CHAPTER FOUR

Ceramic Analysis

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Las Cuevas

Our quest to determine the ceramic sequence for the Etzatlán region began with research on the relatively large collection from the site of Las Cuevas. Here, Long and Glassow had excavated sixteen pits scattered over a relatively flat promontory of land that extended into the lake on the eastern side of the island. We processed about seventy-eight hundred potsherds from these sixteen units, classifying and physically sorting the sherds into sixty-five different types. We also added a unique specimen number to each sherd. Next, we recorded the data in notebooks, listing for each sherd its type, unique ID number, and provenience (square and depth). Finally, we entered the data into a computer and then compared computer printouts to handwritten data, line by line, to eliminate data entry errors.

When we attempted to study type distributions in a traditional way, looking for stratagraphic changes through time, level by level, the data appeared confusing—trends in some units did not appear in or were even contradicted by data from others. Part of the problem was that we were dealing with part of a large open site that had been intensively occupied. Deposits with cultural debris tended to be shallow with 94.9 percent of all potsherds from Las Cuevas excavated from deposits less than 1.0 m deep. Also, we found ample evidence of disturbance:

field notes for the Las Cuevas excavation record fragmentary burials, a rock oven (?), rock concentrations, intrusive pits, and a rock wall foundation. As a result, we took a statistical approach and concentrated at Las Cuevas on data from fifty-two lots of potsherds (samples from individual square levels) with more than fifty sherds each. We also concentrated on those types present in large frequencies in order to reduce the problem of sampling error. Our approach was to look for covariation of types among the samples with the idea being that types, which covaried closely, would tend to be contemporaneous. Initially, we used the correlation coefficient in an explorative way to discover this covariation among important or high frequency types. At this stage of the Las Cuevas analysis, we were able to discern two type complexes. Each group was defined by positive correlations among some of these types, while negative correlations separated these same two complexes on a type-to-type basis. Also, we had some reason to believe that one complex was earlier than the other, given slightly different average levels for the two groups of types in the deposits. The types in each of the suggested groups are listed in table 4-1. In order to increase sample sizes, in several cases we combined sherd data from related types for the analysis. Specifically, sherd data for Huistla Polychrome grater bowl types (7, 8, and 9) were grouped, as were data for Huistla Polychrome non–grater bowl types (19, 20, and 21) and White on Red types (16, 17, and 18). Morphological differences among these individual types are described in chapter 3.

Unfortunately, we had been forced to use type (or combined type) percentages by lot in constructing the correlation matrix in order to obtain any patterning at all. This practice of employing the correlation coefficient with percentages instead of frequencies is considered

Table 4-1: Two provisional ceramic complexes

Early Complex	**Late Complex**
Incised Polychrome	Huistla Polychrome
Gray Slipped and Polished	Huistla Polychrome Grater Bowl
White on Red	Brown Slipped and Polished Comal

to be statistically unreliable. Our initial effort, however, did show some potential for a seriated sequence of ceramic types at Las Cuevas and indicated how those types might figure in such a sequence.

We turned next to a different statistical treatment of these data, correspondence analysis (CA). This procedure uses the chi-square statistic to measure the degree of covariation among both types and samples and maps the results on a two-dimensional grid. CA is described and its archaeological potential evaluated in chapter 2. Evidence for the two complexes (table 4-1) can be seen in the results of an initial CA (fig. 4-1). The three types provisionally designated as early are to the left: they have lower x-axis values than the four types assigned to the late complex. At this point, though, we still did not have enough information to determine if these two complexes represented different portions of a ceramic sequence. The two type groupings, for example, could represent functional rather than chronological differences. In order to explore this issue, we turned to the study of potsherds from three additional sites.

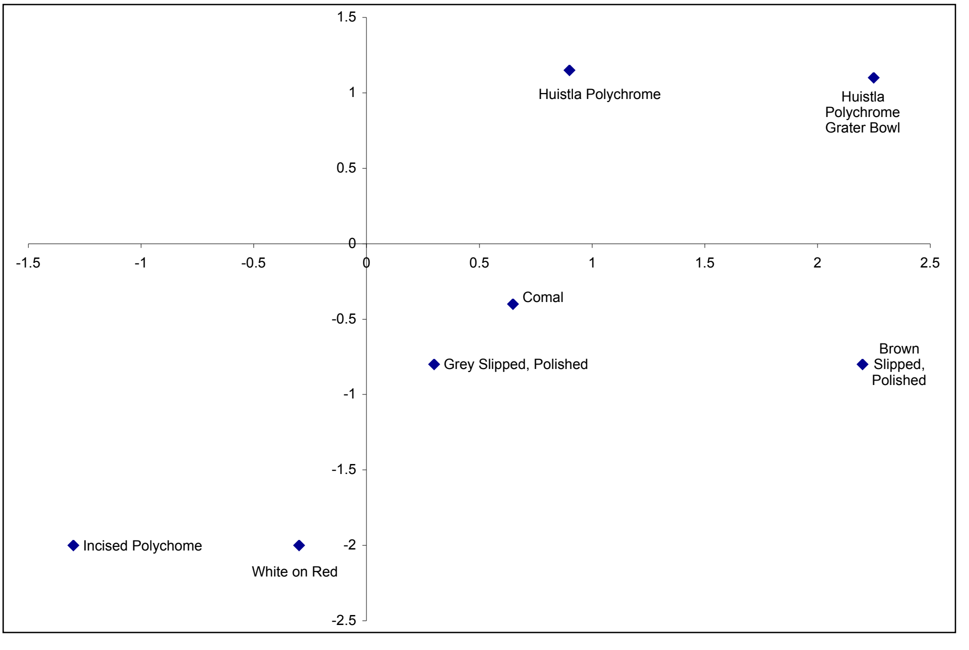


Figure 4-1. Type plot, original Las Cuevas CA.

Tiana

Long excavated few squares at the site of Tiana, and we obtained only eleven lots with the minimum fifty sherds, distributed over four pits. However, when the data were summarized in terms of the original two complexes (table 4-1) and 20 cm level samples, we could see stratigraphic evidence (table 4-2) that the two complexes we proposed for the site of Las Cuevas do represent to some degree different portions of the local ceramic sequence. They align stratigraphically in the suggested chronological order. One should keep in mind here that the four excavation units at Tiana were not contiguous but scattered over the site.

In the course of the Tiana analysis, however, we identified an inconsistency with findings from Las Cuevas. Sherds of the late complex types (see table 4-1) from Tiana did not include those of Huistla Polychrome. Only three Huistla Polychrome sherds were found among approximately eighteen hundred sherds excavated. Instead, the late designation for levels depicted in table 4-2 was based mainly on the presence of sherds of the Comales type. Paint-decorated sherds from these same levels tended to be from three types ignored so far in the analysis: those with red-painted decorations on a cream or buff background. We had not included these types in the Las Cuevas CA because they were not found to correlate significantly with other types when first viewed in the Pearson correlation matrix. Now these Red on Cream types took on significance. In the CA for Las Cuevas (fig. 4-1), Comales can be seen occupying an intermediate position between the Huistla Polychrome

Table 4-2: Distribution of provisional ceramic complexes at Tiana by level and square

Depth of Excavated Unit (cm)	Unit 1	Unit 2	Unit 3	Unit 4
0–20	Late	—	Mixed	—
20–40	Mixed	Late	Mixed	Late
40–60	Mixed	Late	Early	—
60–80	Early	Mixed	—	—
80–100	—	—	—	—

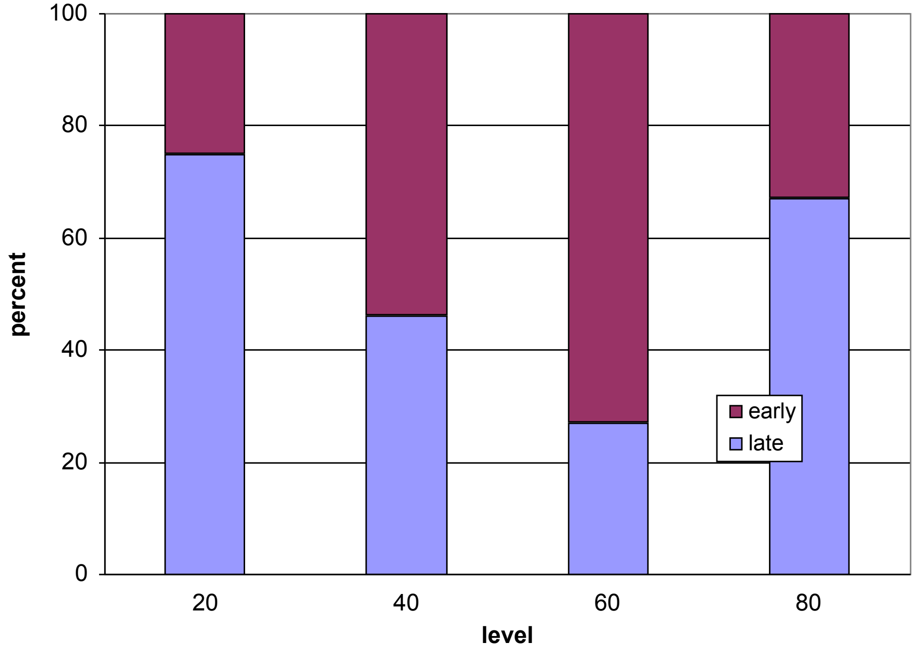
types on the one hand and Incised Polychrome and White on Red on the other. If figure 4-1 represents to some extent a ceramic sequence for the Etzatlán area, then it seemed possible that Red on Cream pottery (i.e., the three types lumped together) might also be diagnostic of an intermediate stage or interval as well. That is, this pottery might not just occur in the upper or later levels at Tiana, it might concentrate there.

We examined the stratigraphic distribution of Red on Cream pottery at Tiana, but such a simple picture failed to materialize. Red on Cream sherds occurred throughout the deposits at Tiana and were also associated in early levels with the Incised Polychrome and White on Red. At the outset, we had constructed a fine-grained typology (chapter 3) and had defined three Red on Cream types (22, 23, and 24). In terms of these individual types, we did find at Tiana vertical separations, which potentially could help to define a portion of the Etzatlán regional sequence. Two of the types (22 and 23) could be identified by the presence of red bands present either singly or as two or more parallel bands, often parallel to the rim. Sherds of these two types tended to be in the upper levels of Tiana. For the third type (24), the red-painted designs were highly varied and more complex, being either rectilinear or curvilinear, with design quality being highly varied as well. Sherds of this type tended to occur in deeper levels of the site.

Figure 4-2 (data in table 4-3) shows the distribution of what we are calling Early versus Late Red on Cream pottery at Tiana. Looking at ratios of one group to the other, we see that the two late banded types combined increase by level and presumably through time at the expense of the third, based on the three excavation units with multiple superposed fifty-sherd samples.

Other evidence for culture change at Tiana can be seen in figure 4-3, which shows proportions of late Red on Cream relative to the contrasting bichrome, White on Red.

At this point, we carried out a CA for the site of Tiana, employing sherd data from the eleven lots in question but now adding data for two additional categories, Early and Late Red on Cream. As discussed in chapter 2, CA also deals with chi-square distances among samples and generates sample loci as well as those for variables (i.e., types). In figure 4-4, both sample (sherd lot) and type loci are depicted. Sample loci are labeled according to the original assessment of type content included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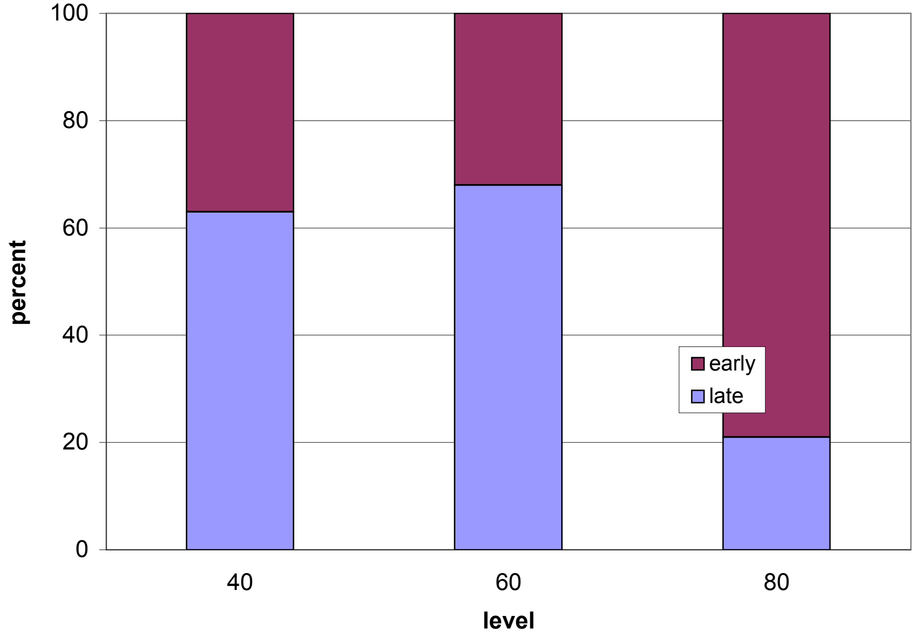
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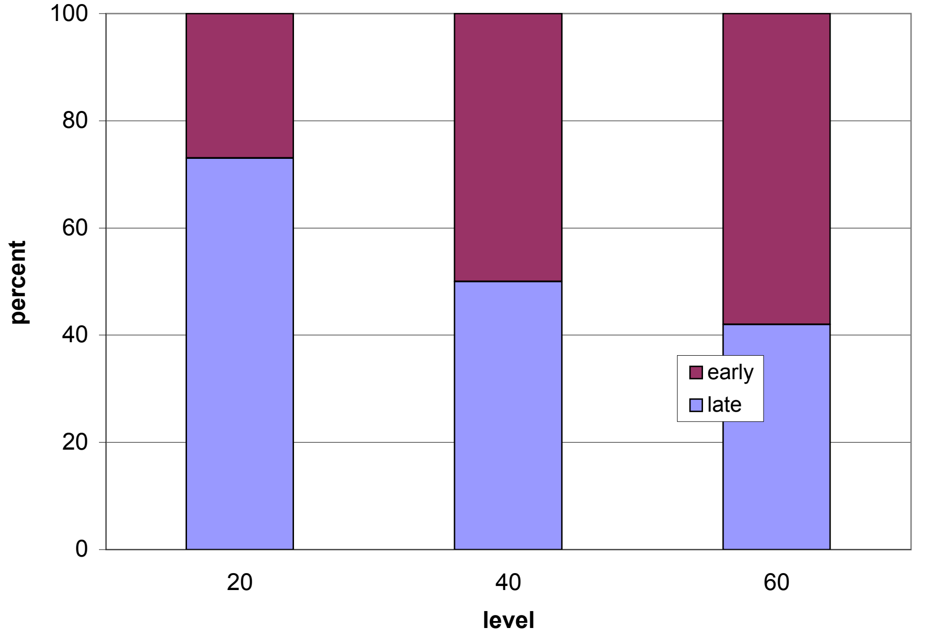


Figure 4-2. Early versus late Red on Cream by level and square, Tiana.

Table 4-3: Type frequencies by sample for the Tiana CA

Lotno	Un/Lv	Comal	GrySP	BrnSP	Inc. P	W/R	L R/C	E R/C	Total
1	1/20	9	0	0	3	1	6	2	21
2	1/40	24	2	1	1	28	12	14	82
3	1/60	14	4	2	1	17	6	16	60
4	1/80	4	6	1	2	13	2	1	29
6	2/40	34	1	1	1	1	5	3	46
7	2/60	57	7	2	5	2	13	6	92
8	2/80	6	1	2	4	1	3	11	28
9	3/20	12	0	1	7	5	8	3	36
10	3/40	41	2	3	10	20	25	25	126
11	3/60	14	4	1	5	35	5	7	71
15	4/40	8	0	0	0	2	1	2	13

in table 4-2. As can be seen, the samples are aligned roughly in the form of a curve, commonly referred to as an arch in CA (chapter 2), from early (E in fig. 4-4) to mixed (M) to late (L). Types line up roughly along the same curve in a generally predictable order from early types, Gray Slipped and Polished, White on Red, Early Red on Cream, and Incised Polychrome to the later Brown Slipped and Polished, Late Red on Cream, and Comales. Keep in mind that Huistla Polychrome is all but absent from the Tiana collection. Type frequencies by sherd lot and type for the Tiana analysis are included in table 4-3.

Anona

Data from Anona are summarized in table 4-4, again in terms of the original two complexes (see table 4-1). These complexes segregate spatially at Anona as well, but here the separation is horizontal and not

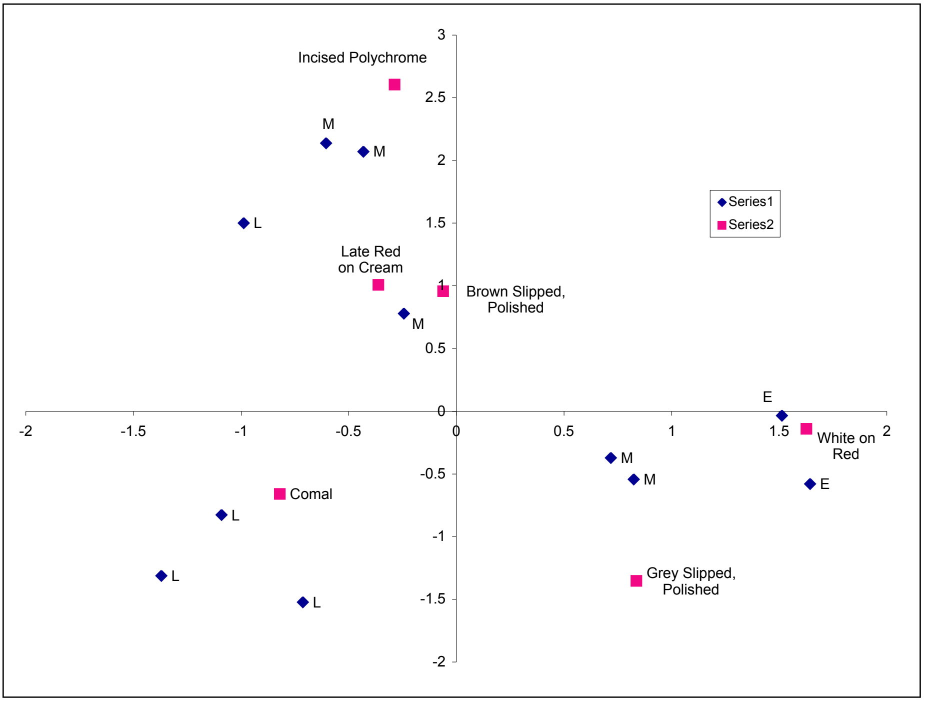


Figure 4-3. Late Red on Cream versus White on Red by level and square, Tiana.

vertical. Missing excavation units and cells with missing data reflect level samples with overall sherd totals of less than fifty. Figure 4-5 depicts the CA for this site with two-dimensional plots for both types and lots. Again, we see evidence of an arch. The difference from the CA for the site of Tiana (see fig. 4-4) is that Huistla Polychrome ceramics are abundant in the Anona collection. Along the curve, samples align from early (E) to late (L; designations from table 4-4), and type-wise the progression begins with the early types/type group Incised Polychrome, Early Red on Cream, and White on Red. Late Red on Cream and the Comales type occupy an intermediate position, and the two categories of Huistla Polychrome follow at the late end of the sequence.

Las Cuevas Reconsidered

Next, we reconsider the site with which we began, Las Cuevas. Figure 4-6 portrays a second CA for the site, now including the two categories Early and Late Red on Cream. In this graphic, only types are included (i.e., sample loci are excluded), and the hypothetical time line is straight across the chart. There is no arch, probably due to the fact that we are dealing here with many more samples: fifty-two versus eleven for both the sites of Tiana and Anona. As for Anona, we see Late Red on Cream along with Comales in an intermediate position between earlier types on the one hand and Huistla Polychrome and Huistla Polychrome Grater Bowls on the other.

Table 4-4: Distribution of provisional ceramic complexes at Anona by level and square

Depth of Excavated Unit (cm)	Unit 6	Unit 7	Unit 8	Unit 9	Unit 12
0–20	Early	—	—	—	—
20–40	—	—	Late	—	—
40–60	—	—	Late	Early	Early
60–80	—	Late	Late	Early	—
80–100	—	—	Late	Early	—
100–120	—	—	Late	—	—

Three-Site Correspondence Analysis

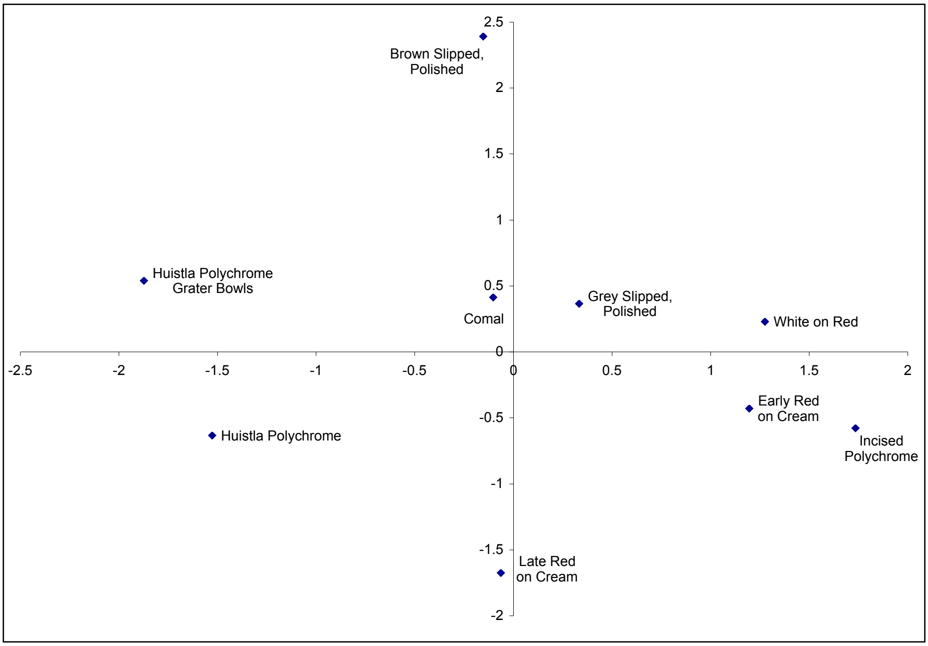
Finally, figure 4-7 depicts the type plot for a CA based on data from all three sites; that is, all seventy-four samples are included. Again, we see a straight-line progression of types, although along the proposed time line, the type progression across the graph is reversed. This fact is not surprising since in any seriation, the actual order is what counts, and in CA the signs for the plot values could all be reversed and the results would be considered identical. Again, we see roughly the same alignment of types, with Late Red on Cream and Comales in an intermediate position.

Santiaguito

Long and Glassow dug twenty pits at Santiaguito and recovered a relatively large sample of pottery, but unfortunately, we found that many of these sherds have eroded surfaces. Sherd erosion at Santiaguito was much more extensive than in other site collections. Because of this erosion, we were able to classify potsherds from certain lots only, and even for those cases, sherd preservation was only marginally satisfactory. Of 103 pottery lots excavated, we classified potsherds from only 40. When we charted the distribution of the original two complexes defined for Las Cuevas within these Santiaguito lots, we found a lack of either horizontal or vertical segregation (table 4-5). As a result, and given our lack of confidence in the collection stemming from varying degrees of erosion, we put further study of the Santiaguito data set on hold. Upon completing the research that led to the three-site CA, however, as well as the alternative analyses discussed in chapter 6, we thought it worthwhile to reconsider the Santiaguito data. How would a CA perform on data compromised in this way? Could anything worthwhile be gleaned from this collection, given the time and effort expended in the field and, more recently, in the laboratory?

For the Santiaguito CA, we selected the twenty-two lots with at least fifty classified sherds and employed the nine types/type groupings already utilized in the three-site CA described previously. Figure 4-8

opposite: Figure 4-4. Type and sample plot, Tiana CA.
Figure 4-5. Type and sample plot, Anona CA.



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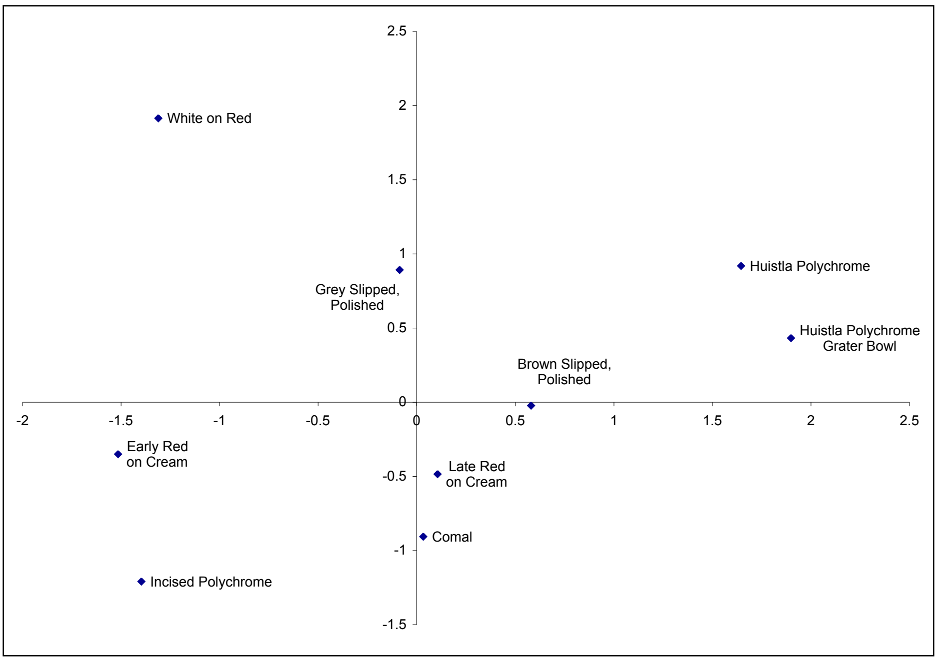
Brown Slipped, Polished
Huistla Polychrome Grater Bowls
Comal
Grey Slipped, Polished
White on Red
Early Red on Cream
Huistla Polychrome
Incised Polychrome
Late Red on Cream



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White on Red
Huistla Polychrome
Grey Slipped, Polished
Huistla Polychrome Grater Bowl
Brown Slipped, Polished
Early Red on Cream
Late Red on Cream
Comal
Incised Polychrome

Table 4-5: Distribution of provisional ceramic complexes at Santiaguito by level and square

Depth of Excavated Unit (cm)	2	3	5	9	10	13	14	15	16	18	18ext	19	20
0–20	—	—	—	—	—	—	—	—	—	—	—	—	—
20-40	—	—	—	—	—	—	—	—	L	L	L*	—	E
40-60	—	L	—	L	E	—	E	E†	E	E	—	E	E
60-80	E	—	L	—	—	L	L	—	E	L	—	—	—
80-100	—	—	—	—	—	—	E	—	—	L	—	—	—

*The sample is from a pit extension excavated in a single 40 cm level (0–40).
†Two lots (nos. 74, 75), both early, were assigned to this same provenience. Both are included independently in the CA.

depicts the distribution of both types and lots in the CA two-dimensional plot. Here, one can see types generally in the same progression described for the three-site CA, except that early and intermediate types are somewhat compressed and separated from the two Huistla Polychrome categories. Within the early and intermediate type distributions, the one discrepancy of note is the earlier positioning of the types Gray/Buff Slipped and Polished (5) and Black/Brown Slipped and Polished (6). Since identification of these types depends on surface finish, it could be that later deposits had been subjected to more erosion, tending to mask the presence of these types in later lots.

Among lots, we should note the single outlier located beyond and above the Huistla Polychrome type groupings (fig. 4-8). It is distinguished from other lots by having a much higher x-axis value. In figure 4-9, only lot loci are included, and the outlying lot has now been excluded. Lots are labeled as to their closest affinity, either the early or the late ceramic type complex as defined provisionally through use of correlation matrixes (see table 4-1). As we can observe, early and late lots, as defined, cluster in separate localities along the x-axis with little overlap. They separate cleanly when viewed along a diagonal extending from the upper left to the lower right quadrant.

We have good evidence, then, that the ceramic sequence identified for the other three sites under investigation is also present at Santiaguito. The outlier lot is of interest because of its very late position in

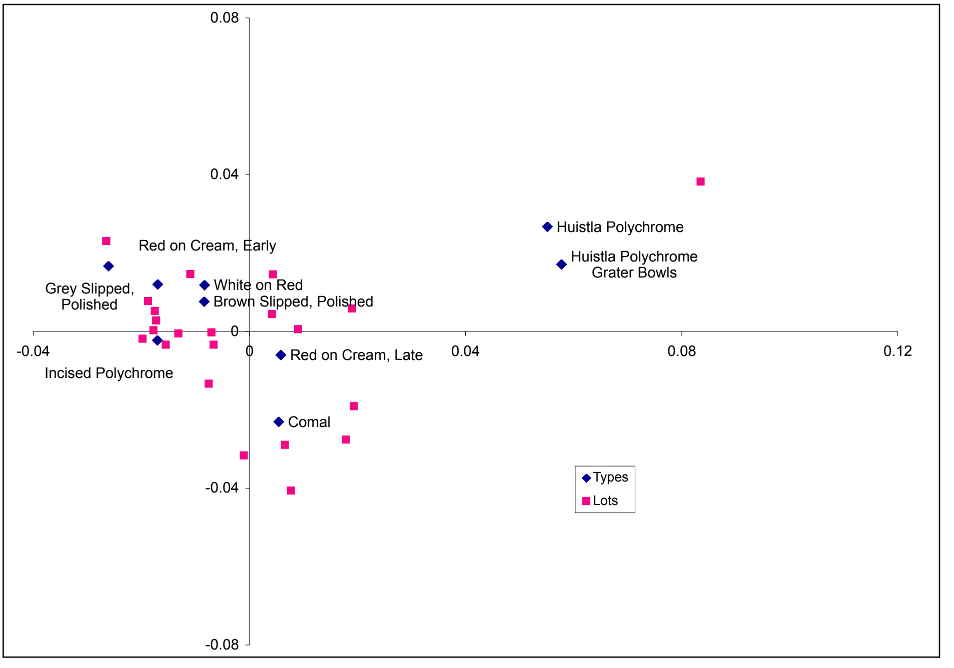

Figure 4-8. Type and sample plot, Santiaguito CA.

the sequence. As a matter of fact, the historic type Glazed Majolica (41) occurs at Santiaguito. We identified fourteen sherds of this type in our research, all, it so happens, coming from lots that figured in the CA. Eight of these sherds are from this single outlier lot. Furthermore, this lot was not a normal 20 cm level sample, but a 0–40 cm sample taken from an extension to pit 18 (table 4-5). No clear reason for this extension survives in the record, since field notes from the Santiaguito excavation are missing. Since types included in the Santiaguito CA are all of indigenous origins, this finding supports the idea that, in the vicinity of Etzatlán, indigenous pottery continued to be made into the historic era.

Extending the Sequence

As indicated in figures 4-4 and 4-5, CA plots for the sites of Tiana and Anona graphically describe relationships (i.e., covariation) among types and samples as aligned along arches. We have discussed evidence that these alignments of types and samples are chronological. For the composite or three-site CA, generally the same alignment of types extends

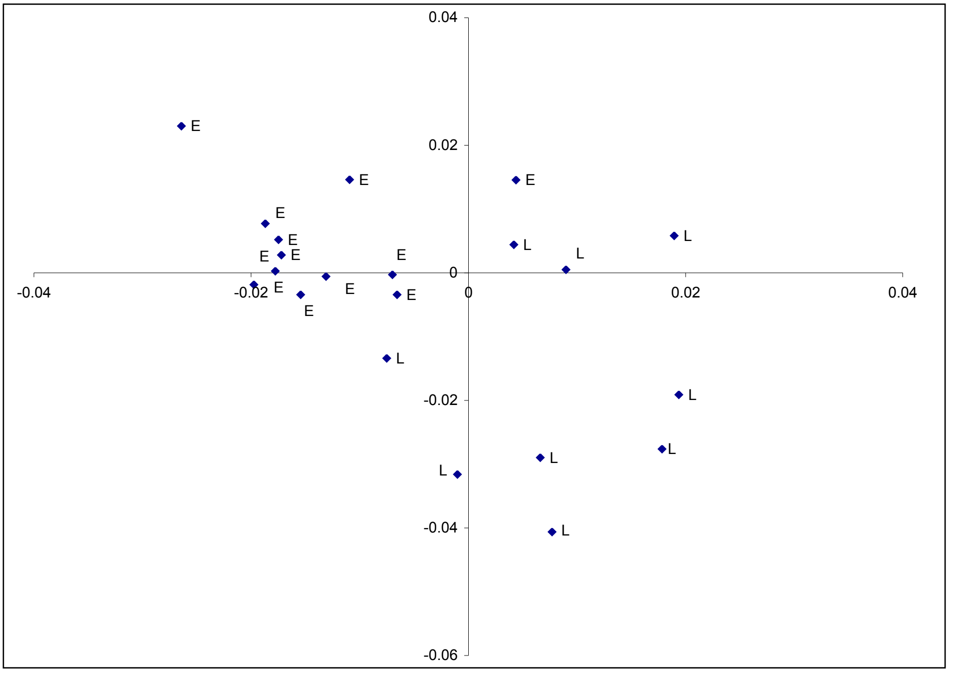

Figure 4-9. Sample plot, Santiaguito CA.

roughly parallel to the horizontal axis. If this alignment represents a chronological progression, then it is reasonable to assume that the seventy-four samples from this three-site analysis, as viewed in a two-dimensional CA plot, would also be ordered chronologically along this same axis. Figure 4-10 depicts the positions of these sample loci graphically by site. Some support for this notion can be seen in the fact that sample loci for the site of Tiana are all in early positions to the left of the vertical axis. This grouping is consonant with the absence of the latest pottery types from that site, types identified as Huistla Polychrome.

During the course of the study, we developed a detailed typology and classified and recorded the sherds in terms of seventy-three individual types (expanded from the sixty-five Las Cuevas types), as described in chapter 3. These type identities and distributions were incorporated into the computerized data set. Each of the nine "types" included in the CAs discussed previously represent one or in some cases several of these specific types, as we have detailed. Most of the seventy-three

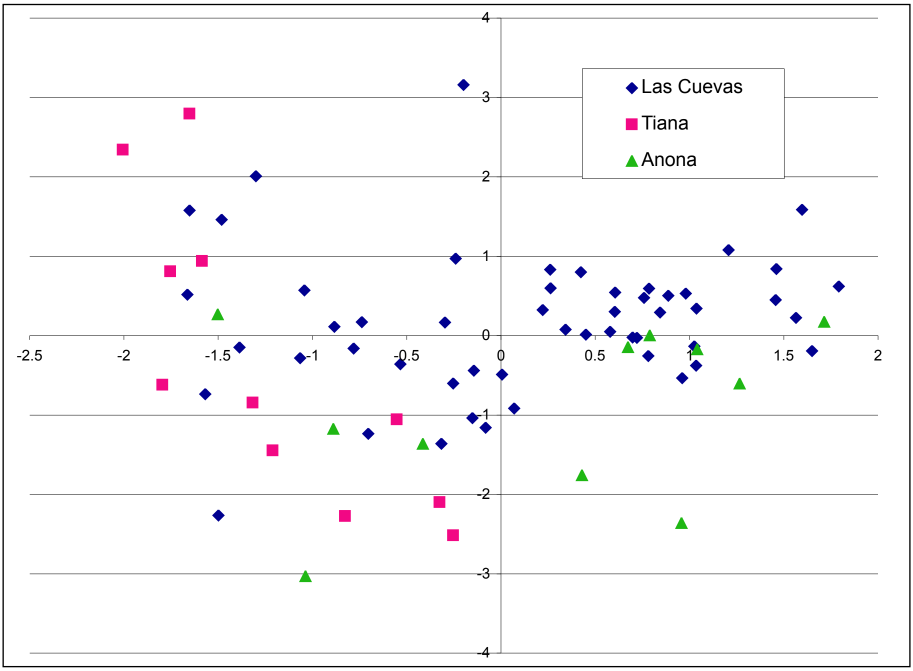

Figure 4-10. Sample plot, three-site CA.

types defined, however, did not figure in the CAs in any way. The question remains, can data from these additional types be related to—or fit into—the relative chronology developed so far? Altogether, 10,594 classified potsherds were included in the seventy-four samples, and of these, we utilized 4,369 (41 percent) in the three-site CA. Of the remaining, 2,461 sherds had been classified into thirty-three potentially well-defined types, with type frequencies varying from 9 to 680 sherds. We found we could obtain an estimate of relative age in the sequence for each of these types by applying the lot or sample horizontal-axis (x) value from the three-site CA to each sherd according to sample membership and then summarizing the distribution.

For example, the type Hatched from Rim Exterior, Incised (44) is represented by forty-three sherds, distributed through twenty-two of the seventy-four samples. Summarizing the sample x- or horizontal-axis values (CAvalues) for these sherds results in the distribution shown in figure 4-11. By contrast, the type Dark Red, Complex (47) had forty-one sherds distributed through twenty-three samples, but the summary by CAvalue produced a much different result (fig. 4-12). While these trends should be treated cautiously, they may well represent the beginnings of a detailed ceramic sequence for the Etzatlán region. In chapter 5, we make use of this approach to provide information on the chronologies of individual types.

CA for Animal Bones

Elsewhere, Porcasi (2012) deals with animal bones recovered during the course of excavations at these sites. In a search for changes or continuity in the procurement of animal resources, an attempt has been made to place bone samples in relative sequence, based on associated ceramics. In other words, the sequence was extended to animal bones in the same way it was to pottery types that did not figure in the CAs, as just described. Initially, this process was accomplished by analyzing bones from the seventy-four level/square samples employed in the three-site CA described previously. X-axis CAvalues were assigned to associated bones according to provenience. Porcasi found, however, that only 39

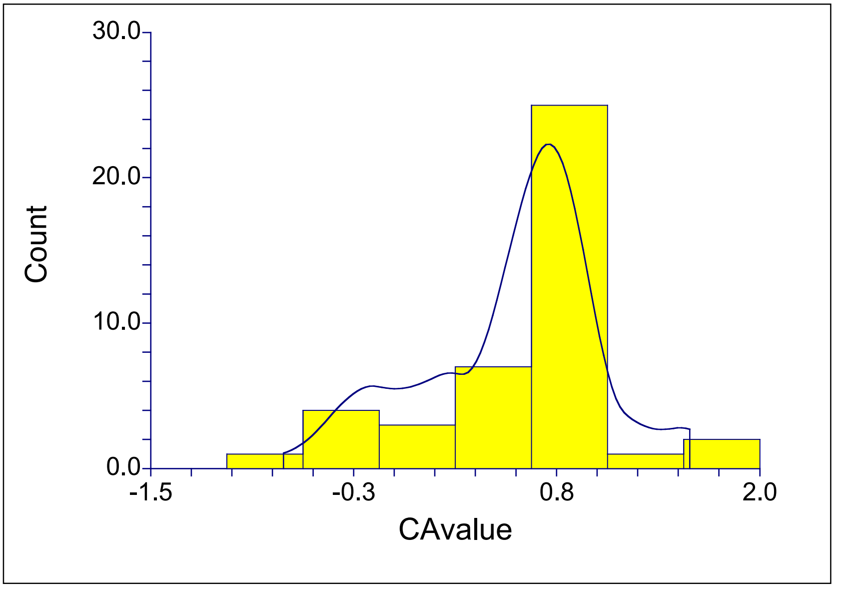

Figure 4-11. CAvalue distribution for type 44, Hatched from Rim Exterior.

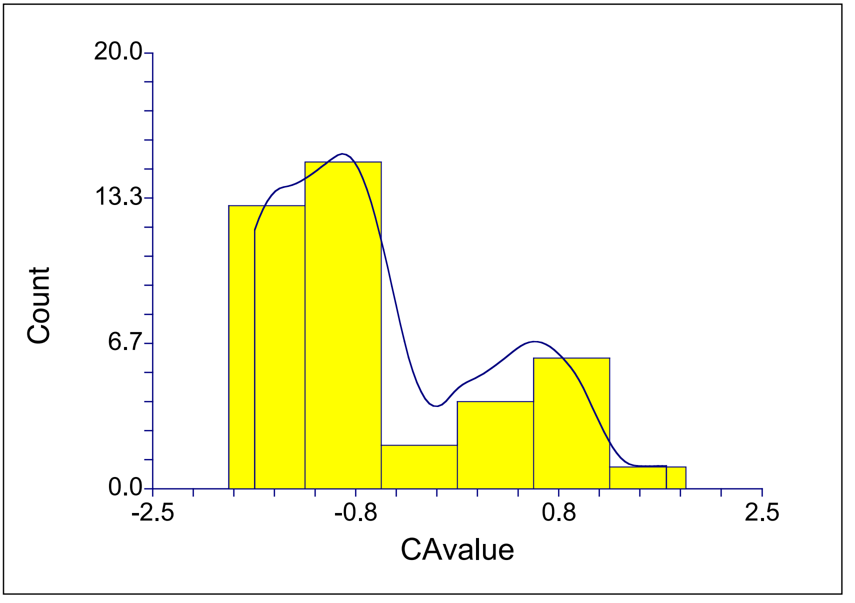

Figure 4-12. CAvalue distribution for type 47, Dark Red, Complex.

percent of 1,676 identified specimens from these sites derived from the seventy-four samples because many bones came from samples with less than fifty sherds and from samples including pottery that remained unclassified for other reasons. Also excluded were bone samples from Santiaguito because no Santiaguito ceramic samples were included in the three-site CA. In order to increase the fraction of bones in relative sequence, we generated a CA for animal bones. This CA included all classified ceramic samples from levels/squares that also contained animal bones, with the minimum number of required sherds/samples dropped from fifty to six. This CA includes sherd samples from all four sites, including Santiaguito. The CA for animal bones is based on the same types/type groupings employed in the three-site CA and all other CAs described previously, except the original Las Cuevas CA. Figure 4-13 displays the two-dimensional CA plot for types, and virtually the same progression of types is manifested, consistent with the CAs we have described. The progression of samples for both ceramic types and, by extension, animal bones may not be as reliable as that generated through the three-site CA due to the inclusion of smaller sherd samples

(< 50 sherds) and samples from the site of Santiaguito. However, it still encompasses considerable data: seventy-six samples of pottery altogether. Of these, fifteen samples (20 percent) contain fewer than 50 sherds, for an average of 19.7 sherds/sample.

Based on this CA, the fraction of animal bones now included in the sequence is 1,196 of 1,617 specimens (74 percent). Porcasi's (2012) findings will be discussed in the concluding chapter (7) of this book.

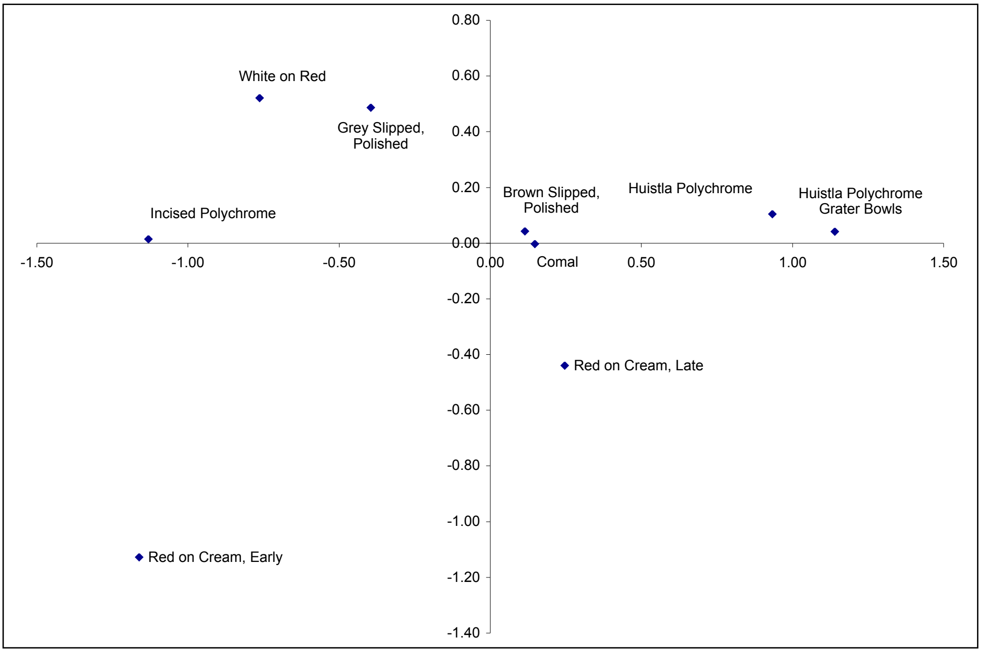

Figure 4-13. Type plot, CA for animal bones.