Simple bowl	CAL_A	
255	311	18	1	4	204	Matlatzinca Red (black and white on red)	Tripod bowl	CAL_A	
256	311	1	4	4	30	Eroded Jar	Jar	CAL_A	
257	311	1	4	4	253	Matlatzinca Red Jar (variant unknown)	Jar	CAL_A	
258	311	5	5	44	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
259	311	5	6	44	31	Plain Jar	Jar	CAL_A	
260	311	5	6	44	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
261	311	18	1	4	30	Eroded Jar	Jar	CAL_A	
262	311	18	1	4	30	Eroded Jar	Jar	CAL_A	
263	311	18	1	4	30	Eroded Jar	Jar	CAL_A	
264	311	18	1	4	266	Matlatzinca Red or Red-on-Buff Jar fragment	Jar	CAL_A	
265	311	20	1	4	31	Plain Jar	Jar	CAL_A	
266	311	5	6	44	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
267	311	5	6	44	46	Plain Comal	Comal	CAL_B	
268	311	11	5	4	101	Scored Censer	Censer	CAL_F	
269	311	18	1	4	70	Copa fragment	Goblet	CAL_A	
270	311	18	1	4	134	Crude Unfinished	Minature Vessel	CAL_H	
271	315	12	10	2	222	Matlatzinca Red-on-Buff (interlocking triangle variant)	Bowl, legs unknown	CAL_H	
272	315	12	10	2	170	Other Censer	Tripod bowl	CAL_H	
273	315	13	9	2	11	Plain Bowl	Simple bowl	CAL_H	
274	315	13	12	2	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
275	315	13	12	2	11	Plain Bowl	Tripod bowl	CAL_U	
276	315	22	11	2	10	Eroded Bowl	Simple bowl	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
277	315	13	13	2	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_A	
278	315	14	8	2	11	Plain Bowl	Simple bowl	CAL_A	
279	315	14	8	2	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_H	
280	315	14	8	2	225	Matlatzinca Red-on-Buff (interior panels variant)	Tripod bowl	CAL_H	
281	315	17	7	2	11	Plain Bowl	Simple bowl	CAL_A	
282	315	22	10	2	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
283	315	22	10	2	226	Matlatzinca Red-on-Buff (simple interior and exterior)	Simple bowl	CAL_A	
284	315	28	1	2	11	Plain Bowl	Simple bowl	CAL_H	
285	315	28	1	2	11	Plain Bowl	Simple bowl	CAL_H	
286	315	13	12	2	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
287	315	13	13	2	31	Plain Jar	Jar	CAL_A	
288	315	14	8	2	31	Plain Jar	Jar	CAL_A	
289	315	21	10	2	31	Plain Jar	Jar	CAL_H	
290	315	22	10	2	31	Plain Jar	Jar	CAL_A	
291	315	22	10	2	31	Plain Jar	Jar	CAL_A	
292	315	22	10	2	31	Plain Jar	Jar	CAL_A	
293	315	22	10	2	31	Plain Jar	Jar	CAL_A	
294	315	28	1	2	30	Eroded Jar	Jar	CAL_A	
295	315	28	1	2	31	Plain Jar	Jar	CAL_H	
296	315	12	10	2	267	Biconical Spiked Censer	Censer	CAL_A	
297	315	22	11	2	267	Biconical Spiked Censer	Censer	CAL_A	
298	315	14	8	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_H	
299	315	17	7	2	101	Scored Censer	Censer	CAL_H	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
300	315	22	10	2	134	Crude Unfinished	Simple bowl	CAL_A	
301	316	5	5	2	133	Matlatzinca Red-on-Buff (multiple sets of parallel lines)	Simple bowl	CAL_A	
302	316	5	5	2	132	Red-on-Buff (parallel line variant)	Tripod bowl	CAL_A	
303	316	5	6	2	11	Plain Bowl	Simple bowl	CAL_A	
304	316	6	5	2	11	Plain Bowl	Bowl, legs unknown	CAL_A	
305	316	7	4	2	200	Red rim bowl	Simple bowl	CAL_A	
306	316	7	4	2	203	Matlatzinca Red (simple red)	Tripod bowl	CAL_A	
307	316	7	4	2	215	Matlatzinca red on white	Tripod bowl	CAL_A	
308	316	7	7	2	11	Plain Bowl	Simple bowl	CAL_U	
309	316	7	7	2	11	Plain Bowl	Simple bowl	CAL_A	
310	316	7	7	2	200	Red rim bowl	Tripod bowl	CAL_H	
311	316	7	7	2	11	Plain Bowl	Bowl, legs unknown	CAL_A	
312	316	7	7	2	225	Matlatzinca Red-on-Buff (interior panels variant)	Jar	CAL_A	
313	316	15	4	2	11	Plain Bowl	Bowl, legs unknown	CAL_H	
314	316	15	4	2	11	Plain Bowl	Simple bowl	CAL_U	
315	316	15	4	2	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_A	
316	316	4	4	2	31	Plain Jar	Jar	CAL_A	
317	316	4	4	2	31	Plain Jar	Jar	CAL_A	
318	316	4	5	2	31	Plain Jar	Jar	CAL_A	
319	316	5	4	2	31	Plain Jar	Jar	CAL_A	
320	316	5	4	2	253	Matlatzinca Red Jar (variant unknown)	Jar	CAL_A	
321	316	7	7	2	31	Plain Jar	Jar	CAL_A	
322	316	15	4	2	30	Eroded Jar	Jar	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
323	316	15	4	2	31	Plain Jar	Jar	CAL_A	
324	316	15	4	2	31	Plain Jar	Jar	CAL_U	
325	316	15	4	2	31	Plain Jar	Jar	CAL_A	
326	316	4	4	2	133	Matlatzinca Red-on-Buff (multiple sets of parallel lines)	Basin	CAL_A	
327	316	5	4	2	267	Biconical Spiked Censer	Censer	CAL_A	
328	316	6	5	2	71	Miniature Vessel	Minature Vessel	CAL_A	
329	316	15	4	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
330	316	7	7	2	101	Scored Censer	Censer	CAL_A	
331	316	5	3	4	213	Matlatzinca Simple polychrome on white	Tripod bowl	CAL_A	
332	316	5	3	4	200	Red rim bowl	Simple bowl	CAL_U	
333	316	8	5	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
334	316	8	5	4	200	Red rim bowl	Simple bowl	CAL_A	
335	316	16	2	4	11	Plain Bowl	Simple bowl	CAL_A	
336	316	16	2	4	11	Plain Bowl	Simple bowl	CAL_A	
337	316	16	2	4	10	Eroded Bowl	Tripod bowl	CAL_A	
338	316	17	2	4	11	Plain Bowl	Simple bowl	CAL_A	
339	316	17	2	4	264	Matlatzinca Red or Red-on-Buff fragment	Simple bowl	CAL_A	
340	316	17	3	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
341	316	25	2	4	10	Eroded Bowl	Simple bowl	CAL_A	
342	316	25	2	4	10	Eroded Bowl	Simple bowl	CAL_A	
343	316	25	2	4	10	Eroded Bowl	Bowl, legs unknown	CAL_U	
344	316	25	2	4	10	Eroded Bowl	Simple bowl	CAL_U	
345	316	25	2	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
346	316	5	3	4	31	Plain Jar	Jar	CAL_A	
347	316	5	3	4	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
348	316	8	5	4	31	Plain Jar	Jar	CAL_A	
349	316	8	5	4	31	Plain Jar	Jar	CAL_A	
350	316	8	5	4	167	Wide rim jar	Jar	CAL_A	
351	316	15	3	4	167	Wide rim jar	Jar	CAL_A	
352	316	15	3	4	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
353	316	17	2	4	30	Eroded Jar	Jar	CAL_A	
354	316	17	2	4	31	Plain Jar	Jar	CAL_A	
355	316	17	2	4	31	Plain Jar	Jar	CAL_U	
356	316	8	5	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
357	316	8	8	4	180	Brazier	Spinning Bowl	CAL_A	
358	316	16	2	4	134	Crude Unfinished	Spoon	CAL_U	
359	316	17	2	4	64	Texcoco Molded Sahumador	Frying Pan Censer	CAL_U	
360	316	17	2	4	267	Biconical Spiked Censer	Censer	CAL_A	
361	316	6	1	6	11	Plain Bowl	Simple bowl	CAL_A	
362	316	6	1	6	11	Plain Bowl	Bowl, legs unknown	CAL_A	
363	316	6	1	6	114	Aztec III/IV, Black-on-Orange	Tripod bowl	CAL_B	
364	316	7	2	6	208	Guinda Black on Red	Simple bowl	CAL_Guinda	
365	316	7	2	6	222	Matlatzinca Red-on-Buff (simple red band variant)	Molcayete	CAL_U	
366	316	15	1	6	271	Aztec III/IV, Black-on-Orange, Local variant A	Tripod bowl	CAL_A	
367	316	15	1	6	11	Plain Bowl	Simple bowl	CAL_A	
368	316	15	2	6	10	Eroded Bowl	Tripod bowl	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
369	316	15	2	6	11	Plain Bowl	Simple bowl	CAL_A	
370	316	15	2	6	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_H	
371	316	15	2	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
373	316	15	2	6	213	Matlatzinca Simple polychrome on white	Bowl, legs unknown	CAL_U	
374	316	15	2	6	200	Red rim bowl	Tripod bowl	CAL_A	
375	316	6	1	6	264	Matlatzinca Red or Red-on-Buff fragment	Simple bowl	CAL_A	
376	316	6	1	6	31	Plain Jar	Jar	CAL_A	
377	316	6	1	6	31	Plain Jar	Jar	CAL_A	
378	316	6	1	6	167	Wide rim jar	Jar	CAL_A	
379	316	6	1	6	167	Wide rim jar	Jar	CAL_A	
380	316	7	2	6	31	Plain Jar	Jar	CAL_A	
381	316	7	2	6	31	Plain Jar	Jar	CAL_A	
382	316	15	1	6	167	Wide rim jar	Jar	CAL_U	
383	316	15	2	6	31	Plain Jar	Jar	CAL_A	
384	316	15	2	6	167	Wide rim jar	Jar	CAL_A	
385	316	5	2	6	31	Plain Jar	Jar	CAL_A	
386	316	15	1	6	45	Eroded Comal	Comal	CAL_U	
387	316	15	1	6	45	Eroded Comal	Comal	CAL_C	
388	316	15	1	6	134	Crude Unfinished	Simple bowl	CAL_U	
389	316	15	2	6	267	Biconical Spiked Censer	Censer	CAL_A	
390	316	15	2	6	100	Spoon	Spoon	CAL_A	
391	317	7	3	6	200	Red rim bowl	Simple bowl	CAL_A	
392	317	12	8	6	11	Plain Bowl	Simple bowl	CAL_B	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
393	317	12	8	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
394	317	13	4	6	10	Eroded Bowl	Simple bowl	CAL_A	
395	317	13	4	6	277	Matlatzinca Red-on-Buff (wide band variant)	Bowl, legs unknown	CAL_A	
396	317	14	6	6	10	Eroded Bowl	Tripod bowl	CAL_A	
397	317	14	6	6	200	Red rim bowl	Simple bowl	CAL_A	
398	317	34	4	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_G	
399	317	35	4	6	10	Eroded Bowl	Simple bowl	CAL_A	
400	317	35	4	6	10	Eroded Bowl	Tripod bowl	CAL_A	
401	317	35	4	6	21	Aztec III, Black-on-Orange	Tripod bowl	CAL_U	
402	317	28	6	6	11	Plain Bowl	Simple bowl	CAL_A	
403	317	28	6	6	133	Matlatzinca Red-on-Buff (multiple sets of parallel lines)	Simple bowl	CAL_A	
404	317	28	6	6	200	Red rim bowl	Simple bowl	CAL_U	
405	317	28	6	6	264	Matlatzinca Red or Red-on-Buff fragment	Tripod bowl	CAL_A	
406	317	7	3	6	30	Eroded Jar	Jar	CAL_A	
407	317	12	8	6	31	Plain Jar	Jar	CAL_A	
408	317	12	8	6	31	Plain Jar	Jar	CAL_A	
409	317	34	4	6	167	Wide rim jar	Jar	CAL_A	
410	317	35	5	6	30	Eroded Jar	Jar	CAL_A	
411	317	35	5	6	38	Other decorated jar	Jar	CAL_U	
412	317	28	6	6	30	Eroded Jar	Jar	CAL_A	
413	317	28	6	6	167	Wide rim jar	Jar	CAL_C	
414	317	28	6	6	167	Wide rim jar	Jar	CAL_U	
415	317	28	6	6	167	Wide rim jar	Jar	CAL_U	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
416	317	7	3	6	100	Spoon	Spoon	CAL_U	
417	317	7	3	6	45	Eroded Comal	Comal	CAL_A	
418	317	13	4	6	64	Texcoco Molded Sahumador	Frying Pan	CAL_A	
419	317	35	5	6	262	Toluca Valley Sahumador	Censer	CAL_A	
420	317	28	6	6	113	Guinda Goblet	Frying Pan	CAL_A	
421	320	5	5	2	11	Plain Bowl	Goblet	CAL_A	
422	320	10	5	2	10	Eroded Bowl	Simple bowl	CAL_U	
423	320	10	5	2	11	Plain Bowl	Simple bowl	CAL_U	
424	320	10	5	2	221	Matlatzinca Red-on-Buff (variant unknown)	Simple bowl	CAL_A	
425	320	10	5	2	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_U	
426	320	10	5	2	215	Matlatzinca red on white	Bowl, legs unknown	CAL_C	
427	320	14	3	2	10	Eroded Bowl	Simple bowl	CAL_A	
428	320	16	4	2	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_A	
429	320	17	4	2	137	Matlatzinca Incised Redware (exterior)	Tripod bowl	CAL_E	East Morelos
430	320	17	4	2	132	Matlatzinca Red-on-Buff (parallel line variant)	Tripod bowl	CAL_A	
431	320	17	6	2	11	Plain Bowl	Tripod bowl	CAL_U	
432	320	17	6	2	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
433	320	17	6	2	203	Matlatzinca Red (simple red)	Tripod bowl	CAL_A	
434	320	22	3	2	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
435	320	22	3	2	226	Matlatzinca Red-on-Buff (simple interior and exterior decoration)	Tripod bowl	CAL_A	
436	320	10	3	2	30	Eroded Jar	Jar	CAL_A	
437	320	10	3	2	30	Eroded Jar	Jar	CAL_A	
438	320	10	5	2	30	Eroded Jar	Jar	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
439	320	10	5	2	30	Eroded Jar	Jar	CAL_A	
440	320	16	4	2	30	Eroded Jar	Jar	CAL_A	
441	320	16	4	2	167	Wide rim jar	Jar	CAL_A	
442	320	17	4	2	30	Eroded Jar	Jar	CAL_A	
443	320	22	3	2	30	Eroded Jar	Jar	CAL_U	
444	320	22	3	2	31	Plain Jar	Jar	CAL_A	
445	320	22	3	2	256	Matlatzinca Red-on-Buff Jar (sets of parallel lines variant)	Jar	CAL_A	
446	320	16	4	2	267	Biconical Spiked Censer	Censer	CAL_U	
447	320	16	4	2	267	Biconical Spiked Censer	Censer	CAL_A	
448	320	17	4	2	134	Crude Unfinished	Simple bowl	CAL_A	
449	320	17	6	2	132	Matlatzinca Red-on-Buff (parallel line variant)	Basin	CAL_A	
450	320	22	3	2	170	Other Censer	Frying Pan Censer	CAL_A	
451	322	1	2	4	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
452	322	1	2	4	200	Red rim bowl	Bowl, legs unknown	CAL_A	
453	322	2	2	4	10	Eroded Bowl	Simple bowl	CAL_A	
454	322	2	2	4	10	Eroded Bowl	Simple bowl	CAL_U	
455	322	2	2	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_A	
456	322	2	2	4	132	Matlatzinca Red-on-Buff (parallel line variant)	Bowl, legs unknown	CAL_A	
457	322	2	2	4	122	Other decorated bowl	Simple bowl	CAL_A	
458	322	2	2	4	200	Red rim bowl	Simple bowl	CAL_A	
459	322	2	3	4	10	Eroded Bowl	Simple bowl	CAL_U	
460	322	2	3	4	11	Plain Bowl	Simple bowl	CAL_A	
461	322	2	3	4	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
462	322	2	3	4	202	Matlatzinca Red (variant unknown)	Bowl, legs unknown	CAL_A	
463	322	2	3	4	200	Red rim bowl	Simple bowl	CAL_A	
464	322	2	3	4	208	Guinda Black on Red	Simple bowl	CAL_Guinda	
465	322	2	3	4	114	Aztec III/IV, Black-on-Orange	Tripod bowl	CAL_U	
466	322	1	2	4	31	Plain Jar	Jar	CAL_E	
467	322	1	2	4	31	Plain Jar	Jar	CAL_E	
468	322	2	2	4	31	Plain Jar	Jar	CAL_A	
469	322	2	2	4	31	Plain Jar	Jar	CAL_A	
470	322	2	2	4	31	Plain Jar	Jar	CAL_A	
471	322	2	2	4	167	Wide rim jar	Jar	CAL_A	
472	322	2	3	4	31	Plain Jar	Jar	CAL_U	
473	322	2	3	4	31	Plain Jar	Jar	CAL_A	
474	322	2	3	4	31	Plain Jar	Jar	CAL_A	
475	322	2	3	4	31	Plain Jar	Jar	CAL_B	
476	322	1	2	4	221	Matlatzinca Red-on-Buff (variant unknown)	Basin	CAL_A	
477	322	2	2	4	267	Biconical Spiked Censer	Censer	CAL_A	
478	322	2	2	4	267	Biconical Spiked Censer	Censer	CAL_E	
479	322	2	2	4	267	Biconical Spiked Censer	Censer	CAL_A	
480	322	2	2	4	72	Matlatzinca Pitcher	Pitcher	CAL_A	
481	323	2	9	2	11	Plain Bowl	Simple bowl	CAL_A	
482	323	2	9	2	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_C	
483	323	2	9	2	221	Matlatzinca Red-on-Buff (variant unknown)	Bowl, legs unknown	CAL_A	
484	323	2	12	2	11	Plain Bowl	Simple bowl	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
485	323	2	12	2	11	Plain Bowl	Simple bowl	CAL_B	East Morelos
486	323	2	12	2	11	Plain Bowl	Simple bowl	CAL_U	
487	323	2	12	2	11	Plain Bowl	Simple bowl	CAL_A	
488	323	2	12	2	277	Matlatzinca Red-on-Buff (wide band variant)	Tripod bowl	CAL_A	
489	323	13	2	2	11	Plain Bowl	Simple bowl	CAL_C	
490	323	13	2	2	133	Matlatzinca Red-on-Buff (multiple sets of parallel lines)	Simple bowl	CAL_C	
491	323	13	2	2	214	Matlatzinca Complex polychrome on white	Tripod bowl	CAL_E	
492	323	13	2	2	225	Matlatzinca Red-on-Buff (int. panels)	Tripod bowl	CAL_U	
493	323	13	2	2	230	Red-on-Buff with negative	Tripod bowl	CAL_U	
494	323	13	3	2	11	Plain Bowl	Simple bowl	CAL_G	
495	323	13	3	2	11	Plain Bowl	Simple bowl	CAL_A	
496	323	2	8	2	31	Plain Jar	Jar	CAL_A	
497	323	2	9	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_U	
498	323	2	12	2	31	Plain Jar	Jar	CAL_A	
499	323	13	2	2	31	Plain Jar	Jar	CAL_A	
500	323	13	2	2	31	Plain Jar	Jar	CAL_U	
501	323	13	2	2	31	Plain Jar	Jar	CAL_U	
502	323	13	2	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_U	
503	323	13	2	2	31	Plain Jar	Jar	CAL_G	
504	323	13	3	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_A	
505	323	13	3	2	31	Plain Jar	Jar	CAL_G	
506	323	2	12	2	31	Crude Unfinished	Simple bowl	CAL_U	
507	323	2	12	2	31	Crude Unfinished	Minature Vessel	CAL_A	

ACH	Context				Type		Vessel	Chem	Macroreg. Chem
Samp. #	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
508	323	13	2	2	31	Toluca Valley Sahumador	Frying Pan	CAL_U	East Morelos
							Censer		
509	323	13	2	2	31	Toluca Valley Sahumador	Frying Pan	CAL_C	
							Censer		
510	323	13	2	2	31	Other vessel form	Frying Pan	CAL_C	
							Censer		
511	324	16	3	2	31	Plain Bowl	Simple	CAL_A	
							bowl		
512	324	16	3	2	11	Plain Bowl	Simple	CAL_U	
							bowl		
513	324	16	3	2	11	Plain Bowl	Bowl, legs	CAL_U	
							unknown		
514	324	16	3	2	11	Plain Bowl	Simple	CAL_E	
							bowl		
515	324	16	3	2	225	Matlatzinca Red-on-Buff (interior panels variant)	Simple	CAL_A	
							bowl		
516	324	16	4	2	10	Eroded Bowl	Simple	CAL_B	
							bowl		
517	324	16	4	2	200	Red rim bowl	Simple	CAL_B	
							bowl		
518	324	16	4	2	11	Plain Bowl	Simple	CAL_A	West Morelos
							bowl		
519	324	16	4	2	11	Plain Bowl	Bowl, legs	CAL_E	
							unknown		
520	324	16	4	2	11	Plain Bowl	Simple	CAL_U	
							bowl		
521	324	16	4	2	225	Matlatzinca Red-on-Buff (interior panels variant)	Bowl, legs	CAL_U	
							unknown		
522	324	16	4	2	225	Matlatzinca Red-on-Buff (interior panels variant)	Tripod	CAL_C	
							bowl		
523	324	16	4	2	230	Red-on-Buff with negative	Tripod	CAL_C	
							bowl		
524	324	16	4	2	173	Matlatzinca Red-on-Buff (interior and exterior decoration in panels)	Simple	CAL_C	
							bowl		
525	324	16	5	2	215	Matlatzinca red on white	Tripod	CAL_U	
							bowl		
526	324	16	3	2	31	Plain Jar	Jar	CAL_U	
527	324	16	3	2	31	Plain Jar	Jar	CAL_C	
528	324	16	3	2	31	Plain Jar	Jar	CAL_U	
529	324	16	3	2	31	Plain Jar	Jar	CAL_C	
530	324	16	3	2	31	Plain Jar	Jar	CAL_U	

ACH Samp. #	Context				Type		Vessel	Chem	Macroreg. Chem
	Unit	Locus	Lot	Phase	Code	Ceramic Type	Form	Group	Grp
531	324	16	3	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_U	
532	324	16	4	2	255	Matlatzinca Red-on-Buff Jar (variant unknown)	Jar	CAL_U	
533	324	16	4	2	31	Plain Jar	Jar	CAL_C	
534	324	16	4	2	31	Plain Jar	Jar	CAL_U	
535	324	16	5	2	31	Plain Jar	Jar	CAL_U	
536	324	16	3	2	45	Eroded Comal	Comal	CAL_U	
537	324	16	3	2	267	Biconical Spiked Censer	Censer	CAL_U	
538	324	16	4	2	134	Crude Unfinished	Minature Vessel	CAL_U	
539	324	16	4	2	134	Crude Unfinished	Minature Vessel	CAL_U	
540	324	16	4	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_U	
541	324	1	5	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
542	324	1	5	6	264	Matlatzinca Red or Red-on-Buff fragment	Simple bowl	CAL_U	
543	324	4	4	6	11	Plain Bowl	Simple bowl	CAL_U	
544	324	4	4	6	11	Plain Bowl	Simple bowl	CAL_A	
545	324	4	4	6	11	Plain Bowl	Bowl, legs unknown	CAL_U	
546	324	4	4	6	11	Plain Bowl	Simple bowl	CAL_A	
547	324	4	4	6	202	Matlatzinca Red (variant unknown)	Tripod bowl	CAL_A	
548	324	4	4	6	264	Matlatzinca Red or Red-on-Buff fragment	Simple bowl	CAL_A	
549	324	4	5	6	10	Eroded Bowl	Bowl, legs unknown	CAL_A	
550	324	4	5	6	222	Matlatzinca Red-on-Buff (interlocking triangle variant)	Bowl, legs unknown	CAL_C	
551	324	6	4	6	264	Matlatzinca Red or Red-on-Buff fragment	Bowl, legs unknown	CAL_A	
552	324	6	4	6	200	Red rim bowl	Tripod bowl	CAL_U	
553	324	6	4	6	11	Plain Bowl	Bowl, legs unknown	CAL_A	

Table C.2 Catalog of type-based sample of ceramic sherds submitted for INAA, with project chemical source group assignments and macroregional matches. For a full list of ceramic type descriptions, see Table A.2.

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
101	304	1	2	4	192	Guinda Black-on-Red (Fine line variant)	Simple bowl	CAL_Guinda	Tenochtitlan
102	307	11	1	6	192	Guinda Black-on-Red (Fine line variant)	Simple bowl	CAL_Guinda	
103	315	7	1	2	192	Guinda Black-on-Red (Fine line variant)	Simple bowl	CAL_Guinda	
104	316	9	2	4	192	Guinda Black-on-Red (Fine line variant)	Simple bowl	CAL_A	
105	307	16	1	6	208	Guinda Black-on-Red	Simple bowl	CAL_Guinda	Tenochtitlan
106	315	12	3	2	208	Guinda Black-on-Red	Simple bowl	CAL_Guinda	
107	307	20	8	4	208	Guinda Black-on-Red	Simple bowl	CAL_Guinda	
108	316	11	5	4	208	Guinda Black-on-Red	Simple bowl	CAL_Guinda	
110	310	4	4	2	207	Interior Incised Red	Tripod bowl	CAL_U	East Morelos
111	315	18	1	2	207	Interior Incised Red	Tripod bowl	CAL_G	
112	315	21	11	2	207	Interior Incised Red	Tripod bowl	CAL_U	
113	323	11	3	2	207	Interior Incised Red	Tripod bowl	CAL_E	
114	307	8	7	4	207	Interior Incised Red	Tripod bowl	CAL_G	
115	303	1	6	4	137	Exterior Incised Red	Tripod bowl	CAL_F	
116	307	16	1	6	137	Exterior Incised Red	Tripod bowl	CAL_U	
117	315	17	2	2	137	Exterior Incised Red	Tripod bowl	CAL_U	
118	315	12	2	2	137	Exterior Incised Red	Tripod bowl	CAL_G	
119	315	17	1	2	137	Exterior Incised Red	Tripod bowl	CAL_G	
120	307	8	7	4	137	Exterior Incised Red	Tripod bowl	CAL_E	
121	313	1	16	4	204	Toluca Valley Black-and-White-on-Red	Tripod bowl	CAL_U	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
122	316	8	3	6	204	Toluca Valley Black-and-White-on-Red	Tripod bowl	CAL_A	
123	307	20	8	4	204	Toluca Valley Black-and-White-on-Red	Tripod bowl	CAL_A	
124	307	20	8	4	204	Toluca Valley Black-and-White-on-Red	Tripod bowl	CAL_A	
125	320	17	6	2	204	Toluca Valley Black-and-White-on-Red	Tripod bowl	CAL_A	
126	320	17	6	2	204	Toluca Valley Black-and-White-on-Red	Bowl, legs unknown	CAL_A	
127	304	1	7	4	46	Plain Comal	Comal	CAL_B	
128	307	14	1	6	46	Plain Comal	Comal	CAL_A	
129	307	20	3	6	46	Plain Comal	Comal	CAL_U	
130	317	10	3	9	46	Plain Comal	Comal	CAL_U	
131	316	8	5	4	46	Plain Comal	Comal	CAL_A	
132	316	9	3	4	46	Plain Comal	Comal	CAL_U	
133	307	20	4	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_A	
134	311	11	5	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_U	
135	311	10	5	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	
136	307	17	3	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	
137	307	17	3	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_F	
138	307	19	2	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_C	
139	316	22	3	4	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_D	
140	309	7	2	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_F	
141	309	18	2	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
142	316	6	1	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	East Morelos
143	317	13	3	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_U	
144	316	6	1	6	274	Aztec III/IV Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	
145	316	6	1	6	274	Aztec III/IV Black-on-Orange, Local Variant A	Tripod bowl	CAL_U	
146	317	10	3	9	274	Aztec III/IV Black-on-Orange, Local Variant A	Tripod bowl	CAL_U	
147	317	14	7	6	274	Aztec III/IV Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	
148	310	4	4	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
149	310	4	2	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
150	315	21	1	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
151	315	13	2	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
152	315	21	2	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_A	
153	323	10	6	2	262	Toluca Valley Sahumador	Frying Pan Censer	CAL_U	
154	315	24	2	2	215	Toluca Valley Red-on-White	Tripod bowl	CAL_A	
156	315	22	2	2	188	Toluca Valley Red-on-White (with panels)	Tripod bowl	CAL_E	
157	323	10	8	2	188	Toluca Valley Red-on-White (with panels)	Tripod bowl	CAL_E	
158	309	14	2	6	215	Toluca Valley Red-on-White	Tripod bowl	CAL_A	
159	307	8	6	4	215	Toluca Valley Red-on-White	Tripod bowl	CAL_E	
160	307	20	8	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
161	315	24	2	2	213	Toluca Valley Polychrome	Tripod bowl	CAL_H	
162	315	24	2	2	213	Toluca Valley Polychrome	Tripod bowl	CAL_H	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
163	315	21	2	2	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	East Morelos
164	315	31	2	2	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
165	316	4	9	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_E	
166	317	31	8	6	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
167	307	20	5	6	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
168	323	10	5	2	213	Toluca Valley Polychrome	Tripod bowl	CAL_E	
169	307	8	6	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
170	307	20	7	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
171	307	20	7	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
172	316	11	4	6	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
173	316	11	4	6	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
174	322	2	2	4	213	Toluca Valley Polychrome	Tripod bowl	CAL_A	
175	307	20	6	6	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
176	307	20	9	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
177	307	5	1	6	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
178	315	8	1	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
179	315	13	1	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
180	315	13	1	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
181	315	25	1	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
182	315	21	2	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
183	307	20	8	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
184	323	13	6	2	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_U	
185	307	8	6	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_U	
186	307	8	7	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
187	307	8	7	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
188	316	5	1	6	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
189	307	20	7	4	222	Toluca Valley Red-on-Buff (int. & ext. thick red band)	Tripod bowl	CAL_A	
190	307	20	7	4	225	Toluca Valley Red-on-Buff (interior panels)	Simple bowl	CAL_A	
191	310	4	4	2	225	Toluca Valley Red-on-Buff (interior panels)	Simple bowl	CAL_A	
192	310	4	4	2	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_C	
193	310	4	2	2	225	Toluca Valley Red-on-Buff (interior panels)	Bowl, legs unknown	CAL_A	
194	315	23	2	2	225	Toluca Valley Red-on-Buff (interior panels)	Bowl, legs unknown	CAL_A	
195	315	17	2	2	225	Toluca Valley Red-on-Buff (interior panels)	Bowl, legs unknown	CAL_A	
196	316	13	7	4	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_A	
197	326	3	6	2	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_A	
198	315	22	10	2	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_U	
199	323	10	7	2	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_U	
200	316	15	2	6	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_A	
201	316	15	2	6	225	Toluca Valley Red-on-Buff (interior panels)	Simple bowl	CAL_A	
202	316	15	2	6	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_A	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
203	324	4	4	6	225	Toluca Valley Red-on-Buff (interior panels)	Tripod bowl	CAL_A	
204	324	4	4	6	225	Toluca Valley Red-on-Buff (interior panels)	Bowl, legs unknown	CAL_C	
205	307	2	3	2	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
206	303	1	12	4	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
207	307	20	8	4	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
208	307	5	1	6	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_U	
209	315	18	2	2	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_H	
210	315	15	1	2	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
211	324	16	3	2	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
212	323	2	9	2	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
213	307	20	7	4	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
214	307	8	6	4	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_U	
215	316	4	9	4	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
216	316	7	2	6	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
217	316	7	2	6	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_U	
218	316	15	2	6	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
219	316	15	2	6	277	Toluca Valley Red-on-Buff (wide bands)	Tripod bowl	CAL_A	
220	310	3	2	2	256	Toluca Valley Red-on-Buff (parallel Jar line jars)		CAL_A	
221	307	20	8	4	256	Toluca Valley Red-on-Buff (parallel Jar line jars)		CAL_A	
222	307	4	2	6	256	Toluca Valley Red-on-Buff (parallel Jar line jars)		CAL_U	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
223	310	4	4	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
224	315	13	2	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
225	315	25	2	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
226	315	26	2	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
227	307	8	9	6	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
228	326	3	6	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_E	
229	316	16	5	4	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
230	323	5	10	2	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
231	307	20	7	4	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
232	324	4	4	6	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
233	316	15	2	6	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
234	316	15	2	6	256	Toluca Valley Red-on-Buff (parallel line jars)	Jar	CAL_A	
235	304	1	2	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
236	307	20	7	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
237	307	9	4	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
238	307	13	1	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_B	
239	307	20	2	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
240	316	13	8	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
241	316	6	1	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
242	316	9	2	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_B	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
243	317	28	6	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
244	307	10	2	6	21	Aztec III Black-on-Orange	Tripod bowl	CAL_B	
245	307	20	7	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
246	307	20	7	4	21	Aztec III Black-on-Orange	Tripod bowl	CAL_D	
247	316	5	1	6	114	Aztec III/IV Black-on-Orange	Tripod bowl	CAL_B	
248	316	7	2	6	114	Aztec III/IV Black-on-Orange	Tripod bowl	CAL_B	
249	324	1	8	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_B	
250	316	6	1	6	114	Aztec III/IV Black-on-Orange	Tripod bowl	CAL_D	
251	317	28	5	6	114	Aztec III/IV Black-on-Orange	Tripod bowl	CAL_U	
252	317	35	4	6	114	Aztec III/IV Black-on-Orange	Tripod bowl	CAL_B	
253	307	20	8	4	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
254	307	20	1	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
255	317	14	6	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
256	317	35	4	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_U	
257	317	28	5	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_U	
258	322	2	4	4	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
259	322	2	2	4	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
260	324	6	4	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
261	307	19	2	4	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_B	
262	311	10	5	4	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_D	

MES Samp. #	Context				Type Code	Ceramic Type	Vessel Form	Chem Group	Macroreg. Chem Grp
263	317	64	3	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_E	
264	309	17	3	6	181	Aztec III Black-on-Orange, Local variant B	Tripod bowl	CAL_U	
265	309	17	3	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_B	
266	317	14	7	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_D	
267	309	14	2	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_U	
268	316	15	1	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_B	
269	317	13	4	6	182	Aztec III/IV Black-on-Orange, Local variant B	Tripod bowl	CAL_B	
270	307	20	3	6	271	Aztec III Black-on-Orange, Local Variant A	Tripod bowl	CAL_B	



Archaeometry Laboratory



NEUTRON ACTIVATION ANALYSIS OF POTTERY FROM CALIXTLAHUACA IN THE TOLUCA VALLEY

ANIDS:

MES121-270 and
ACH001-570

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INTRODUCTION

This report describes the preparation, analysis, and interpretation of 739 samples of pottery from the Toluca Valley, Mexico (Table 1, Figure 1). The sample comes entirely from one site, Calixtlahuaca, but it consists of several types and multiple phases of occupation during the Middle and Late Postclassic. This report combines submissions from two researchers at the Arizona State University's School of Human Evolution and Social Change. Because both samples are from the same site, we combine the results into a single report.

Huster selected a random sample from different households at the site. The random quality of the sample is designed to produce results that are generalizable to the assemblage as a whole. She specifically wants to examine the effects of integration into the Aztec Empire on the common household. Alternatively, Smith selected a stratified sample of pottery types that likely represent import into the region from elsewhere (specifically the Valley of Mexico). In this report, we examine the chemical composition of each sample compared to other samples from the Toluca Valley, the Valley of Mexico, and Morelos.

Table 1. NAA pottery sample and its types across time.

<i>PI</i>	<i>Ware</i>	<i>Dongu</i> <i>1150-1300 CE</i>	<i>Ninupi</i> <i>1300-1480 CE</i>	<i>Yata</i> <i>1480-1530 CE</i>	<i>Middle-Late</i> <i>Postclassic</i> <i>1150-1521 CE</i>	<i>Late</i> <i>Postclassic</i> <i>1300-1521 CE</i>	<i>Total</i>
Huster	Aztec Orange Guinda Red	2	4	10			16
	Matlatzinca Polychrome	1	3	1			5
	Matlatzinca Red	8	16	10		1	35
	Matlatzinca Red-on-Buff	50	50	27		5	132
	Matlatzinca Red-on-White	3	1				4
	Plain	80	97	55		3	235
	Ritual	10	12	6			28
	Unknown	25	48	37			110
	Subtotal	179	232	149		9	569
Smith	Aztec Orange Ware		18	32	1		51
	Earthen Ware, unspecified		3	2	1		6
	Guinda Red Ware	2	4	2			8
	Matlatzinca Buff Ware	49	29	25	2		105
	Subtotal	51	54	61	4		170
Total		230	286	210	4	9	739

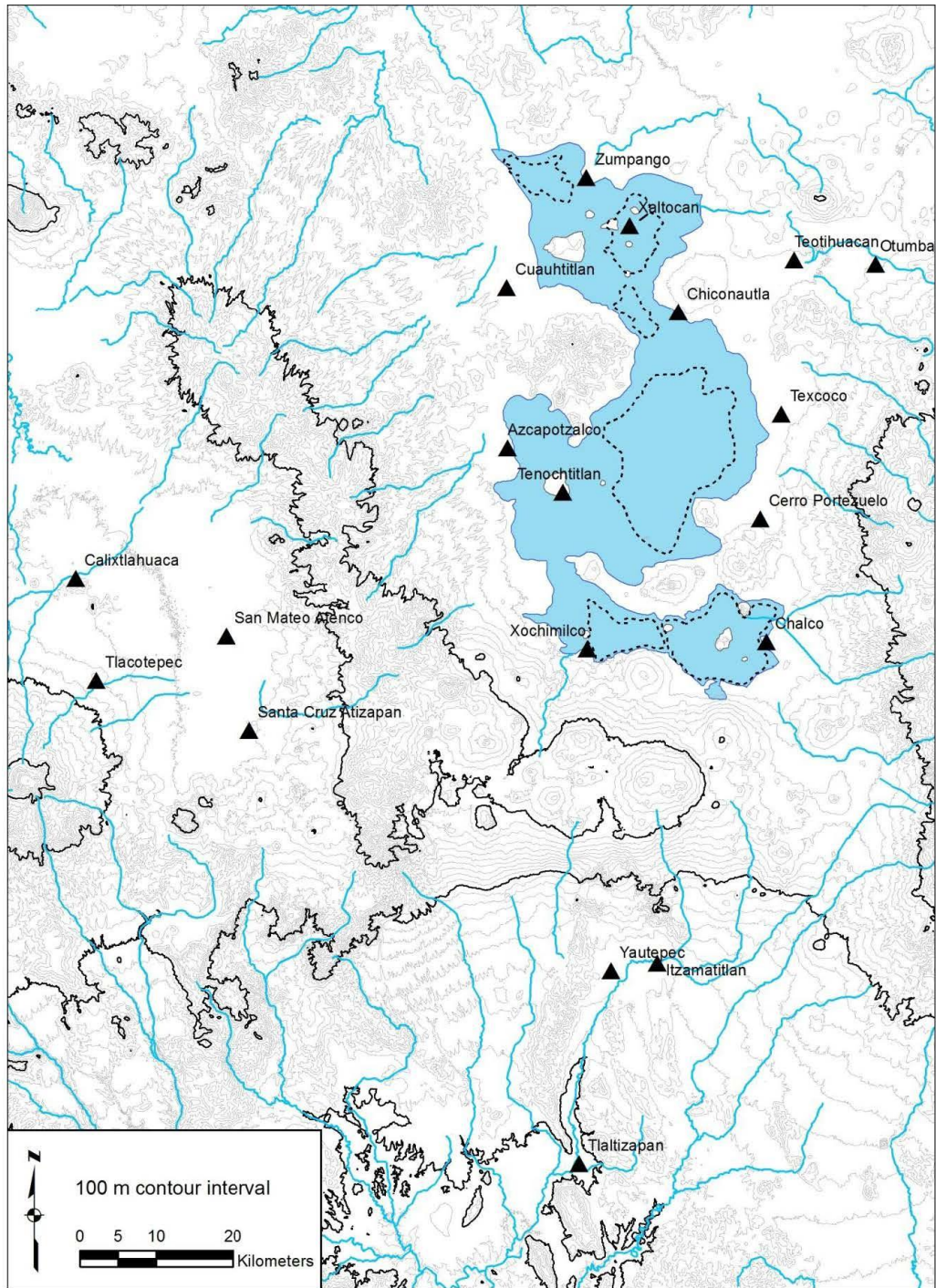


Figure 1. Map of the study region showing the locations of sites mentioned in the text.

SAMPLE PREPARATION

Pottery and clay samples were prepared for INAA using procedures standard at MURR. Fragments of about 1 cm² were removed from each sample and abraded using a silicon carbide burr in order to remove glaze, slip, paint, and adhering soil, thereby reducing the risk of measuring contamination. The samples were washed in deionized water and allowed to dry in the laboratory. Once dry, the individual sherds were ground to powder in an agate mortar to homogenize the samples. Archival samples were retained from each sherd (when possible) for future research.

Two analytical samples were prepared from each source specimen. Portions of approximately 150 mg of powder were weighed into clean high-density polyethylene vials used for short irradiations at MURR. At the same time, 200 mg of each sample was weighed into clean high-purity quartz vials used for long irradiations. Individual sample weights were recorded to the nearest 0.01 mg using an analytical balance. Both vials were sealed prior to irradiation. Along with the unknown samples, Standards made from National Institute of Standards and Technology

(NIST) certified standard reference materials of SRM-1633a (coal fly ash) and SRM-688 (basalt rock) were similarly prepared, as were quality control samples (e.g., standards treated as unknowns) of SRM-278 (obsidian rock) and Ohio Red Clay (a standard developed for in-house applications).

NAA: IRRADIATION AND GAMMA-RAY SPECTROSCOPY

Neutron activation analysis of ceramics at MURR, which consists of two irradiations and a total of three gamma counts, constitutes a superset of the procedures used at most other NAA laboratories (Glasecock 1992; Neff 1992, 2000). As discussed in detail by Glasecock (1992), a short irradiation is carried out through the pneumatic tube irradiation system. Samples in the polyvials are sequentially irradiated, two at a time, for five seconds by a neutron flux of 8×10^{13} n cm⁻² s⁻¹. The 720-second count yields gamma spectra containing peaks for nine short-lived elements aluminum (Al), barium (Ba), calcium (Ca), dysprosium (Dy), potassium (K), manganese (Mn), sodium (Na), titanium (Ti), and vanadium (V). The samples are encapsulated in quartz vials and are subjected to a 24-hour irradiation at a neutron flux of 5×10^{13} n cm⁻² s⁻¹. This long irradiation is analogous to the single irradiation utilized at most other laboratories. After the long irradiation, samples decay for seven days, and then are counted for 1,800 seconds (the "middle count") on a high-resolution germanium detector coupled to an automatic sample changer. The middle count yields determinations of seven medium half-life elements, namely arsenic (As), lanthanum (La), lutetium (Lu), neodymium (Nd), samarium (Sm), uranium (U), and ytterbium (Yb). After an additional three- or four-week decay, a final count of 8,500 seconds is carried out on each sample. The latter measurement yields the following 17 long half-life elements: cerium (Ce), cobalt (Co), chromium (Cr), cesium (Cs), europium (Eu), iron (Fe), hafnium (Hf), nickel (Ni), rubidium (Rb), antimony (Sb), scandium (Sc), strontium (Sr), tantalum (Ta), terbium (Tb), thorium (Th), zinc (Zn), and zirconium (Zr). The element concentration data from the three measurements are tabulated in parts per million.

INTERPRETING CHEMICAL DATA

Nickel (Ni) was removed from all NAA statistical techniques due to the high number of missing values within the dataset.

Statistical analysis was carried out on base-10 logarithms and/or linear concentrations for all elements. Use of log concentrations rather than raw linear data compensates for differences in magnitude between the major elements, such as calcium, on one hand and trace elements, such as the rare earth or lanthanide elements (REEs). Transformation to base-10 logarithms also yields a more normal distribution for many trace elements. However, log expressions distort the true nature of chemical relationships, so we employ linear expressions in certain cases.

The interpretation of compositional data obtained from the analysis of archaeological materials is discussed in detail elsewhere (e.g., Baxter and Buck 2000; Bieber *et al.* 1976; Bishop and Neff 1989; Glascock 1992; Harbottle 1976; Neff 2000) and will only be summarized here. The main goal of data analysis is to identify distinct and relatively homogeneous groups within the analytical database. Based on the provenance postulate of Weigand *et al.* (1977), different chemical groups may be assumed to represent geographically restricted sources. With pottery, however, chemical composition additionally varies according to the paste recipes that potters employ. A paste recipe reflects the cumulative pottery production steps from the selection of raw materials, preparation of those materials, the mixing of temper and clay, and even the firing of the pottery can affect the final recipe as changes in color and mineral structure can take place. For lithic materials such as obsidian, basalt, and cryptocrystalline silicates (e.g., chert, flint, or jasper), raw material samples are frequently collected from known outcrops or secondary deposits and the compositional data obtained on the samples is used to define the source localities or boundaries. The locations of sources can also be inferred by comparing unknown specimens (i.e., ceramic artifacts) to knowns (i.e., clay samples) or by indirect methods such as the “criterion of abundance” (Bishop *et al.* 1982) or by arguments based on geological and sedimentological characteristics (e.g., Steponaitis *et al.* 1996). The ubiquity of ceramic raw materials usually makes it impossible to sample all potential “sources” intensively enough to create groups of knowns to which unknowns can be compared. Lithic sources tend to be more localized and compositionally homogeneous in the case of obsidian or compositionally heterogeneous as is the case for most cherts.

Compositional groups can be viewed as “centers of mass” in the compositional hyperspace described by the measured elemental data. Groups are characterized by the locations of their centroids and the unique relationships (i.e., correlations) between the elements. Decisions about whether to assign a specimen to a particular compositional group are based on the overall probability that the measured concentrations for the specimen could have been obtained from that group.

Initial hypotheses about source-related subgroups in the compositional data can be derived from non-compositional information (e.g., archaeological context, decorative attributes, etc.) or from application of various pattern-recognition techniques to the multivariate chemical data. Some of the pattern recognition techniques that have been used to investigate archaeological data sets are

cluster analysis (CA), principal components analysis (PCA), and discriminant analysis (DA). Each of the techniques has its own advantages and disadvantages which may depend upon the types and quantity of data available for interpretation.

The variables (measured elements) in archaeological and geological data sets are often correlated and frequently large in number. This makes handling and interpreting patterns within the data difficult. Therefore, it is often useful to transform the original variables into a smaller set of uncorrelated variables in order to make data interpretation easier. Of the above-mentioned pattern recognition techniques, PCA is a technique that transforms from the data from the original correlated variables into uncorrelated variables most easily.

PCA creates a new set of reference axes arranged in decreasing order of variance subsumed. The individual PCs are linear combinations of the original variables. The data can be displayed on combinations of the new axes, just as they can be displayed on the original elemental concentration axes. PCA can be used in a pure pattern-recognition mode, i.e., to search for subgroups in an undifferentiated data set, or in a more evaluative mode, i.e., to assess the coherence of hypothetical groups suggested by other criteria. Generally, compositional differences between specimens can be expected to be larger for specimens in different groups than for specimens in the same group, and this implies that groups should be detectable as distinct areas of high point density on plots of the first few components. It is well known that PCA of chemical data is scale dependent, and analyses tend to be dominated by those elements or isotopes for which the concentrations are relatively large. This is yet another reason for the log transformation of the data.

One frequently exploited strength of PCA, discussed by Baxter (1992), Baxter and Buck (2000), and Neff (1994, 2002), is that it can be applied as a simultaneous R- and Q-mode technique, with both variables (elements) and objects (individual analyzed samples) displayed on the same set of principal component reference axes. A plot using the first two principal components as axes is usually the best possible two-dimensional representation of the correlation or variance-covariance structure within the data set. Small angles between the vectors from the origin to variable coordinates indicate strong positive correlation; angles at 90 degrees indicate no correlation; and angles close to 180 degrees indicate strong negative correlation. Likewise, a plot of sample coordinates on these same axes will be the best two-dimensional representation of Euclidean relations among the samples in log-concentration space (if the PCA was based on the variance-covariance matrix) or standardized log-concentration space (if the PCA was based on the correlation matrix). Displaying both objects and variables on the same plot makes it possible to observe the contributions of specific elements to group separation and to the distinctive shapes of the various groups. Such a plot is commonly referred to as a “biplot” in reference to the simultaneous plotting of objects and variables. The variable inter-relationships inferred from a biplot can be verified directly by inspecting bivariate elemental concentration plots. [Note that a bivariate plot of elemental concentrations is not a biplot.]

Whether a group can be discriminated easily from other groups can be evaluated visually in two dimensions or statistically in multiple dimensions. A metric known as the Mahalanobis distance (or generalized distance) makes it possible to describe the separation between groups or between

individual samples and groups on multiple dimensions. The Mahalanobis distance of a specimen from a group centroid (Bieber *et al.* 1976, Bishop and Neff 1989) is defined by:

$$D_{y,x}^2 = [y - \bar{X}]^t I_x [y - \bar{X}]$$

where y is the $1 \times m$ array of logged elemental concentrations for the specimen of interest, X is the $n \times m$ data matrix of logged concentrations for the group to which the point is being compared with $\bar{X}$ being its $1 \times m$ centroid, and I_x is the inverse of the $m \times m$ variance-covariance matrix of group X . Because Mahalanobis distance takes into account variances and covariances in the multivariate group it is analogous to expressing distance from a univariate mean in standard deviation units. Like standard deviation units, Mahalanobis distances can be converted into probabilities of group membership for individual specimens. For relatively small sample sizes, it is appropriate to base probabilities on Hotelling's T^2 , which is the multivariate extension of the univariate Student's t .

When group sizes are small, Mahalanobis distance-based probabilities can fluctuate dramatically depending upon whether or not each specimen is assumed to be a member of the group to which it is being compared. Harbottle (1976) calls this phenomenon "stretchability" in reference to the tendency of an included specimen to stretch the group in the direction of its own location in elemental concentration space. This problem can be circumvented by cross-validation, that is, by removing each specimen from its presumed group before calculating its own probability of membership (Baxter 1994; Leese and Main 1994). This is a conservative approach to group evaluation that may sometimes exclude true group members.

Small sample and group sizes place further constraints on the use of Mahalanobis distance: with more elements than samples, the group variance-covariance matrix is singular thus rendering calculation of I_x (and D^2 itself) impossible. Therefore, the dimensionality of the groups must somehow be reduced. One approach would be to eliminate elements considered irrelevant or redundant. The problem with this approach is that the investigator's preconceptions about which elements should be discriminate may not be valid. It also squanders the main advantage of multielement analysis, namely the capability to measure a large number of elements. An alternative approach is to calculate Mahalanobis distances with the scores on principal components extracted from the variance-covariance or correlation matrix for the complete data set. This approach entails only the assumption, entirely reasonable in light of the above discussion of PCA, that most group-separating differences should be visible on the first several PCs. Unless a data set is extremely complex, containing numerous distinct groups, using enough components to subsume at least 90% of the total variance in the data can be generally assumed to yield Mahalanobis distances that approximate Mahalanobis distances in full elemental concentration space.

Lastly, Mahalanobis distance calculations are also quite useful for handling missing data (Sayre 1975). When many specimens are analyzed for a large number of elements, it is almost certain that a few element concentrations will be missed for some of the specimens. This occurs most frequently when the concentration for an element is near the detection limit. Rather than

eliminate the specimen or the element from consideration, it is possible to substitute a missing value by replacing it with a value that minimizes the Mahalanobis distance for the specimen from the group centroid. Thus, those few specimens which are missing a single concentration value can still be used in group calculations.

STRUCTURE OF THE DATA SET

We begin by examining the dataset in isolation. Identification of internal groupings helps to explain the influence of time, space, and paste recipe on the locally-produced ceramics. It also serves to identify outliers that may be of non-local origin. Outlier groups are compared to the central Mexican macroregion below to find possible sources of import. We examine the Huster and Smith datasets together here, but address specific research questions in different sections at the end of the report. Table 2 lists the numbers of each ceramic type that fall into eight different paste recipes.

Table 2. Cross-tabulation of ceramic ware against chemical group.

SIMPLIFIED WARE	CAL-A	CAL-B	CAL-C	CAL-D	CAL-E	CAL-F	CAL-G	CAL-H	CAL-U	Total
	Main Local			BOM Import	High Cr & Fe	High Mn & Co	High As & Sb	High Zn	Unass- igned	
Aztec Orange	6	21	1	22	1	2			14	67
Earthen Ware	2	1							3	6
Guinda	2					1	1		8	12
Matlazinga										
Red	28		1		2	1	1	1	1	35
Red-on-Buff	81	1	9		1	9		7	24	132
Buff	72		2		8	1	5	3	14	105
Red-on-White	1		1						2	4
Polychrome	3				1				1	5
Plain Ware	134	9	6	1	4	13	3	13	52	235
Ritual Ware	18		1		1	1		1	6	28
Unknown	74	1	3	1		12	1	1	17	110
Total	421	33	24	23	18	40	11	26	142	739

Table 3. Cross-tabulation of chemical group versus temper category.

Chemical Group	amphibole and volcanic glass	none	organic	Total
CAL_A	415	5		420
CAL_B	25		8	40
CAL_C	23			23
CAL_D	9		15	23
CAL_E	18			18
CAL_F	39	1		40
CAL_G	10	1		11
CAL_H	25	1		26
CAL_U	124	12	5	135
Total	688	20	28	736

CAL-A (n=421)

The majority of ceramics fit within what we assume is the dominant local paste recipe, based on the criterion of abundance (Table 2). This group is a robust local reference group that cannot be meaningfully subdivided according to any of the descriptive data provided by Huster and Smith

(time, household, ceramic type). All but five of these specimens were characterized as having amphibole and volcanic rocks as temper (Table 3). The remainder contained no visible temper. In addition to amphibole, the temper/aplastic fraction in this group likely contains plagioclase, pyroxene, and biotite. Meanwell's (2012) petrographic analysis of a sample from the same site (for Juliana Novic) identified plagioclase as the most prominent mineral in the paste.

CAL-A ceramics are quite distinctive in central Mexico due to high concentrations of Ba and Sr but low concentrations of rare earth elements (REEs) and most transition metals (see Figures 2-6). The ceramics tempered with "organics" found at Calixtlahuaca do not display this elevation of Ba and Sr, so these elements likely reside in the aplastic fraction of CAL-A ceramics. Barium and Sr can be concentrated in amphiboles and biotites. Amphibole is present in most of the pottery fabrics identified by Meanwell (2012:3-5), but biotite is rare. It is possible that biotite is finely divided among the clay fraction of the pottery, which would influence bulk chemistry but not be detectable with the petrographic microscope. The low values of lanthanide series elements in the local ceramic chemistry may result from dilution due to the elevation of the elements mentioned above.

All of the ceramic wares in the sample are represented in CAL-A, but Matlazinga and Plain wares dominate. Six Aztec Orange ware samples fall into this chemical group, and are considered imitations of the imperial style. At least two of the 12 Guinda ware ceramics also appear of local manufacture.

CAL-B (n=33)

CAL-B is a group of potential imports. It displays lower levels of Ba and Sr, and higher levels of REEs and transition metals than the local reference group, CAL-A (see Figures 2-6). A total of 25 of these ceramics were visually characterized to contain the same temper as CAL-A (see Table 3), but eight specimens contained organic temper instead. The chemical distinctiveness of the organic-tempered ceramics obviously pertains to the materials that the potters added (or did not add) to the paste.

In total, the primary ware included within the CAL-B group is Aztec Orange (n=21) (see Table 2). Seven of the eight organic-tempered specimens have been identified as Aztec Orange ware thought to be imported from the Valley of Mexico. The remainder was visually identified to contain the same amphibole and volcanic temper as CAL-A. Among the Aztec Orange sherds with this temper type, half (n=7) were coded as Type 271 or 274. These types are thought, based on visual inspection, to be local imitations. Other types that display chemistry of CAL-B are Plain ware (n=9), Earthenware (n=1), Matlazinga Red-on-Buff (n=1), and Unknown (n=1). This chemical group contains only one ceramic made in the local Matlazinga style.

CAL-C (n=24)

CAL-C is a group of ceramics that was probably produced within the Toluca Valley. They may be of local production at Calixtlahuaca, but using a different paste recipe than the CAL-A ceramics. The chemistry of CAL-C is lower in Ba and slightly lower in Mn and most REEs (see

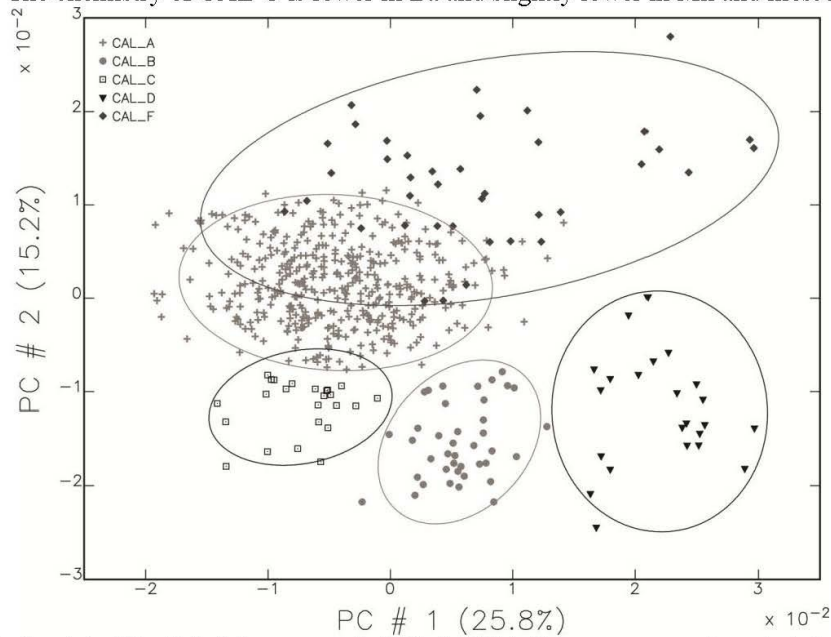


Figure 2. Scatterplot of the Calixtlahuaca sample (with the High Cr group removed) projected on Principal Components 1 and 2. Ellipses represent 90 percent confidence intervals of group membership. The Calixtlahuaca Core and Macro groups will function as local references in the analyses to follow. The other groups will be explored as potential imports.

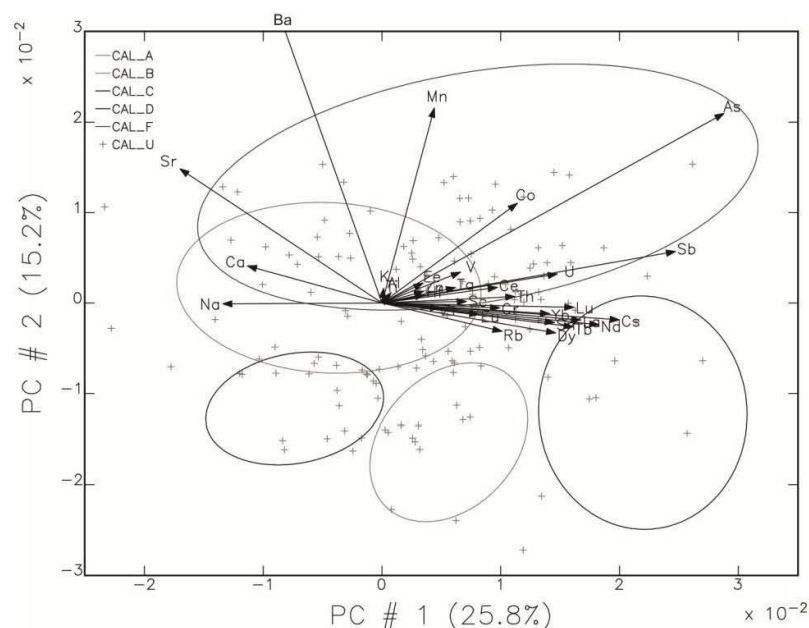


Figure 3. RQ-Mode plot of the Calixtlahuaca groups (with the High Cr group removed) projected on Principal Components 1 and 2. Ellipses represent 90 percent confidence intervals of group membership. Vectors represent relative importance of each element on the principal components.

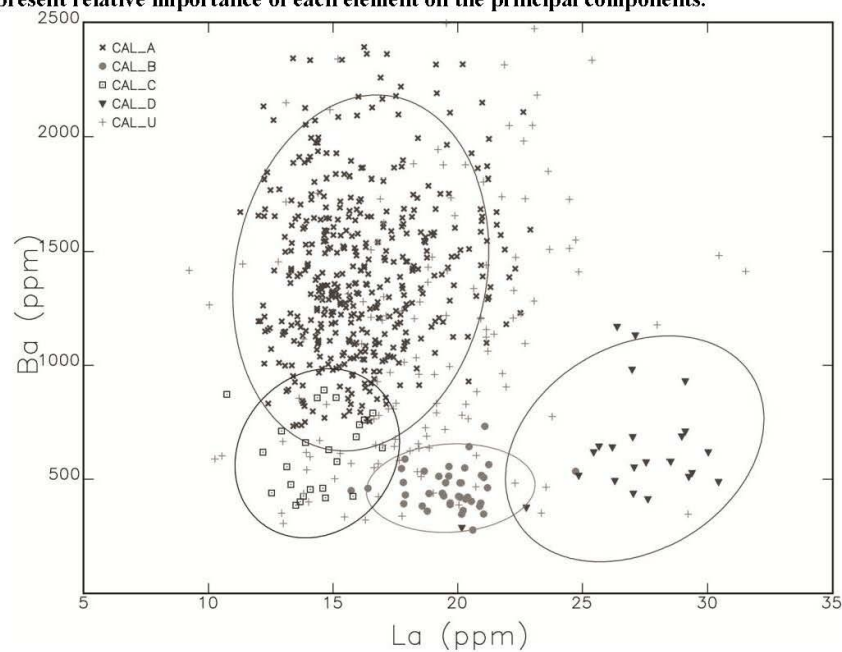


Figure 4. Scatterplot of the Calixtlahuaca sample (with the High Cr group removed) projected on logged axes of La and Ba. Ellipses represent 90 percent confidence intervals of group membership. These two elements contribute much of the variability in Principal Components 1 and 2.

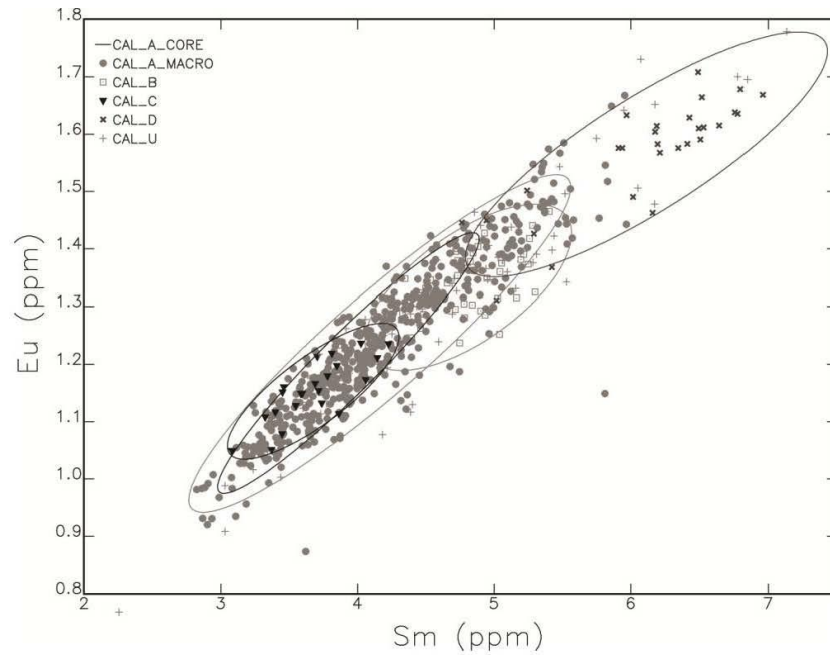


Figure 5. Scatterplot of the Calixtlahuaca sample (with the High Cr group removed) projected on linear axes of Sm and Eu. Ellipses represent 90 percent confidence intervals of group membership. These are both lanthanide series elements and display strong positive correlation.

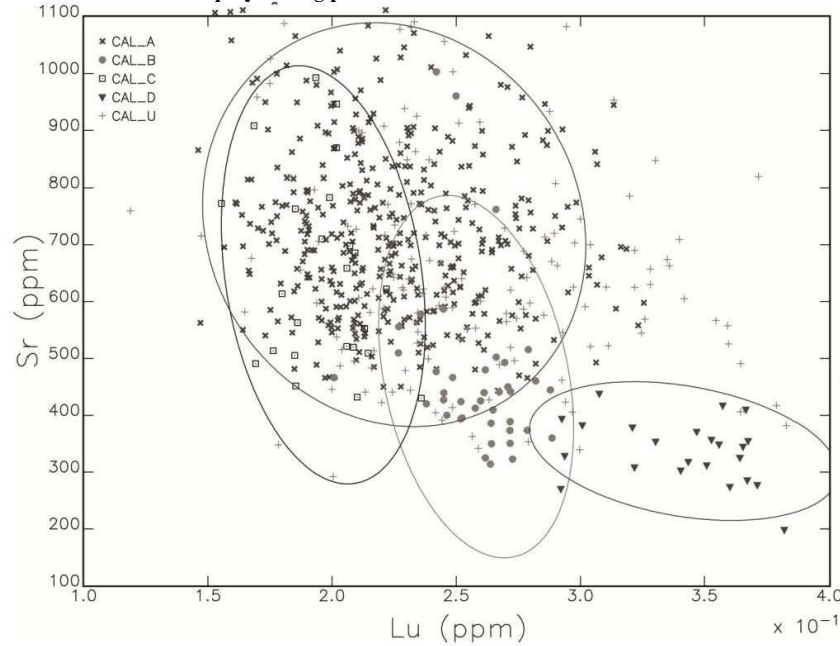


Figure 6. Scatterplot of the Calixtlahuaca sample (with the High Cr group removed) projected on linear axes of Lu and Sr. Ellipses represent 90 percent confidence intervals of group membership.

Figures 2-6). It is subtly higher in Rb than CAL-A. We suggest that the chemistry of this group is essentially the same as CAL-A, but with a lesser representation of whatever agent causes elevated Ba in the main local reference group. If Ba is contributed by temper, CAL-C could simply be a more lightly tempered version. If it was produced at another site, we argue based on the general similarity to Calixtlahuaca ceramics that it was within the Toluca Valley.

Reinforcing the possibility of local production, all of the CAL-C ceramics were visually identified to contain the same volcanic temper as CAL-A (see Table 3). Over half (n=13) of the ceramics in this group were of the local Matlazinga style, and the remainder comprises Plain (n=6), Unknown (n=3), Ritual (n=1), and Aztec (n=1) wares (see Table 2).

CAL-D (n=24)

CAL-D consists of imports from the Basin of Mexico. We discuss this further below. Almost all (n=22) of the ceramics in this group are Aztec Orange wares (see Table 2). Only 15 of these contain organic temper, the remainder contains volcanic inclusions (see Table 3). Despite the difference in visual identification of temper these ceramics form a relatively coherent chemical group. Only one of these was typed as a local imitation (see Table 2), so the visual differentiation employed by Smith and Huster seems efficient. One Plain and one Unknown ware specimens were included in this group.

CAL-E (n=18)

CAL-E is a loose cluster of outlier ceramics high in Cr and Fe (Figure 7). Most of the members in this group (n=12) are executed in the local Matlazinga style (see Table 2), so we tend to think that they are aberrant local paste recipes. Such a pattern could be formed by inclusion of rare mafic rocks in the paste. Mafic materials, such as basalt, are high in Cr and most other transition metals. This highly variable chemical pattern is what one would expect from weathering of ceramics. It would be nearly impossible, however, that post-depositional processes *elevates* the concentrations of transition metals unless some other component is removed thereby concentrating Cr. Such could take place by the extreme leaching of other components in the paste, such as alkali and alkaline earth metals, but we do not observe such leaching.

An alternative scenario is that this set of ceramics was imported from a place with high concentrations of Cr. Morelos represents a continuation of the north-south trend of increasingly mafic rocks observed in the Basin of Mexico. (Neff and Glascock 2000, Nichols et al. 2002). Reference groups for Morelos are much higher in Cr, Fe and several other transition metals. However, it is not known to the authors whether groups in Morelos were producing Matlazinga wares. The project PIs would better evaluate this hypothesis.

A third option is that these ceramics represent abnormal local paste recipes that are heavily tempered with mafic rocks.

CAL-F (n=40)

Much like CAL-E, CAL-F is an outlier cluster of ceramics high in Mn and Co (Figure 8). The chemical pattern again is very linear and variable, suggesting that the same process – be it tempering practice, diagenesis, or contamination – elevated all of these ceramics in the same way but to different extents. All but one of these ceramics were visually identified to have volcanic temper (see Table 3). Ceramic wares represented are Plain (n=13), Unknown (n=12), Matlazinga (n=11), Aztec Orange (n=2), Ritual (n=1), and Guinda (n=1) (see Table 4). It is interesting that such a high proportion of Unknown ceramics occur in this group. It begs the question, was there something odd about this group of ceramics? Even more interesting is that the overwhelming majority of these ceramics (n=35) were excavated within Excavation Unit 303, and all but five of those come from the same provenience (3030609). If no mineralogical or contextual reason can explain this chemical abnormality, we must consider contamination during sample preparation. MURR burrs all surfaces of the sample with a silicon carbide bit, which could not account for the elevation of transition metals. In a previous correspondence, Huster mentioned that the samples were cut with a saw prior to export from Mexico. If a different saw blade had been used for ceramics from provenience 3030609, we would suspect contamination that was not completely remove by burring the surface. Cobalt is a common binding agent in tungsten carbide tools, but Mn is less common. MURR does not usually measure tungsten (W) due to imprecision and its low concentrations in natural materials, but we reviewed the spectra for W and there is no detectible amount of this element in the samples. This suggests that a tungsten-carbide tool was not likely the reason for the elevated Mn and Co in these samples.

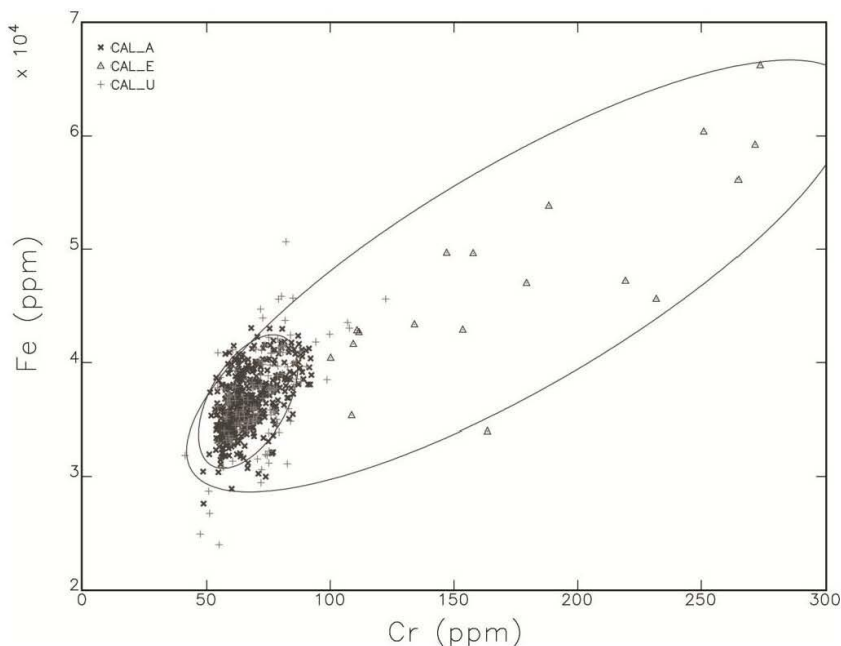


Figure 7. Scatterplot showing the high levels of Cr and Fe in CAL-E. Axes are linear. Ellipses represent 90 percent confidence ellipses of group membership.

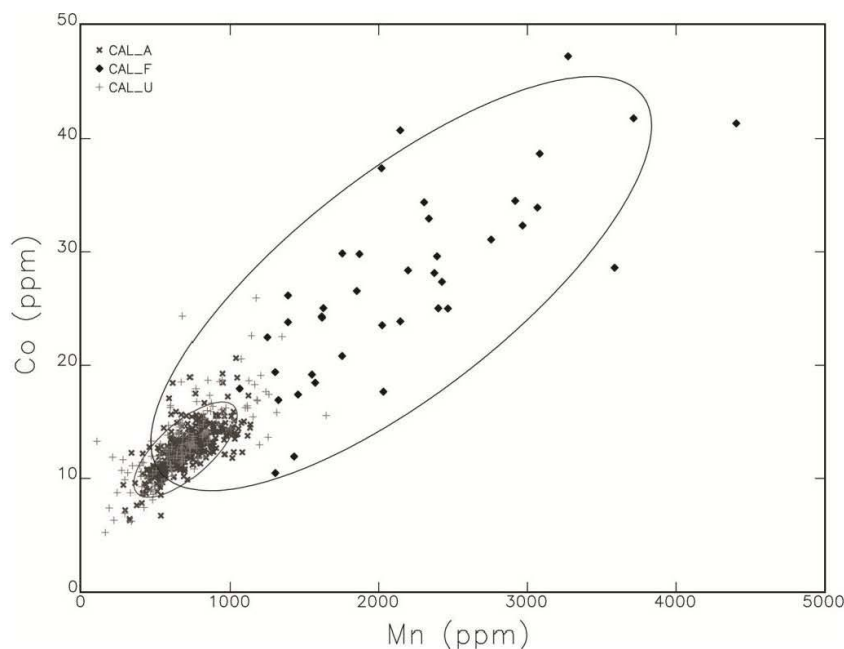


Figure 8. Scatterplot showing the high levels of Mn and Co in CAL-F. Axes are linear. Ellipses represent 90 percent confidence ellipses of group membership.

CAL-G (n=11)

CAL-G represents outliers high in As or Sb (Figure 9). These elements are not chemically mobile in nature, and they tend to occur as particulates in ceramic matrices. This group should not be considered in any provenance determinations. With As and Sb removed, these specimens appear to be similar to the local paste recipe.

CAL-H (n=26)

This compositional group is a cluster of ceramics mildly high in Zn (Figure 10). It should be considered a local paste recipe that differs from CAL-A only in this one element. The majority (n=14) of these specimens were excavated in Unit 315. All but one was tempered with volcanic rocks (see Table 3). Half of this chemical group consists of Plain ware ceramics, with 11 made in the Matlazinga style, one Ritual ware, and one Unknown (see Table 2).

CAL-U (n=142)

CAL-U contains unassigned ceramics, 19 percent of the entire combined sample. Most of these are most chemically similar to CAL-A, but some outliers exist. Below we attempt to associate these specimens with the best group using Mahalanobis distance-based probability assessments.

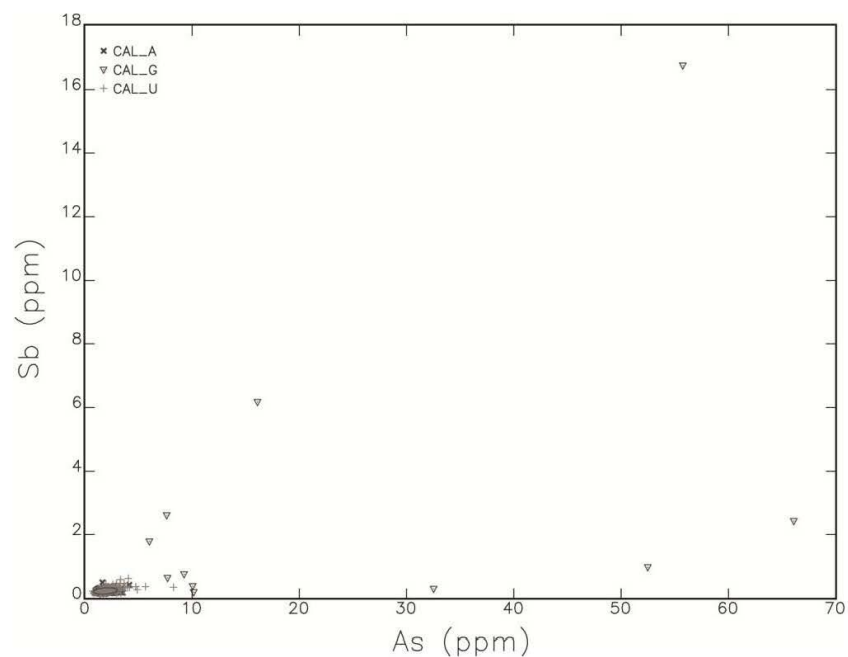


Figure 9. Scatterplot showing the high levels of As and Sb in CAL-G. Axes are linear.

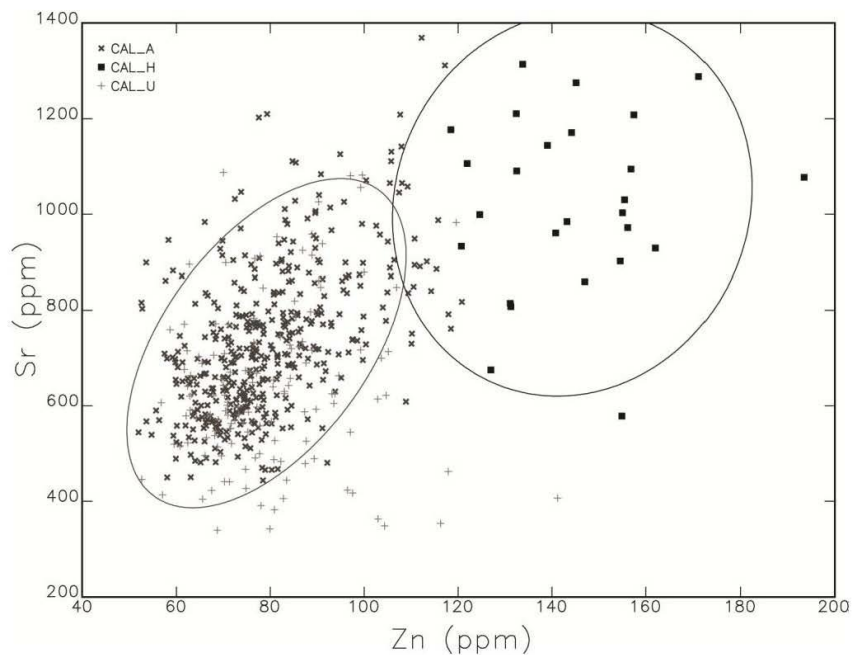


Figure 10. Scatterplot showing the high levels of Zn in CAL-H. Axes are linear. Ellipses represent 90 percent confidence ellipses of group membership.

The Chemical Effects of Temper on the Calixtlahuaca Dataset

As argued above, the primary determinant of Calixtlahuaca pottery chemistry is the tempering agent. Organic-tempered ceramics are low primarily in Ba and Sr, but high in most other elements. If at least some of the organic-tempered ceramics were made locally, we could deduce that the elements Ba and Sr concentrated in the volcanic-tempered ceramics derive from the tempering materials themselves. Microanalysis using laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) could be used to evaluate this hypothesis. Temper alone, however, does not explain all of the variability in the sample. Comparing samples with “No Temper” to those with volcanic temper establishes a continuum of local paste recipes that varies with the percentage of temper added to raw clays. The untempered ceramics display many of the same chemical characteristics as the tempered ceramics. Concentration of Ba and Sr is on average very similar, suggesting that it may be the clay fraction of the ceramics that possesses the elevated levels of this element. The untempered ceramics typically contain higher REE concentrations. Adding temper must dilute the levels of these elements in the resulting ceramics, meaning that the temper contains lower values for REEs. Confounding this reconstruction is the facts that most of the untempered ceramics are of the Guinda type that may be imported to the Toluca Valley (see below)

The majority of organic tempered ceramics fall within the CAL-D group on axes of Ba and Sr (Figure 11). Lanthanide series elements provide chemical differentiation among those that fall

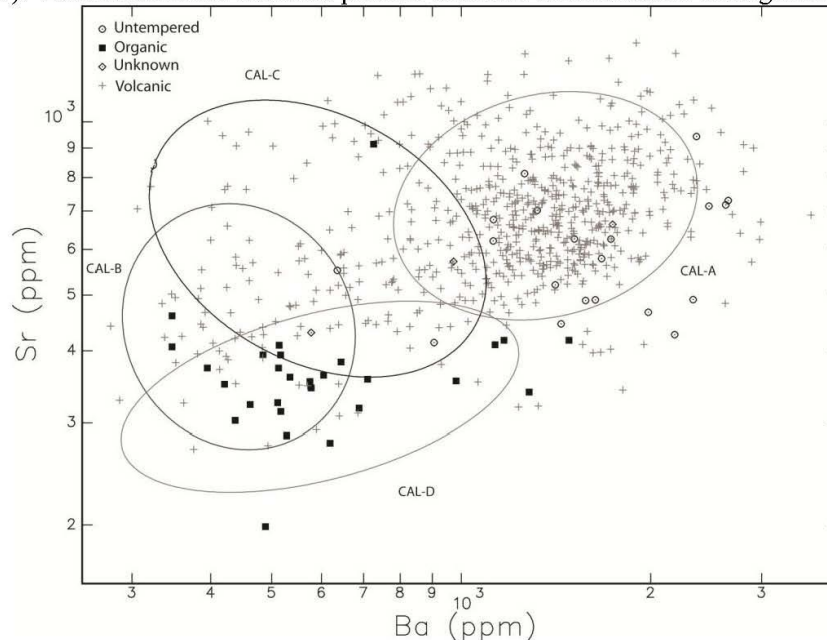


Figure 11. Scatterplot of temper categories projected on logged axes of Ba and Sr.

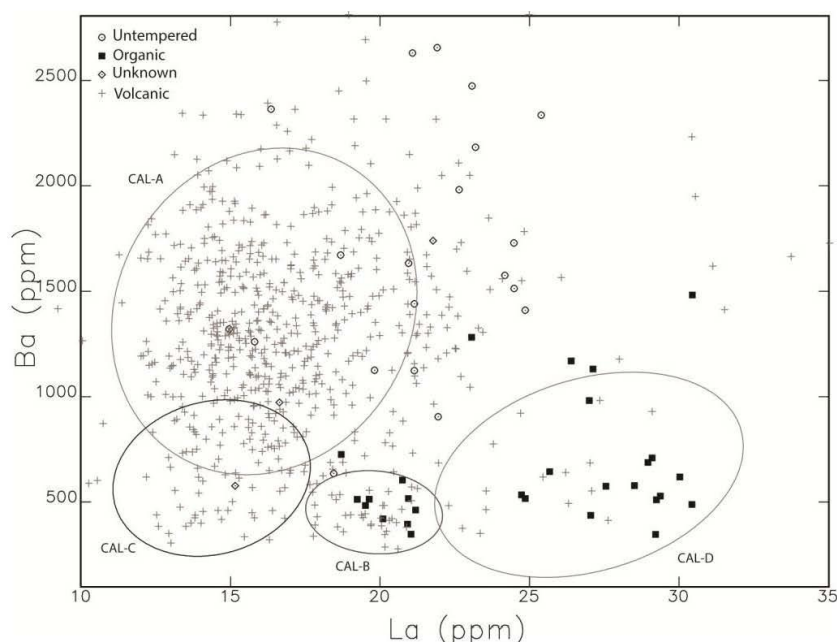


Figure 12. Scatterplot of temper categories on linear axes of La and ba.

into CAL-B and Cal-D (Figure 12). Given that organic tempering was common in the Basin of Mexico, it is possible that most of the organic-tempered ceramics are actual imports. The chemistry is not so clear, as discussed below.

Chemical Patterns According to Ceramic Type

Examining the chemical patterning according to the ceramic types provided by Huster and Smith provides further evidence to evaluate “non-local” types that have potential for import. The Aztec style ceramics in particular have the greatest chance of being imported from the Valley of Mexico. Most of the Aztec wares are organic tempered. The chemical difference can, therefore, be explained by differences in paste recipe between the Valley of Mexico and the Toluca Valley, which could indicate that most of the Aztec wares were imports. Aztec style ceramics that are visually defined as locally-made are separated in Figure 13 (Type Codes 271 and 274). They generally display wide ranging chemical compositions. Notice, however, that the visually identified imports form two main clusters. The first makes up the majority of CAL-D, which we determine below to be a good match for the Tenochtitlan reference group in the Basin of Mexico. The second comingles with visually-identified Aztec imitations in CAL-B. The possibility that these groups were actually imported is more rigorously tested below. A relatively smaller portion of the Aztec ware falls into the local Calixtlahuaca group (CAL-A) and are definitely of local make.

The few Earthenware samples display highly variable chemistry. At least two are locally produced, but the others are chemical outliers of CAL-A. Two Earthenware specimens are chemically similar to the Aztec ware and may be imports.

The Guinda ware is an interesting situation. Barium levels are inline or higher than the local reference group, but Guinda ceramics possess higher REE concentrations, similar to the Basin imports. Most of these ceramics were untempered. As mentioned above, if local clays were naturally elevated in Ba and Sr, the Guinda ware in the current sample are likely local products. Again, this hypothesis could be tested with LA-ICP-MS of the clay fraction.

Ritual ceramics also mostly possess the dominant local paste recipe with a few chemical outliers. Almost all of these contain the same visually-identified temper as the local reference group.

The Matlazinga ware is considered to be a local style. We therefore anticipated assignment of most of these types to the local paste recipe. Our expectations were largely confirmed, but a number of exceptions exist (Figure 14). Matlazinga Polychrome, Red-on-Buff, and Red-on-White almost exclusively match the local paste recipe. Matlazinga Red and Buff possess number of chemical outliers. Many of these occur in the High Mn group (CAL-F). Many of the Matlazinga Red fall in to the CAL-C group. The fact that a number of local-style ceramics match the chemistry of the CAL-C group support the possibility that it was locally produced using a different paste recipe.

A substantial number of Plain ware ceramics chemically resemble the Aztec ware in CAL-B and CAL-D (Figure 15), but the majority belong to the local CAL-A group. The same can be said for

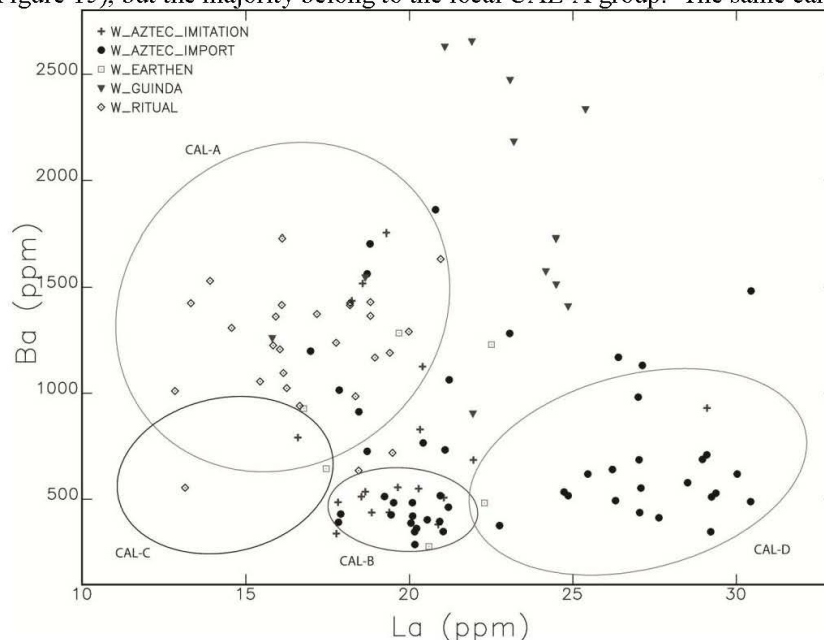


Figure 13. Type categories of ceramics that are potentially imported to Calixtlahuaca. The Aztec Imitation category comprises Type Codes 271 and 274 that are executed in the Aztec style but appear local. The Aztec Import category consists of all other Aztec style ceramics that are visually indistinguishable from those found in the Basin of Mexico.

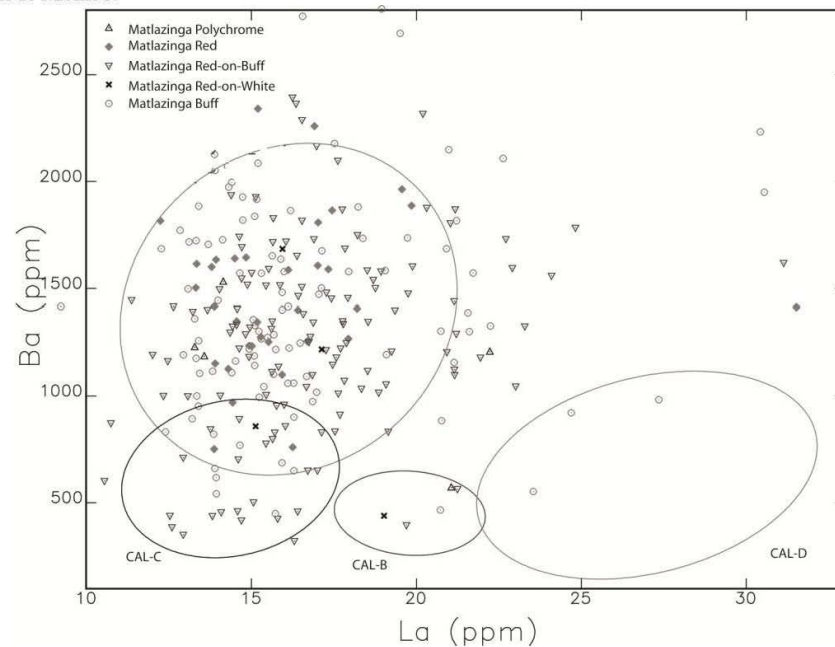


Figure 14. Type categories of Matlazinga ceramics from Calixtlahuaca projected on Principal Components 1 and 2.

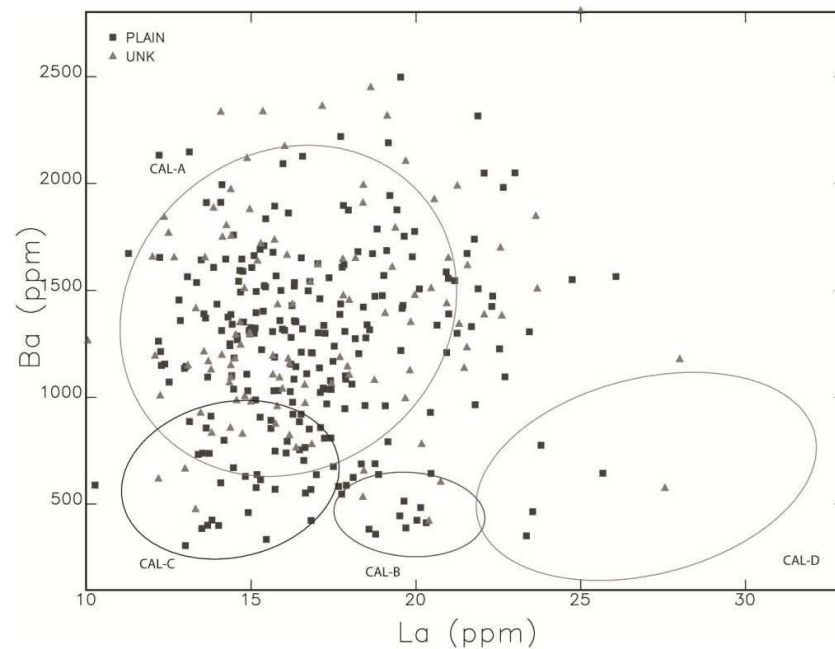


Figure 15. Plain and Unknown Types of ceramics from Calixtlahuaca projected on Principal Components 1 and 2.

ceramics of an unknown type. Both of these categories are focused on the local cluster of ceramics, but outliers cover nearly the complete chemical range of the sample.

COMPARISON TO THE CENTRAL MEXICAN MACROREGION

The initial overview above focused on the Calixtlahuaca sample in isolation, but identified several potential trade categories. The most likely category to have been imported to Calixtlahuaca is the CAL-D group. These consist mostly of Aztec style ceramics. Somewhat less likely to have been imported is the CAL-B group. CAL-C is the least likely import because it is chemically the closest to the Calixtlahuaca macro group.

We selected several datasets to compare with the Calixtlahuaca sample. For the Basin of Mexico (which includes the Teotihuacan Valley) we combined all of the core reference groups into a single macroregional group. To represent Morelos, we combined Groups A and B from the Yautepec region with Group D from western Morelos. To represent the southern Toluca Valley, we used a relatively small dataset previously analyzed for Yoko Sugiura (Stoner and Glascock 2012) from the sites of San Mateo Atenco and Santa Cruz Atizapan. Finally, we incorporated pottery from Tlacotepec, located directly south of Calixtlahuaca, that was previously determined to be local (Glascock 1992). We conducted a new principal component analysis for this macroregional perspective (Figures 16 and 17).

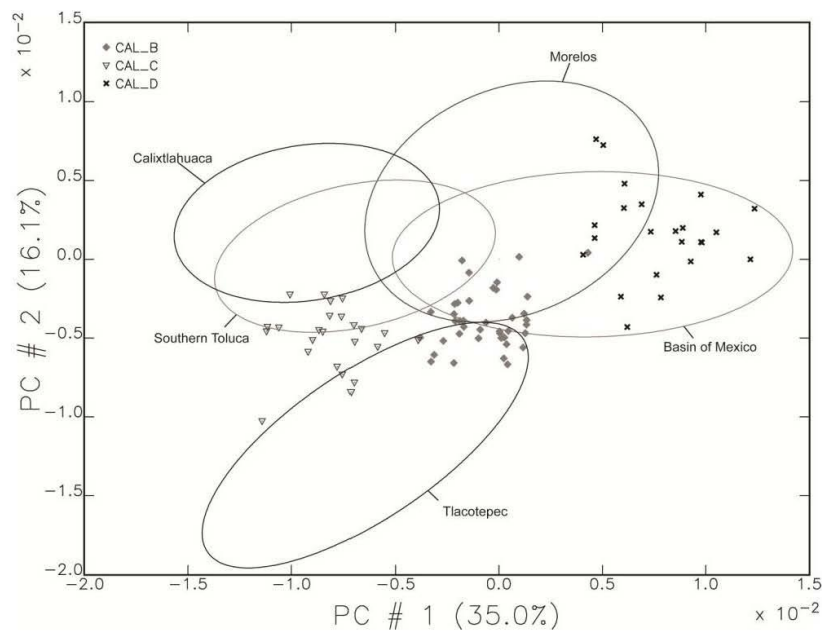


Figure 16. Initial groups composed from the Calixtlahuaca sample projected against regional reference data on Principal Components 1 and 2. The regional reference groups are represented by 90 percent confidence ellipses with the data points removed for clarity.

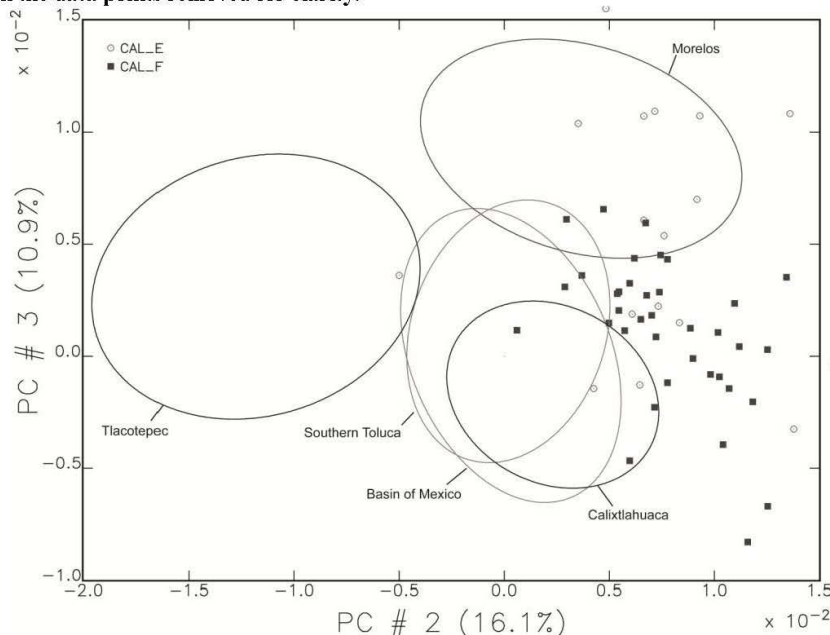


Figure 17. Initial groups composed from the Calixtlahuaca sample projected against regional reference data on Principal Components 1 and 3. The regional reference groups are represented by 90 percent confidence ellipses with the data points removed for clarity. Principal component 3 highlights the separation of the Morelos reference group.

The clearest pattern to emerge from the macroregional perspective is the import of Aztec wares from the Basin of Mexico. The entire CAL-D group that we created above is a comfortable chemical fit with the Basin of Mexico macro group. We conduct a finer grained analysis of the imported samples below. The CAL-B group is similar to the Basin of Mexico, but generally falls outside an acceptable probability for group membership, with a few possible exceptions. The CAL-C group is chemically intermediate between the Southern Toluca group and the Tlacotepec group. Neither the CAL-B nor CAL-C groups have a clear chemical match among the comparison groups employed here. However, CAL-B does hold some promise to have been imported because it does not precisely match any other reference group in the Toluca Valley and most of the ceramics in the group are Aztec Orange ware.

Many of the High Cr ceramics in CAL-E appear most similar to the Morelos macro group. We examine the possibility of the import of this group below. The High Mn group, CAL-F, does not have a good chemical match among the macroregional database. This reinforces the abnormal status of CAL-F discussed above.

Evaluation of Basin of Mexico Imports

When we zoom into the scale of the Basin of Mexico, we discover that almost all of the Aztec imports identified in CAL-D above chemically match the Tenochtitlan reference group (Figure 18-20). One specimen may pertain to the Xaltocan 1a or Cuauhtitlan reference group. The sample clearly shows that interaction between Calixtlahuaca and the Basin of Mexico took place almost exclusively through Tenochtitlan. This stands in contrast to the situation in Morelos, where Tenochtitlan and Texcoco wares were more equally represented (Smith et al. n.d).

Comparing the CAL-B group to Basin of Mexico reference groups does not solidly resolve its provenance. On most discriminant and elemental axes, CAL-B resembles the general chemistry of the Basin of Mexico, but not any specific reference group. Otumba in the Teotihuacan Valley provides the closest match. Certain elements, however, pull CAL-B outside the Basin of Mexico chemistry. CAL-B tends to be slightly, but consistently, higher in some REEs and Sc, but consistently lower in Ba, Ta, Co, and Hf than the closest reference group (Otumba) (see Figures 19 and 20). We do not believe that there is enough chemical evidence to rule out CAL-B as an import. However, exports from the Teotihuacan Valley would not be expected in the Toluca Valley. Otumba had no political influence in the region. Even if it did, CAL-B does not precisely match the Otumba reference group. If these are locally-made ceramics, the potters did a tremendous job copying the original paste recipe. Alternatively, they may be imported from the Basin but subjected to post-depositional diagenesis.

The sample of Guinda ware presents similar uncertainty. The Guinda ware sample generally presents levels of Ba common to the CAL-A reference group, but they are much higher in REE concentrations. Like CAL-B, the Guinda ware displays an intermediate chemistry among Otumba, Xaltocan 1a, and Tenochtitlan compositional groups. Otumba is the best source reference for most of these, but none has a high percentage probability of group membership. Some samples from the Teotihuacan Valley display high Ba, similar to the majority of the

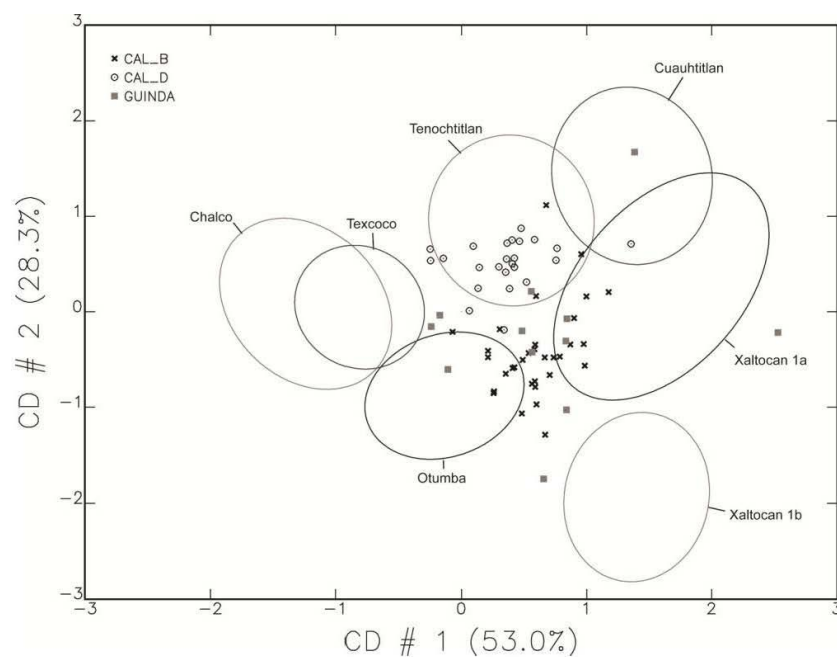


Figure 18. Scatterplot of datapoints for CAL-B, CAL-D, and Guinda were projected over Discriminant Functions 1 and 2 for the Basin of Mexico. Ellipses represent 90 percent confidence intervals of group membership.

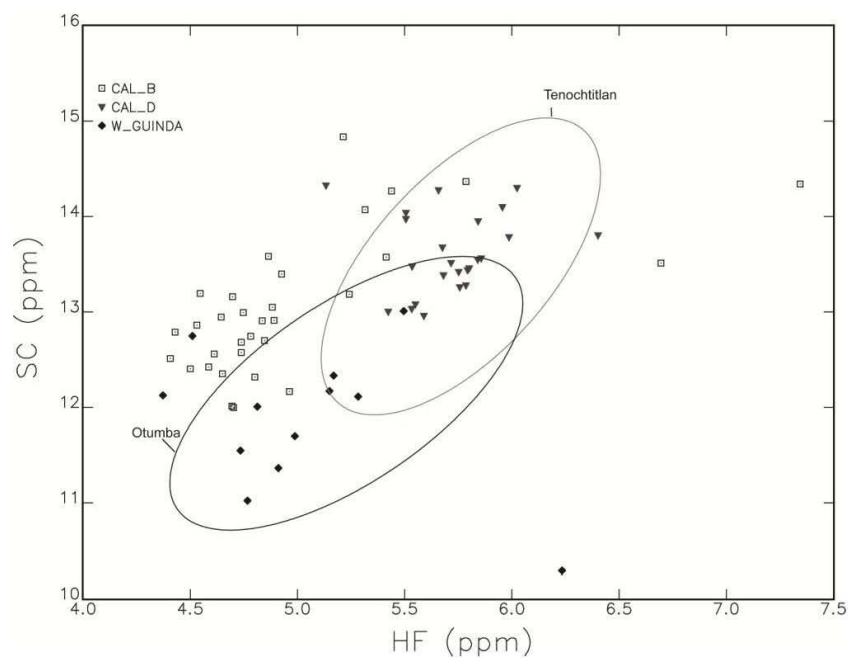


Figure 19. Scatterplot of datapoints for CAL-B, CAL-D, and Guinda were projected over linear axes of HF and SC for the Basin of Mexico. Ellipses represent 90 percent confidence intervals of group membership.

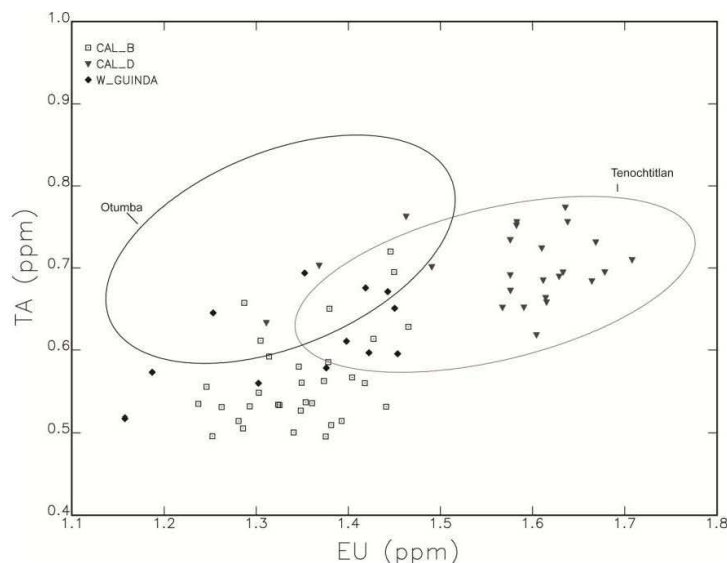


Figure 20. Scatterplot of datapoints for CAL-B, CAL-D, and Guinda ware projected over linear axes of Eu and Ta for the Basin of Mexico. Ellipses represent 90 percent confidence intervals of group membership.

Guinda wares. Two specimens (MES103 and MES106) are probable imports matching the Tenochtitlan reference group.

Evaluation of Morelos Imports

Imports from the Morelos region are potentially found among the High-Cr CAL-E group. The same north-to-south pattern of increasing mafic rock composition seen in the Basin continues further south into Morelos. Clays and potential tempering materials available in Morelos are therefore much higher in transition metals, particularly Cr and Co. Morelos is therefore the best known chemical match for the CAL-E group identified at Calixtlahuaca. These 18 specimens do not form a homogeneous chemical cluster, so they were likely made at different places using rather different paste recipes. As a whole, this group of ceramics is too high in most transition metals to come from the Basin of Mexico or the Toluca Valley, unless they are extremely heavily tempered with mafic volcanic rocks. Morelos is the *best* chemical match for this set of ceramics, but this does not necessarily mean that they were produced there. Projecting them on principal component axes calculated from the local Morelos ceramic data shows that most of the High Cr group fits the chemistry of eastern Morelos ceramics rather than the more proximate western Morelos (Figure 21). However, the majority of specimens in the CAL-E group were typed as Matlazinga wares, which were doubtfully produced in Morelos (?). If not for the type descriptions of pottery submitted by Huster and Smith, we would source these ceramics to Morelos.

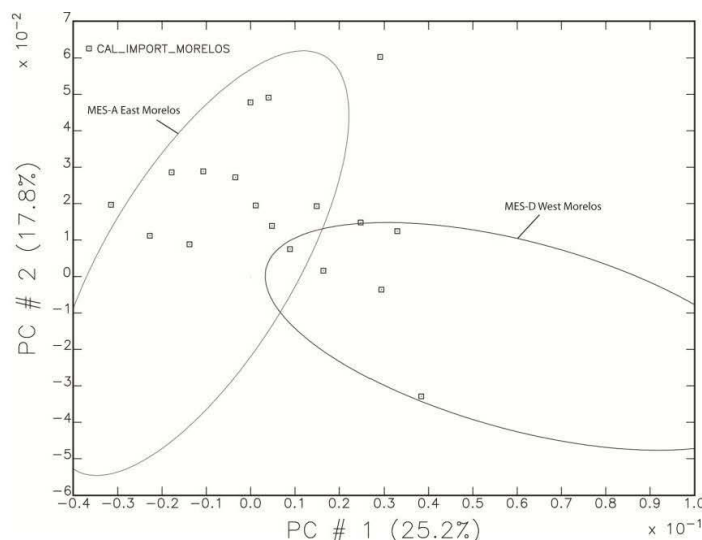


Figure 21. Scatterplot of CAL-E ceramics over Principal Components 1 and 2 calculated from local Morelos chemical groups. Ellipses represent 90 percent confidence of group membership.

Evaluation of Trade within the Toluca Valley

Due to the chemical similarity among the known Toluca Valley reference groups (excluding Tlacotepec), we are limited to discuss exchange among its different subregions. However, CAL-B, CAL-C and CAL-F deserve more attention since they do not match the dominant paste recipe at Calixtlahuaca and they have no known chemical match among the better-known central Mexican data sets. CAL-B and CAL-C differ subtly based on the levels of REE. Within the Toluca Valley, they are both most similar to a small sample of Coyotlatelco ceramics from the southern Valley (Figure 22). Both of these chemical groups differ from the southern Toluca Valley group and from CAL-A at Calixtlahuaca based primarily on lower concentrations of Ba. If we remove Ba from the principal component analysis (and also the correlated element Sr), not only do both CAL-B and CAL-C merge into CAL-A, but all three become chemically indistinguishable from the southern Toluca Valley group (Figure 23). This may be evidence that CAL-B and CAL-C were locally produced. Tlacotepec specimens were analyzed at MURR but prepared at the Field Museum. It is possible that difference in sample preparation affected its chemistry relative to other MURR-prepared specimens.

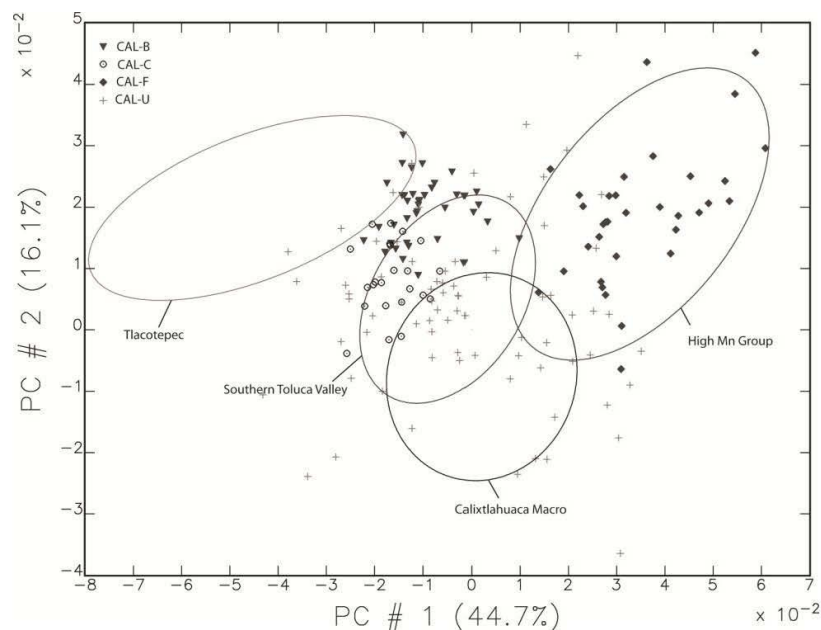


Figure 22. Scatterplot of data points for groups CAL-B, CAL-C, CAL-F, and CAL-U (unassigned) over Principal Components 1 and 2 calculated from the Toluca Valley macroregion. Ellipses represent 90 percent confidence of group membership.

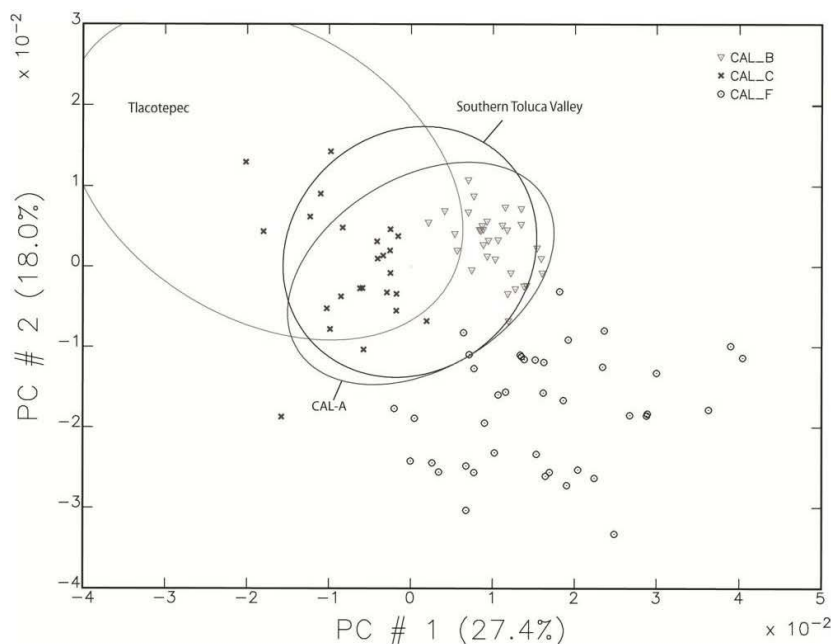


Figure 23. Scatterplot of data points for groups CAL-B, CAL-C, CAL-F, and CAL-U (unassigned) over Principal Components 1 and 2 calculated from the Toluca Valley macroregion with the elements Ba and Sr removed. Ellipses represent 90 percent confidence of group membership.

CONCLUSIONS

The discussions above lead us to a number of significant conclusions. The goals of Smith's sample are clear and simple: to identify ceramic imports, and potential imitations, from the Basin of Mexico. Ceramic imports provide an index of economic interaction and potentially represent the political connections (through elite gifting) and wealth (as imports may be more 'expensive') of households at Calixtlahuaca. If imports were purchased in a local marketplace, they would not serve as an index of political connectivity, but they may represent relative wealth.

Huster's sample in part addresses whether or not a marketplace operated locally and what types of goods circulated there. More generally, Huster seeks to evaluate the effects of integration into the Aztec Empire among different commoner households at the site.

Imports

First, the clearest group of imports to Calixtlahuaca is CAL-D. All but two of these imports stylistically resemble Aztec Black-on-Orange ceramics, but one plain ware ceramic and one unknown type fall into this group based on chemistry. All but four of the specimens in this group pertained to the targeted sample collected by Smith. Huster's random sample contained only four ceramics in the CAL-D group. This entire group represents import specifically from Tenochtitlan, the dominant capital in the Aztec Triple Alliance. The exclusion of imports from the other Triple Alliance partners at Calixtlahuaca speaks to the strong influence of Tenochtitlan in the Toluca Valley. Interestingly, these Teotihuacan imports are rather evenly spread over the Ninupi and Yata phases. When normalized to locally-made ceramics ($CAL-D/CAL-A \times 100$), Ninupi phase imports (pre-Aztec integration) are 7.2 percent in proportion to the local group while the Yata phase imports (post-Aztec integration) rises only to 9.0 percent. The difference may be affected by intentional sampling bias, but a significant economic relationship existed between Calixtlahuaca and Tenochtitlan prior to conquest.

Other potential imports are less clear cut. CAL-B is somewhat chemically similar to CAL-D and comprises a similar range of ceramic types. It does not, however, precisely match the chemistry of any known Aztec ceramics produced in the Basin of Mexico. Given the extensive sampling of Aztec period ceramics in the Basin of Mexico, we suggest that CAL-B ceramics were produced elsewhere. If CAL-B ceramics were produced within the Toluca Valley, they were executed using a paste recipe that not only visually resembles those from the imperial capital, but bears chemical similarity as well. The "local" provenance for this group may be supported by the fact that 27 percent of the group is made up of plain wares. It seems as though that not only were Aztec designs copied, the imitating potters also did their best to match the paste texture and raw materials used. Could this have involved apprenticeship? Migration of craft specialists to Calixtlahuaca? Or, did local potters simply visually identify the materials used in the paste? We must not completely rule out the possibility that post-depositional context caused some minor chemical variation. Interestingly, the normalized percentage of CAL-B ceramics pre-Aztec conquest is 6 percent while the post-conquest percentage rises to 16 percent.

Table 4. Distribution of ceramics of different chemistries among the households at Calixtlahuaca.

Period	Context	A	B	C	D	E	F	G	H	U	Guinda Import	D/A* 100	(B+D+E+ Guinda)/ A * 100	Total
Dongu	307	20			1					10		5.0	5.0	31
	315	35				1		3	14	4	2	0.0	8.5	59
	316	24							2	3		0.0	0.0	29
	320	24		1		1				6		0.0	4.1	32
	323	13	1	5		4		3		12		0.0	38.4	38
	324	4	2	6		2				17		0.0	100.0	31
	310	6		1						1		0.0	0.0	8
	326	1				1						0.0	100.0	2
Ninupi	303	19	1	1	1	1	35			4		5.2	15.7	62
	307	34	3	1	4	2	2	1	2	10	1	11.7	29.4	60
	308	19	2		1				2	6		5.2	15.7	30
	311	41	1	1	1		1		2	7		2.4	4.8	54
	316	30	1		2	1				8	1	6.6	16.6	43
	322	22	1		2	3				4	1	9.0	31.8	33
	304		1		1						1	0.0	0.0	3
	313									1		0.0	0.0	1
	307	21	5	2	4	1		1	1	11	2	19.0	57.1	48
	309	22	3		1		1		2	5	1	4.5	22.7	35
Yata	316	32	6	1	2				1	7	1	6.2	28.1	50
	317	22	4	1	3	1		1		10		13.6	36.3	42
	324	24	1	4	1					5		4.1	8.3	35
	Late Postclassic	311	7	1						1		0.0	14.2	9
	Middle-Late Postclassic	Surface	1					1				0.0	0.0	2
Total	317									2			0.0	2
		421	33	24	24	18	39	10	26	134	10	5.7	20.1	739

ceramics in the CAL-B chemical group. CAL-B consists mainly of Aztec-style ceramics, which may or may not be imports (see above).

After Aztec conquest during the Yata phase, differential access to foreign wares continues at Unit 307. This household has the highest number of imports (CAL-D), Aztec imitations/imports (CAL-B), and potential Guinda imports. Unit 317 also appears to have developed different access to these resources. Again, every household in Huster's random sample contains at least one import.

Over the entire time sequence, there appears to have operated a mechanism of exchange that provided relatively equal access to rare or imported goods. According to Hirth's (1998) distributional approach, this is what we would expect if these goods were exchanged through a marketplace. The difference in quantity or proportion of imported ceramics among households could be explained by differential purchasing power. It is clear that the patterns observed here cannot be explained by elite gifting relationships.

The shift from pre- to post-conquest does not appear to have dramatically affected patterns of household consumption at Calixtlahuaca. Prior to conquest, there already existed a desire for each household to associate with the rising powers in the Basin of Mexico. This pattern strengthened subtly after conquest.

ACKNOWLEDGMENTS

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APPENDIX D

PETROGRAPHIC SAMPLE LIST AND FABRIC DESCRIPTION REPORT

This appendix includes a catalog of ceramic samples submitted to Dr. Jennifer Meanwell for thin section petrography and her report describing the paste groups that she identified based on those samples. The petrographic batch codes refer to the year of sampling, as well as the reason for sample selection.

Table E.1 Catalog of ceramic samples submitted for thin section petrography, with resulting petrographic fabric group assignments.

Batch	Code	Provenience				Type	Macro-	Paste	INAA Group	Petro Fabric
		Unit	Locus	Lot	Phase					
2009-3	TSN 1	307	20	4	6	167	C			I-C
2009-3	TSN 2	307	20	4	6	167	C			X
2009-3	TSN 3	307	20	6	6	167	C			I-A
2009-3	TSN 4	307	20	5	6	31	A			III
2009-3	TSN 5	307	20	4	6	167	E			I-C
2009-3	TSN 6	307	20	3	6	253	E			I-A
2009-3	TSN 7	307	20	6	6	266	E			II
2009-3	TSN 8	307	20	6	6	31	E			I-A
2009-3	TSN 9	307	20	4	6	208	G			XIII
2009-3	TSN 10	307	20	3	6	208	G			XIII
2009-3	TSN 11	307	20	3	6	132	C			I-C
2009-3	TSN 12	307	20	3	6	11	C			I-A
2009-3	TSN 13	307	20	5	6	226	E			III
2009-3	TSN 14	307	20	3	6	200	E			III-var?
2009-3	TSN 15	307	20	6	6	202	E			II
2009-3	TSN 16	307	20	3	6	264	E			I-C
2009-3	TSN 17	307	20	6	6	267	A			III
2009-3	TSN 18	307	20	5	6	262	D			XIV
2009-3	TSN 19	307	20	3	6	68	A			XV
2009-3	TSN 20	307	20	3	6	45	E			I-A
2009-3	TSN 21	307	20	6	6	267	E'			I-A
2009-3	TSN 22	307	20	5	6	71	E			XIV
2009-2	TSN 23	307	20	7	4	167	C			III
2009-2	TSN 24	307	8	7	4	31	D			I-A
2009-2	TSN 25	307	20	7	4	31	D			I-C
2009-2	TSN 26	307	20	7	4	31	D			I-C
2009-2	TSN 27	307	20	7	4	167	C			III
2009-2	TSN 28	307	8	7	4	31	E			I-A
2009-2	TSN 29	307	8	7	4	31	E'			I-A
2009-2	TSN 30	307	8	7	4	31	E			I-A
2009-2	TSN 31	307	20	7	4	209	J			X
2009-2	TSN 32	307	8	6	4	11	C			X
2009-2	TSN 33	307	8	6	4	11	B			XIV
2009-2	TSN 34	307	20	7	4	11	D			XV
2009-2	TSN 35	307	8	7	4	133	E'			III
2009-2	TSN 36	307	8	7	4	202	E'			I-C
2009-2	TSN 37	307	20	7	4	222	E			I-C
2009-2	TSN 38	307	20	7	4	200	E			I-C
2009-2	TSN 39	307	20	7	4	169	C			II

Batch	Code	Provenience				Type	Macro-	Paste	Group	Petro Fabric
		Unit	Locus	Lot	Phase					
2009-2	TSN 40	307	20	7	4	101		D		III
2009-2	TSN 41	307	8	6	4	60		J		X
2009-2	TSN 42	307	20	7	4	267		E'		I-C
2009-2	TSN 43	307	8	6	4	267		E		I-A
2009-2	TSN 44	307	20	7	4	170		E'		I-A
2009-1	TSN 45	307	5	3	2	31		C		II
2009-1	TSN 46	307	5	2	2	31		D		III
2009-1	TSN 47	307	12	4	2	31		D		I-A
2009-1	TSN 48	307	12	4	2	31		D		I-A
2009-1	TSN 49	307	5	2	2	31		E'		III
2009-1	TSN 50	307	2	4	2	31		E'		III
2009-1	TSN 51	307	12	3	2	31		E'		I-C
2009-1	TSN 52	307	12	3	2	31		E		I-C
2009-1	TSN 53	307	2	4	2	11		D		III
2009-1	TSN 54	307	12	4	2	11		C		I-A
2009-1	TSN 55	307	5	2	2	11		J		I-B
2009-1	TSN 56	307	2	3	2	11		D		III
2009-1	TSN 57	307	2	3	2	277		E'		I-C
2009-1	TSN 58	307	2	3	2	11		F		I-B
2009-1	TSN 59	307	2	4	2	213		E'		I-C
2009-1	TSN 60	307	12	4	2	11		E		I-B
2009-1	TSN 61	307	12	3	2	134		D		I-C
2009-1	TSN 62	307	12	4	2	134		D		I-C
2009-1	TSN 63	307	12	4	2	134		D		II
2009-1	TSN 64	307	12	4	2	267		E'		I-A
2009-1	TSN 65	307	12	4	2	267		F		III
2009-1	TSN 66	307	12	4	2	169		E		I-B
2009-10	TSN 67	300	403	1		11		A		III
2009-10	TSN 68	300	403	1		225		A		III
2009-10	TSN 69	300	11	1		30		A		X
2009-10	TSN 70	300	396	1		30		A		III
2009-10	TSN 71	300	403	1		11		A		III
2009-10	TSN 72	300	454	1		10		A		X
2009-10	TSN 73	300	153	1		11		B		XIV
2009-10	TSN 74	300	0	0		31		B		X
2009-10	TSN 75	300	357	1		11		B		II
2009-10	TSN 76	300	403	1		225		B		XIII
2009-10	TSN 77	300	5	1		10		B		II
2009-10	TSN 78	300	357	1		11		B		XIV

Batch	Code	Provenience			Phase	Type	Macro- Paste	INAA Group	Petro Fabric
		Unit	Locus	Lot					
2009-10	TSN 79	300	569	1		167	C		I-C
2009-10	TSN 80	300	781	1		11	C		II
2009-10	TSN 81	300	376	1		167	C		II-var
2009-10	TSN 82	300	569	1		10	C		XV
2009-10	TSN 83	300	365	1		264	C		XIV
2009-10	TSN 84	300	60	1		11	C		II
2009-10	TSN 85	300	60	1		31	D		I-C
2009-10	TSN 86	300	0	0		30	D		III
2009-10	TSN 87	300	0	0		134	D		I-var
2009-10	TSN 88	300	0	0		11	D		I-var
2009-10	TSN 89	300	0	0		10	D		III
2009-10	TSN 90	300	60	1		169	D		I-D
2009-10	TSN 91	300	153	1		134	E		IX
2009-10	TSN 92	300	53	1		30	E		I-B
2009-10	TSN 93	300	4	1		10	E		III
2009-10	TSN 94	300	353	1		30	E		I-C
2009-10	TSN 95	300	153	1		31	E		I-A
2009-10	TSN 96	300	353	1		31	E		I-C
2009-10	TSN 97	300	153	1		256	E'		I-C
2009-10	TSN 98	300	371	1		31	E'		I-A
2009-10	TSN 99	300	158	1		31	E'		III
2009-10	TSN 100	300	371	1		31	E'		I-D
2009-10	TSN 101	300	354	1		264	E'		II
2009-10	TSN 102	300	232	1		11	E'		I-B
2009-10	TSN 103	300	153	1		31	F		I-C
2009-10	TSN 104	300	466	1		213	F		II
2009-10	TSN 105	300	53	1		30	F		III
2009-10	TSN 106	300	357	1		31	F		III
2009-10	TSN 107	300	153	1		225	F		I-B
2009-10	TSN 108	300	365	1		31	F		I-B
2009-10	TSN 109	300	407	1		208	G		XIV
2009-10	TSN 110	300	796	1		31	J		I-A
2009-10	TSN 111	300	796	1		30	J		I-C
2009-10	TSN 112	300	232	1		167	J		XV
2009-10	TSN 113	300	810	1		167	J		I-D
2009-10	TSN 114	300	153	1		167	J		I-A
2009-10	TSN 115	300	354	1		31	J		IX
2009-5	TSN 116	307	20	4	6	114	aztec		XI
2009-5	TSN 117	307	20	5	6	215	high bio		XV

Batch	Code	Provenience				Type	Macro-	Paste	INAA Group	Petro Fabric
		Unit	Locus	Lot	Phase					
2009-5	TSN 118	307	20	3	6	181		B		XIV
2009-5	TSN 119	307	20	3	6	21		aztec		XI
2009-5	TSN 120	307	20	6	6	182		B		XI
2009-4	TSN 121	307	8	6	4	180		D		I-C
2009-4	TSN 122	307	20	7	4	180		F		I-A
2009-4	TSN 123	307	8	7	4	207		E	CAL_G	VIII
2009-4	TSN 124	307	8	7	4	137		D	CAL_E	VII
2009-4	TSN 125	307	20	7	4	134		E'		I-A
2009-6	TSN 126	316	15	4	2	31		E'		I-A
2009-6	TSN 127	316	7	7	2	256		E'		I-B
2009-6	TSN 128	316	7	7	2	31		E		I-C
2009-6	TSN 129	316	15	4	2	31		E'		I-B
2009-6	TSN 130	316	15	4	2	30		A		X
2009-6	TSN 131	316	15	4	2	31		D		I-A
2009-6	TSN 132	316	6	5	2	30		D		III
2009-6	TSN 133	316	6	5	2	38		B		X
2009-6	TSN 134	316	15	4	2	11		F		I-C
2009-6	TSN 135	316	7	7	2	225		F		I-B
2009-6	TSN 136	316	15	4	2	277		E		I-D
2009-6	TSN 137	316	7	7	2	225		F		I-B
2009-6	TSN 138	316	7	7	2	132		A		I-B
2009-6	TSN 139	316	5	6	2	11		A		III
2009-6	TSN 140	316	6	5	2	11		C		II
2009-6	TSN 141	316	15	4	2	11		A		II
2009-6	TSN 142	316	5	6	2	267		E'		I-A
2009-6	TSN 143	316	5	4	2	267		F		I-B
2009-6	TSN 144	316	7	7	2	170		F		III
2009-6	TSN 145	316	7	7	2	180		D		I-C
2009-6	TSN 146	316	15	4	2	134		D		III
2009-6	TSN 147	316	7	7	2	68	A?salt vessel			XV
2009-7	TSN 148	316	6	3	4	31		E		I-D
2009-7	TSN 149	316	6	4	4	31		E'		I-B
2009-7	TSN 150	316	15	3	4	167		E		I-D
2009-7	TSN 151	316	6	3	4	31		F		I-B
2009-7	TSN 152	316	16	4	4	256		A		III
2009-7	TSN 153	316	22	2	4	30		C		XIV
2009-7	TSN 154	316	16	5	4	31		A		XIV
2009-7	TSN 155	316	6	3	4	31		D		III
2009-7	TSN 156	316	22	2	4	11		F		I-B

Batch	Code	Provenience			Phase	Type	Macro- Paste	INAA Group	Petro Fabric
		Unit	Locus	Lot					
2009-7	TSN 157	316	6	3	4	11	F		I-B
2009-7	TSN 158	316	16	3	4	222	E'		I-A
2009-7	TSN 159	316	6	4	4	203	F		III
2009-7	TSN 160	316	16	4	4	11	B		XIV
2009-7	TSN 161	316	22	2	4	11	D		I-B
2009-7	TSN 162	316	16	2	4	10	aztec		XIII
2009-7	TSN 163	316	16	5	4	10	D		III
2009-7	TSN 164	316	15	3	4	267	E'		I-A
2009-7	TSN 165	316	15	3	4	262	E'		I-B
2009-7	TSN 166	316	22	2	4	267	E		II
2009-7	TSN 167	316	6	3	4	134	J		I-B
2009-7	TSN 168	316	16	5	4	134	D		III
2009-7	TSN 169	316	16	4	4	68	A?salt vessel		XV
2009-8	TSN 170	316	5	1	6	167	E		I-C
2009-8	TSN 171	316	5	1	6	31	F		II
2009-8	TSN 172	316	5	1	6	31	E'		I-C
2009-8	TSN 173	316	15	2	6	167	E		I-C
2009-8	TSN 174	316	5	1	6	167	C		I-A
2009-8	TSN 175	316	5	1	6	256	D		I-B
2009-8	TSN 176	316	15	2	6	31	A		X
2009-8	TSN 177	316	6	2	6	167	A		I-A
2009-8	TSN 178	316	6	2	6	11	F		I-B
2009-8	TSN 179	316	15	2	6	264	F		III
2009-8	TSN 180	316	5	1	6	10	E'		I-B
2009-8	TSN 181	316	15	2	6	269	E'		III
2009-8	TSN 182	316	5	1	6	192	G		XIII
2009-8	TSN 183	316	6	2	6	114	Aztec		XI
2009-8	TSN 184	316	5	1	6	182	B		XIII
2009-8	TSN 185	316	5	2	6	182	B		XII-var
2009-8	TSN 186	316	6	2	6	267	E'		I-C
2009-8	TSN 187	316	5	1	6	134	E'		I-B
2009-8	TSN 188	316	15	1	6	267	E		I-B
2009-8	TSN 189	316	15	2	6	180	D		I-B
2009-8	TSN 190	316	6	2	6	46	Aztec		XIV
2009-8	TSN 191	316	15	2	6	46	A		XV
2013	ACH 181	309	7	2	6	271	C	CAL_A	II
2013	ACH 193	309	18	3	6	132	E	CAL_A	I-A
2013	ACH 204	309	25	3	6	30	E-prime	CAL_A	I-B
2013	ACH 214	311	1	6	4	11	E-prime	CAL_A	I-A

Batch	Code	Provenience			Phase	Type	Macro- Paste	INAA	Petro
		Unit	Locus	Lot				Group	Fabric
2013	ACH 224	311	11	6	4	213	E-prime	CAL_A	I-D
2013	ACH 234	311	21	3	4	30	Other	CAL_A	XV
2013	ACH 481	323	2	9	2	11	E	CAL_A	I-B
2013	ACH 499	323	13	2	2	31	E-prime	CAL_A	I-A
2013	ACH 507	323	2	12	2	31	J	CAL_A	X
2013	MES 128	307	14	1	6	46	C	CAL_A	III
2013	MES 131	316	8	5	4	46	Coarse Orange	CAL_A	III
2013	MES 133	307	20	4	6	271	C	CAL_A	II
2013	ACH 267	311	5	6	4	46	Coarse Orange	CAL_B	XII
2013	ACH 392	317	12	8	6	11	Aztec	CAL_B	XII
2013	MES 127	304	1	7	4	46	Coarse Orange	CAL_B	XII
2013	MES 141	309	18	2	6	271	C	CAL_B	XII-var
2013	MES 144	316	6	1	6	274	C	CAL_B	XII
2013	MES 147	317	14	7	6	274	C	CAL_B	XII
2013	MES 248	316	7	2	6	114	Aztec	CAL_B	XI
2013	ACH 387	316	15	1	6	45	E-prime	CAL_C	I-A
2013	ACH 413	317	28	6	6	167	Other	CAL_C	I-A
2013	ACH 510	323	13	2	2	31	C	CAL_C	I-A
2013	ACH 533	324	16	4	2	31	E	CAL_C	I-C
2013	MES 204	324	4	4	6	225	E	CAL_C	I-C
2013	ACH 45	303	1	7	4	11	Aztec	CAL_D	XV
2013	MES 239	307	20	2	6	21	Aztec	CAL_D	XI
2013	MES 250	316	6	1	6	114	Aztec	CAL_D	XI
2013	MES 253	307	20	8	4	181	B	CAL_D	XI-var
2013	MES 255	317	14	6	6	181	B	CAL_D	XV
2013	ACH 37	303	1	8	4	166	C	CAL_E	VII
2013	MES 113	323	11	3	2	207	E	CAL_E	VII
2013	MES 157	323	10	8	2	188		CAL_E	VI
2013	MES 168	323	10	5	2	213	E	CAL_E	VII
2013	MES 228	326	3		2	256	E	CAL_E	III
2013	ACH 4	303	6	9	4	11	E-prime	CAL_F	I-A
2013	ACH 8	303	6	9	4	185	C	CAL_F	I-B
2013	ACH 24	303	6	9	4	31	F	CAL_F	III
2013	ACH 28	303	6	9	4	134	E	CAL_F	III
2013	MES 137	307	17	3	4	271	C	CAL_F	II
2013	ACH 494	323	13	3	2	11	E	CAL_G	I-C
2013	ACH 505	323	13	3	2	31	A	CAL_G	IX
2013	MES 109	300-SURVEY			n/a	207	E	CAL_G	XV
2013	MES 114	307	8	7	4	207		CAL_G	VIII

Batch	Code	Provenience				Phase	Type	Macro- Paste	INAA	Petro
		Unit	Locus	Lot					Group	Fabric
2013	MES 119	315	17	1	2		137	E	CAL_G	IX
2013	MES 103	315	7	1	2		192	G	CAL_Gui	XIII
2013	ACH 271	315	12	10	2		222	E-prime	CAL_H	III
2013	ACH 272	315	12	10	2		170	E-prime	CAL_H	I-C
2013	ACH 273	315	13	9	2		11	C	CAL_H	I-A
2013	ACH 289	315	21	10	2		31	E-prime	CAL_H	III
2013	MES 162	315	24	2	2		213	E	CAL_H	I-C
2013	MES 129	307	20	3	6		46	Coarse Orange	CAL_U	III
2013	MES 130	317	10	3	9		46	Coarse Orange	CAL_U	III
2014	ACH 277	315	13	13	2		132	E-prime	CAL_A	I-D
2014	ACH 287	315	13	13	2		31	E	CAL_A	I-A
2014	ACH 300	315	22	10	2		134	E	CAL_A	XV
2014	MES 136	307	17	3	4		271	C	CAL_B	XI
2014	ACH 119	307	20	8	4		46	Coarse Or	CAL_B	XV
2014	MES 265	309	17	3	6		182	B	CAL_B	XII
2014	ACH 529	324	16	3	2		31	E-prime	CAL_C	I-A
2014	ACH 523	324	16	4	2		230	E	CAL_C	III
2014	ACH 524	324	16	4	2		173	E-prime	CAL_C	III
2014	MES 235	304	1	2	4		21	Aztec	CAL_D	XI
2014	MES 240	316	13	8	4		21	Aztec	CAL_D	XII
2014	MES 266	317	14	7	6		182	B	CAL_D	XII
2014	MES 120	307	8	7	4		137		CAL_E	VII
2014	MES 165	316	4	9	4		213	E	CAL_E	X
2014	ACH 491	323	13	2	2		214	E	CAL_E	VII
2014	MES 111	315	18	1	2		207	High Biotite	CAL_G	VIII
2014	MES 118	315	12	2	2		137	High Biotite	CAL_G	I-A
2014	ACH 398	317	34	4	6		202	E-prime	CAL_G	X
2014	ACH 280	315	14	8	2		225	E-prime	CAL_H	I-D
2014	ACH 299	315	17	7	2		101	E-prime	CAL_H	I-B
2014	ACH 295	315	28	1	2		31	F	CAL_H	I-D
2014	ACH 65	307	2	3	2		277	E-prime	CAL_U	
2014	ACH 87	307	5	2	2		42	E-prime	CAL_U	
2014	ACH 66	307	5	2	2		202	High Biotite	CAL_U	
2014	ACH 103	307	20	8	4		222	E-prime	CAL_U	III
2014	ACH 113	307	20	8	4		256	E-prime	CAL_U	I-D
2014	ACH 117	307	20	8	4		267	E	CAL_U	I-A
2014	ACH 222	311	5	7	4		11	E-prime	CAL_U	I-D
2014	ACH 240	311	21	3	4		46	E-prime	CAL_U	I-A var
2014	ACH 243	311	2	8	4		221	E	CAL_U	IX

Batch	Code	Provenience				Phase	Type	Macro- Paste	INAA	Petro
		Unit	Locus	Lot					Group	Fabric
2014	ACH 416	317	7	3	6	100	G		CAL_U	I-A
2014	ACH 401	317	35	4	6	21	Aztec		CAL_U	XI
2014	ACH 415	317	28	6	6	167	E		CAL_U	I-A
2014	ACH 492	323	13	2	2	225	E-prime		CAL_U	I-A
2014	ACH 493	323	13	2	2	230	E-prime		CAL_U	III
2014	ACH 500	323	13	2	2	31	F		CAL_U	III-var?

Calixtlahuaca Master List of Petrographic Fabric Designations

Jennifer Meanwell

The petrographic fabrics identified at Calixtlahuaca include a set of fabrics that appear to be made from locally available materials (within 5-10 km of the site, most likely). These fabrics all contain similar inclusions that are consistent with the local geology around Calixtlahuaca, and are divided based on the optical activity of the matrix, the size and sorting of the inclusions, and slight variations in the relative frequency of different inclusions. The samples that were analyzed via chemical analysis as well as petrographic analysis also place the “local” fabrics into the local chemical groups. A number of presumably non-local fabrics have also been identified, and outlier sherds were placed into a presumed region of origin where possible. A summary table of the fabrics (with subgroups) and their designations appears first, followed by a more detailed description of each fabric. The fabrics have been organized into three different regions: local, elsewhere in the Toluca Valley, and Basin of Mexico. All fabrics are now given a Roman numeral designation (skipping IV and V to avoid confusion with an earlier iteration of fabric designations), although former designations are noted in the table as well.

Fabric Code	Former Code	Region	Distinctive Characteristics
I-A		Local	Typical mineralogy suite, darker colored amphibole, low to moderate optical activity in the clay matrix
I-B		Local	Typical mineralogy suite, lighter colored amphibole, moderate optical activity in the clay matrix
I-C		Local	Typical mineralogy suite, lighter colored amphibole, very high optical activity in the clay matrix (likely low fired)
I-D		Local	Typical mineralogy suite, darker colored amphibole, moderate to high optical activity in the clay matrix
II		Local	Typical mineralogy suite, inclusions usually smaller and

			better sorted than Fabric I, clay matrix has low optical activity and a light beige color
III		Local	Typical mineralogy suite, moderate to high optical activity in the clay matrix, which fires to red and brown shades, some examples have iron minerals present in volcanic rock fragments and may have grog temper
VI	OTHER	Local	Outlier fabrics that look local in origin
VII	COYO	Toluca Valley	Typical mineral suite, low volume fraction of inclusions, grog or clay lumps present, incomplete clay mixing or processing likely, bimodal size distribution in minerals (likely tempered)
VIII	GR	Toluca Valley	Similar texture to Fabric VII above, but higher volume fraction of grog/clay lumps relative to mineral inclusions, mineralogy seems more felsic than most of the Calixtlahuaca sherds, with higher quartz and biotite, bimodal size distribution in the minerals (likely tempered)
IX	OA	Toluca Valley	Likely variant from S/SW Toluca Valley, characterized by very high optical activity in the clay matrix, bimodal size distribution in the inclusions (likely tempered), and more felsic minerals, such as quartz and biotite
X	OTHER, V	Toluca Valley	Outlier fabrics that seem to match the other S/SW Toluca Valley fabrics in mineralogy (relatively more felsic)
XI	RA	Basin of Mexico	Extremely fine grained and well sorted, typical mineral suite, reddish clay matrix with generally low optical activity (likely high fired)
XII	B	Basin of Mexico	Very low optical activity in the core (likely high fired), typical mineral suite, varied size and texture in the inclusions, some examples exhibit bimodal size distribution
XIII	ORG, Guinda	Basin of Mexico	Typical mineral suite, large organic temper burnout voids, some still containing remnant carbon, clay matrix is generally fine and well sorted
XIV	OTHER, IV	Basin of Mexico	Outlier fabrics that seem to match the texture and processing consistent with a Basin of Mexico origin
XV	OTHER	Unknown	Outliers that cannot be associated with any region studied within this project

Detailed Fabric Descriptions:

Fabric Groups

Fabric I:

Fabric I is characterized by typically intermediate to mafic inclusions, primarily plagioclase feldspar, with lesser amounts of quartz, amphibole, minerals with a high iron content, and volcanic rock fragments. Other accessory minerals present in smaller amounts include biotite, orthopyroxene, and clinopyroxene, as well as fragments of what appears to be volcanic glass. Many of the plagioclase feldspar grains are zoned. The amphiboles are present in two forms, which is one of the characteristics used to divide this fabric into subgroups. One amphibole is consistent with hornblende, and has a deep color, strong pleochroism, and second-order interference colors. The other amphibole displays a paler green color, weaker pleochroism, and first-order interference colors, but still exhibits the typical cleavage and crystal habit of amphiboles. All of the inclusions are generally subangular and range in size from silt sized to coarse sand, with a few larger fragments seen occasionally. Very few sherds in the collection show strong evidence for deliberate tempering, and most of these are clearly imported from the Valley of Mexico or elsewhere.

Fabric I-A contains the deeper-colored amphibole and the clay matrix exhibits low to moderate optical activity. Fabric I-B contains the lighter-colored amphibole and the clay matrix has moderate optical activity. Fabric I-C contains the lighter-colored amphibole with a very optically active clay matrix. Fabric I-D is similar to Fabric I-A, except that the clay matrix is more optically active.

Fabric II

Fabric II contains the same suite of inclusions present in Fabric I, including plagioclase feldspar, quartz, amphibole, volcanic rock fragments, volcanic glass, pyroxene, and biotite, and it can be distinguished from Fabric I primarily based on texture and the clay matrix. Fabric II samples contain smaller grains and fewer voids. The clay matrix generally displays low optical activity, and it tends to be lighter in color in plane-polarized light than the clays used for Fabric I. Due to the strong similarity to Fabric I, Fabric II is likely a manufacturing variant, either using a local clay deposit that naturally contains smaller inclusions, or by deliberately processing the clay to contain smaller inclusions.

Fabric III

Fabric III again contains the same general suite of inclusions found in Fabrics I and II, with plagioclase feldspar being the most common inclusion, followed by quartz, volcanic rock fragments, amphibole, volcanic glass, pyroxene, and biotite. The major difference is that the amount of iron present in both the clay matrix and among the inclusions seems to be higher. The clays fire to a rich reddish brown color (when they are not reduced to a black or grey shade), and many of the volcanic rock fragments show iron staining. The clay is generally moderately to very optically active, and the volcanic glass fragments are more often orange, rather than the typical brownish-gray.

Several of the Fabric III examples include grog temper in small amounts. While the sherds that have grog always have more than one piece of grog in them, it is not the only non-plastic inclusion within the fabric. In general, though, the grog pieces contain the same set of inclusions as the surrounding clay matrix, so it is likely that other locally produced vessels were added to the clay mixture for Fabric III, in some cases.

Fabric VII

This small group of sherds is characterized by a fabric that has a low volume fraction of inclusions with an inhomogeneous clay matrix that is optically active. These sherds also have fragments of grog or clay lumps in them. The clay matrix preserves clay domains that are likely related to the production process. This clay does not seem to have been well mixed prior to use, and the clay preserves evidence of this incomplete mixing, with randomly oriented domains that are not oriented parallel to the vessel walls.

The inclusions present in the Fabric VII sherds are similar to those found in other Calixtlahuaca sherds, with plagioclase feldspar, amphibole, quartz, pyroxene, and iron rich inclusions predominating. The inclusions are generally well sorted and demonstrate a bimodal size distribution, suggesting that the inclusions were deliberately added as tempering material to the base clay. The grog fragments do not always match the fabric of the surrounding sherd, so it is possible that a variety of sherds were processed as grog to be added to Fabric VII sherds.

Fabric VIII

Although grog is found as an inclusion in the local Calixtlahuaca Fabric III, the sherds placed in this fabric are full of grog fragments. The Fabric VIII sherds are made from a clay fabric that has a dark core (dark brown in thin section, but appears black in hand sample) with a red surface layer. The clay is moderately optically active, but not quite as active as that seen in the Fabric VII fabrics. The clay domains are also more oriented parallel to the vessel walls, which may indicate additional clay mixing and processing during manufacture.

The inclusions are also subtly different. Although the texture and sorting is similar to the inclusions found in Fabric VII, including the bimodal size distribution that indicates tempering, the mineralogy is different. These sherds contain more quartz relative to the amount of plagioclase feldspar, although they also contain the amphibole, pyroxene, and iron rich inclusions commonly found in the Calixtlahuaca material. In addition, small fragments of biotite and muscovite are seen, as well as polycrystalline quartz. This suggests that this fabric comes from a more felsic source region.

Fabric IX

The sherds that are placed in fabric IX were not necessarily made in the same location, although they do share several production techniques. This fabric shows considerable similarities to

fabrics VII and VIII, just made with different clays or with shorter firing times. The fabric is characterized by extremely high optical activity in the clay matrix. Sherds exhibit a bimodal inclusion size distribution as well as unusual mineralogy for the Calixtlahuaca material. Although the typical inclusions are present, quartz is more prevalent than in the Calixtlahuaca material, and more felsic inclusions are seen, including biotite and possibly a small fragment of muscovite.

NOTE: With further investigation and a larger sample size, it is possible that some combination of fabric VII, VIII, and IX will happen. These seem similar, and may overlap with a larger set.

Fabric XI

This fabric appears only in sherds that were visually sorted to Aztec black-on-orange types (project types 114, 21, 271, and 182). The fabric is generally extremely fine-grained and well-sorted. The suite of inclusions is not dissimilar to the intermediate to mafic minerals found in the local Calixtlahuaca material, as would be expected given the generally similar volcanic conditions within the Basin of Mexico, however, the volume fraction of inclusions is much lower within fabric XI than is found within Fabric XII or the local Calixtlahuaca material. The most common inclusion is plagioclase feldspar, with amphibole, quartz, pyroxene, volcanic rock fragments, and biotite also present. The clay matrix is generally a reddish shade, and shows evidence of being fired at a high temperature, not dissimilar to Fabric XI. The clays used to make these sherds was highly processed, likely using levigation or some other method of extracting the largest inclusions.

Fabric XII

The most characteristic feature of Fabric XII is a consistently high temperature firing. These sherds all have a deep red, non-optically active core. The inclusions are generally consistent with the Calixtlahuaca material, with plagioclase feldspar, amphibole, and quartz being the most common, with lesser amounts of volcanic rock fragments, pyroxene, iron-rich minerals, and very occasional biotite. The amphiboles are mainly deep red in plane-polarized light, suggesting that they were exposed to high temperatures, which is consistent with the deep core with no optical activity.

The major source of variation within the Fabric XII samples is related to the size and texture distribution of the inclusions. Most are as coarse as the locally produced plain-ware ceramics. At least one example is finer (ACH-392) with a lower volume fraction of inclusions. It also displays a bimodal distribution in the size of the inclusions, suggesting that it was processed to remove the larger inclusions and then had additional sand added as temper. The chemical consistency in the fabric may be related to the high temperature firing, as the amount of clay processing that occurred during the production of each vessel varies.

Fabric XIII

Fabric XIII seems consistent with a Basin of Mexico origin, and is generally well sorted and fine to medium in texture. The clay matrix is slightly optically active, and most have a dark core, which is possibly linked to organic inclusions. The inclusion mineralogy is similar to other sherds analyzed, with quartz, feldspar, amphibole, volcanic rock fragments, and iron-rich minerals all present. There are also elongated voids present in the center of several of the sherds that are consistent with the use of organic temper. This fabric is similar in processing to the fabric XII sherds, but seems to have been made from a different clay with less iron content. TSN 76 is placed in this fabric, despite a lack of visible organic burnout voids.

APPENDIX E

LITHIC TECHNOLOGICAL CLASSIFICATION CODES

This appendix includes a list of type codes used by Dr. Bradford Andrews to classify lithics excavated at Calixtlahuaca.

Table E.1 Meanings of codes used to group lithic classification codes for analysis

Code	Meaning
<i>Technology</i>	
BC	Blade-Core
FC	Flake-Core
BIF	Bifacial
BP	Bipolar
U	Unidentified
Lap	Lapidary
<i>Production/Consumption (pro/con)</i>	
cs	core shaping
ips	initial pressure series
ps	prismatic
ps	production
t	tool
crjuv	core rejuvenation
cr	core recycling
<i>Biface</i>	
5	Percussion
6	Pressure
t	finished tool

Table E.2 Lithic type codes used at Calixtlahuaca, with grouping codes used for analysis.

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
MF	Macro flake	BC	cs	
1UCB-DS	Unilateral crested blade-distal section	BC	cs	
MB-gd	Macroblade, proximal section with ground platform	BC	cs	
MB-ms	Macroblade medial section	BC	cs	
MB-ds	Macroblade distal section	BC	cs	
MB-ds-C	Macroblade, distal section w/cortex	BC	cs	
MB-f	Macroblade fragment	BC	cs	
SPPS-sf	Small percussion, proximal section, single facet platform	BC	cs	
SPPS-gd	Small percussion, proximal section, ground platform	BC	cs	
SPPS-gd-C	Small percussion, proximal section, ground platform w/cortex	BC	cs	
SPPS-cr	Small percussion, proximal section, crushed platform	BC	cs	
SPPS-cr-C	Small percussion, proximal section, crushed plat w/cortex	BC	cs	
SPMS	Small percussion blade, medial section	BC	cs	
SPMS-h	Small percussion, medial section w/hinge	BC	cs	
SPMS-C	Small percussion, medial section w/cortex	BC	cs	
SPDS	Small percussion, distal section	BC	cs	
SPDS-C	Small percussion, distal section w/ cortex	BC	cs	
SPB-f	Small percussion blade fragment	BC	cs	
PORF-perc	Platform overhang removal flake, percussion	BC	cs	
SPNacelle	Small percussion flake, nacelle flake	BC	cs	
DS-pl-perc	Plunging blade distal section, percussion	BC	cs	
MB-scr	Macroblade scraper	BC	t	
MB-es	Macroblade end scraper	BC	t	
SPDS-em	Small percussion, distal section, end modified	BC	t	
SPPS-gd-scr	Small percussion, proximal section, scraper	BC	t	

TPB-gd	Triangular prismatic blade, ground platform	BC	cs
TPS-gd	Triangular prismatic proximal section, ground platform	BC	cs

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
1MS	1st series prismatic blade, medial section	BC	ips	
1PB-gd	1st series prismatic blade, ground platform	BC	ips	
1PB-sf	1st series prismatic blade, single facet platform	BC	ips	
1PS-gd	1st series prismatic blade, proximal section, ground platform	BC	ips	
2MS	2nd series prismatic blade, medial section	BC	ips	
PB-c	Prismatic blade complete	BC	ps	
PS-cor	Prismatic blade, proximal section, cortical platform	BC	ps	
PS-sf	Prismatic blade, proximal section, single facet platform	BC	ps	
PS-gd	Prismatic blade, proximal section, ground platform	BC	ps	
PS-gd-C	Prismatic blade, proximal section, ground plat w/cortex	BC	ps	
PS-cr	Prismatic blade, proximal section, crushed platform	BC	ps	
PS-mf	Prismatic blade, proximal section, multi facet platform	BC	ps	
MS	Prismatic blade medial section	BC	ps	
MS-C	Prismatic blade medial section, w/cortex	BC	ps	
DS	Distal prismatic blade section	BC	ps	
DS-C	Distal prismatic blade section, w/cortex	BC	ps	
DS-pl	Distal prismatic blade section, plunging blade	BC	ps	
DS-pl-CT-gd	Distal prismatic blade section, plunging blade w/distal ground core top	BC	ps	
BF	Prismatic blade fragment	BC	ps	

DRS-sf	Distal reverse prismatic blade section w/distal single facet platform	BC	ps
Pres-B	Pressure bifacial thinning flake, thinning of prismatic blade	BC	ps
BNF	Flake made from notching a prismatic blade section	BC	ps

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
PS-gd-h	Prismatic blade proximal section, ground plat w/hinge term	BC	p	
PS-gd-j	Prismatic blade proximal section, ground plat w/dorsal "j" hinge removal scar	BC	p	
PS-sf-hb	Prismatic blade proximal section, single facet plat w/dorsal "hb" hinge removal scar	BC	p	
MS-h	Prismatic blade medial section with hinge termination	BC	p	
MS-hb	Prismatic blade medial section w/dorsal "hb" hinge removal scar	BC	p	
Nacelle	Pressure derived nacelle flake (flex tablet, created during blade removal)	BC	p	
PORF	Platform overhang removal flake, pressure	BC	p	
PS-gd-SM-EM	Proximal prismatic section, ground platform, side & end modified	BC	t	
PT	Pointed top prismatic blade section	BC	t	
MNB	Multi-notched prismatic blade section	BC	t	
DT	Diagonal tipped prismatic blade section	BC	t	
EM	End-modified prismatic blade section	BC	t	
EM-SM	End-modified and side modified prismatic blade section	BC	t	
NT	Needle-tipped prismatic blade section	BC	t	
NB-c	Notched prismatic blade section, complete	BC	t	
NB-f	Notched prismatic blade section	BC	t	

	fragment			
Haft-B	Hafted prismatic blade section	BC	t	
Haft-B-sn	Hafted prismatic blade section, notched on its sides	BC	t	
LP-f	Large point prismatic blade section, fragment	BC	t	
LP-sn	Large prismatic blade section, side- notched	BC	t	

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
LP-sn-cnv	Large prismatic blade section, side- notched with a convex base	BC	t	
LP-st	Large prismatic blade section, stemmed base	BC	t	
SP-bn	Small prismatic blade section, basally notched	BC	t	
SP-bs-cnv	Small prismatic blade section	BC	t	
SP-bs-sn	Small prismatic blade section	BC	t	
SP-cnv	Small prismatic blade section	BC	t	
SP-sn	Small prismatic blade section	BC	t	
SP-sn-cnv	Small prismatic blade section	BC	t	
SP-st	Small prismatic blade section	BC	t	
SP-f	Small prismatic blade section	BC	t	
X-cres	Prismatic blade section	BC	t	
X-cres-f	Prismatic blade section	BC	t	
X-multi	Prismatic blade section	BC	t	
X-tri	Prismatic blade section	BC	t	
X-tri-f	Prismatic blade section	BC	t	
WBF	Worked prismatic blade fragment	BC	t	
SBF	Snapped prismatic blade fragment	BC	t	
CT-gd-bp	Ground prismatic core top, bipolar	BC	crjuv	
CR	Recycled prismatic core	BC	cr	
CR-scr	Recycled prismatic core, scraper	BC	t	
CSF	Prismatic core section flake	BC	crjuv	
CDT	Prismatic core distal tip	BC	crjuv	
SPF-f	Prismatic core split platform flake	BC	cr	
PPF	Prismatic core platform preparation flake	BC	crjuv	
PPF-int	Prismatic core interior platform preparation flake	BC	crjuv	

DOF-j	Prismatic core distal orientation flake w/j flake hinge removal scar	BC	crjuv
DOF-pres	Prismatic core distal orientation flake, removed with pres	BC	crjuv
DOF-scr	Prismatic core distal orientation flake	BC	t
PF	Prismatic core single facet platform flake	BC	cr
PF-gd	Prismatic core, ground platform flake	BC	crjuv

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
PD	Primary decortication flake	FC	p	
SD	Secondary decortication flake	FC	p	
IC	Interior core flake w/cortical platform	FC	p	
IS	I core flake w/ single facet platform	FC	p	
FC	Flake core	FC	p	
FC-scr	Flake core used as scraping tool	FC	t	
SDBT	Secondary flake w/characteristics of perc biface thinning flake	BIF	p	5
EPBT	Early percussion biface thinning flake	BIF	p	5
EPBT-B	Early percussion biface thinning flake, from thinning a prismatic blade	BIF	p	5
EPBT-det	Early percussion biface thinning flake w/remnant detachment scar	BIF	p	5
BT-alt	Percussion biface thinning, alternate flake	BIF	p	5
BT-alt-C	Percussion biface thinning	BIF	p	5
BT-bulb	Percussion biface thinning, bulb removal flake	BIF	p	5
BT-ed	Percussion biface thinning, edge preparation flake	BIF	p	5
BT-ed-C	Percussion biface thinning, edge preparation flake - remnant cortex	BIF	p	5
BT-mar	Percussion biface thinning, margin removal flake	BIF	p	5
LPBT	Late percussion biface thinning flake	BIF	p	5

LPBT-det	Late percussion biface thinning, remnant detachment scar	BIF	p	5
EPres	Early pressure biface thinning flake	BIF	p	6
EPres-det	Early pressure biface thinning flake, remnant detachment scar	BIF	p	6
LPres	Late pressure biface thinning flake	BIF	p	6
NF	Pressure notch flake	BIF	p	6
BIF-bs	Biface base fragment	BIF	t	t
BIF-bs-sb	Biface base, straight base	BIF	t	t
BIF-bs-sn	Biface base, side notched	BIF	t	t

Artifact Code	Description	Technology	Pro/Con Code	Biface Code
BIF-cnv	Biface base, convex base	BIF	t	t
BIF-dsc	Biface, discoid scraper	BIF	t	t
BIF-f	Biface fragment	BIF	t	t
BIF-ms	Biface mid-section	BIF	t	t
BIF-tip	Biface tip	BIF	t	t
BIF-tip-C	Biface tip w/cortex	BIF	t	t
BIF-sb	Biface, straight base	BIF	t	t
BIF-scr	Biface scraper	BIF	t	t
BIF-scr-C	Biface scraper w/cortex	BIF	t	t
BIF-sn	Biface, side-notched	BIF	t	t
BIF-sn-bn	Biface, side-notched & basally notched	BIF	t	t
BIF-st	Biface, stemmed base	BIF	t	t
SP-FB-cn	Small point, flake blank, corner notched	BIF	t	t
SP-FB-sn	Small point, flake blank, side notched	BIF	t	t
UNIF	Uniface	BIF	t	t
UNIF-C	Uniface w/cortex	BIF	t	t
UNIF-dsc-C	Unifacial discoid scraper	BIF	t	t
UNIF-dsc-C	Uniface discoid scraper w/cortex	BIF	t	t
UNIF-f	Uniface-fragment	BIF	t	t
UNIF-scr	Uniface scraper	BIF	t	t
UNIF-ss	Uniface side scraper	BIF	t	t
UNIF-scr-C	Uniface side scraper w/cortex	BIF	t	t
X-f	Biface eccentric fragment	BIF	t	t
EPBT-scr	Early percussion biface thinning flake, scraper	BIF	t	t
CR- bp	Recycled prismatic blade core, bipolar	BP	cr	
SPMS-bp	Small percussion blade medial section, bipolar	BP	p	
PS-sf-bp	Proximal prismatic blade section, single facet platform, bipolar	BP	p	
PS-gd-bp	Proximal blade prismatic section, ground platform, bipolar	BP	p	
SBF-bp	Snapped prismatic blade fragment, bipolar	BP	p	
MS-bp	Prismatic blade medial section, bipolar	BP	p	

BIF-bp	Biface fragment, bipolar	BP	t	t
BP	Bipolar flake	BP	p	
Artifact Code	Description	Technology	Pro/Con Code	Biface Code
BP-C	Bipolar flake w/cortex	BP	p	
BP-ch	Bipolar chunk	BP	p	
BP-ch-C	Bipolar chunk w/cortex	BP	p	
BP-n	Bipolar flake w/notch	BP	t	
DS-bp	Prismatic blade distal section, bipolar	BP	p	
MB-bp	Macroblade, bipolar	BP	p	
SC-bp	Bipolar scalar core	BP	p	
SPB-bp	Small percussion blade section, bipolar	BP	p	
E	Errillure flake	U	p	
UC	Unidentified flake w/cortex	U	p	
UN	Unidentified flake	U	p	
FF	Flake fragment	U	p	
FF-C	Flake fragment w/cortex	U	p	
SH	Shatter	U	p	
SH-C	Shatter w/cortex	U	p	
CH	Chunk of toolstone	U	p	
CHB	Battered chunk of toolstone	U	p	
WF	Worked fragment	U	t	
WF-C	Worked fragment with cortex	U	t	
WF-cir	Worked fragment - circular piece	U	t	
UN-polish	Unidentified flake w/polish	Lap	l	
SD-scr	Secondary decortication flake, made into a scraper	BIF	t	