LATE POSTCLASSIC CHRONOLOGY IN WESTERN MORELOS, MEXICO

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Chronology building is an integral part of the archaeological research process, and changing research questions often require the refinement of existing chronologies. This view is illustrated with a description of the derivation, refinement, and confirmation of a ceramic sequence for the Postclassic period in Morelos, Mexico. The joint application of stratigraphy and quantitative ceramic seriation produced a five-phase Postclassic chronology. To deal with problems in distinguishing the stylistically similar ceramics of the final three phases, discriminant-function analysis was employed, resulting in the confident phasing of nearly all excavated contexts at the sites of Capilco and Cuexcomate. Calendar years are assigned to the phases by radiocarbon dating, and the implications of the dated sequence are explored briefly.

La construcción de cronologías es una parte esencial del proceso de investigación en arqueología, y a menudo, los cambios en las preguntas que el arqueólogo hace requieren de un refinamiento en las cronologías ya existentes. Este tema se ilustra con la descripción de la derivación, refinamiento y confirmación de una secuencia cerámica para la época Postclásica en Morelos, México. La primera actividad fue la construcción de una secuencia cerámica, con cinco fases para la época Postclásica. Se utilizó la estratigrafía y la seriación cuantitativa de la cerámica de Xochicalco. Esta cronología se aplicó a los depósitos excavados en los sitios de Capilco y Cuexcomate para el Proyecto Morelos Postclásico. Hay tres fases en estos sitios: Temazcalli, Cuauhnahuac Temprano y Cuauhnahuac Tardío. La secuencia temporal se confirmó con la estratigrafía, pero fue difícil fechar casas y depositos debido a la gran semejanza de los tipos cerámicos en Cuauhnahuac Temprano y Tardío. Luego se empleó la técnica de análisis de funciones discriminantes, y como resultado fue posible fechar casi todos los depósitos usando las fases cerámicas. Usamos fechamiento de radiocarbono para determinar las fechas calĕndricas de las fases. También usamos la hidratación de obsidiana, pero sín éxito. El artículo concluye con una discusión de los resultados del estudio.

The Late Postclassic period in central Mexico was a time of rapid social change. Dramatic population growth in the Basin of Mexico and elsewhere was accompanied by agricultural intensification, economic growth, mass movements of peoples, urbanization, political centralization, and imperial expansion. Although recent research in ethnohistory and archaeology permits some of these processes of change to be documented with increasing detail (e.g., Brumfiel 1983; Sanders et al. 1979), they remain poorly dated and not well understood at a regional scale.

One of the hallmarks of central Mexican native history is the attention paid to time and dates, but the chronological content of the available sources is limited to a narrow range of dynastic and ritual matters. This leaves archaeology as the main source of information on most processes of social change prior to the Spanish Conquest. However, existing Postclassic chronologies are not sufficiently refined to address adequately processes of urbanization, empire formation, and the like. We argue that regional sequences need refinement and dating with greater precision if archaeologists are to produce satisfactory descriptions and explanations of Postclassic social change.

CHRONOLOGY BUILDING AND SOCIAL CHANGE

Social and cultural processes operate at a variety of time scales ranging from days to millennia. In one of the better-known treatments of this issue, the historian Fernand Braudel (1972, 1980) singles out three contrasting time scales or rhythms of change as points along a continuum. "Events"

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are the specific actions of individuals, with occurrences like battles, treaties, and political decisions operating over a span of days or weeks. Braudel's "conjunctures" are economic and social processes that develop over the course of decades and include wage and price cycles, wars, urbanization, and the changing dimensions of states and empires. Braudel's third temporal scale, the *longue durée*, concerns processes of environmental adaptation that take centuries to develop (see Braudel 1972). Braudel's purpose in distinguishing the various temporal scales is to direct attention to the fact that different types of social processes operate at different temporal rhythms, a notion of great importance for understanding the pace and nature of ancient changes.

Karl Butzer (1982) presents a similar formulation in a systems framework, covering Braudel's three levels under the categories of "adaptive adjustments" and "adaptive modifications." He also adds a still-longer scale, the "adaptive transformation," that goes beyond Braudel's *longue durée* (Butzer 1982:279–320). Geoff Bailey presents a parallel account in more explicitly archaeological terms (Bailey 1983, 1987), and Binford's (1986) distinction between time for the ethnographer and archaeologist is a more limited statement of the same theme.

These insights are directly relevant to the problem of chronology building in archaeology. Chronological refinement is an expensive endeavor (in both time and funds), and the work of Braudel and others on time scales can help archaeologists decide which level of chronological refinement is needed to address different kinds of past social change. For example, because long-term processes of adaptation usually take centuries to develop, an archaeological sequence with phases several hundred years in length is probably adequate to monitor such changes. However, the expansion of a state or empire typically happens over a much shorter time scale, and archaeologists who wish to study such a process require more precise chronological phases (the reader is referred to Smith [1992a] for a theoretical treatment of this issue).

In the case of Postclassic central Mexico, the settlement-pattern research of Sanders et al. (1979) employed 200-year ceramic phases to address long-term adaptations and evolutionary trends, and this is an adequate level of chronological refinement for such issues. However, as scholars turn to questions such as the impact of Toltec or Aztec imperialism or the growth of city-states, shorter phases are needed because of the faster pace of these developments. Rather than simply continuing to rely upon existing chronologies, archaeologists now need to invest the time and funds to produce the shorter phases required. Thus chronology building is not just a preliminary chore to be settled before addressing more interesting questions. Rather it is part of basic research into social and evolutionary issues (see Plog and Hantman 1990; Smith 1992a). It is in this spirit that the chronological research described here was undertaken.

LATE POSTCLASSIC MORELOS

The state of Morelos is located immediately south of the Basin of Mexico in the central Mexican highlands, and the two areas sustained a high degree of contact throughout the Prehispanic period (Figure 1). Western Morelos was the first area outside the Basin of Mexico to be conquered by the expanding Mexica (or Aztec) empire in the fifteenth century (Smith 1987). The Aztec tributary province of Cuauhnahuac, which took its name from a powerful local state centered in what is now the city of Cuernavaca, paid tribute to the Aztecs in cotton textiles, paper, grains, and warriors' costumes.

The Postclassic Morelos Archaeological Project conducted fieldwork at Late Postclassic rural sites in western Morelos between 1985 and 1988 (Smith 1992b; Smith et al. 1989). The goal of this research was to reconstruct rural social and economic organization before and after Morelos was conquered by the Aztec empire. Two sites were extensively tested through excavation. Capilco is a small settlement of 20 houses located just east of the large Epiclassic city of Xochicalco, although there is no Epiclassic occupation at Capilco. Cuexcomate is a larger settlement of 135 houses plus other structures distributed over 14 ha along a ridge 3 km east of Capilco. Excavations at these sites in 1986 focused on residential contexts. House remains are visible on the surface and a three-part sampling procedure was used to gather information on social and economic patterns. First, a random sample of 8 houses at Capilco and 21 houses at Cuexcomate was selected for test-pitting operations. Second, a number of houses were excavated more extensively, including the clearing of large exterior

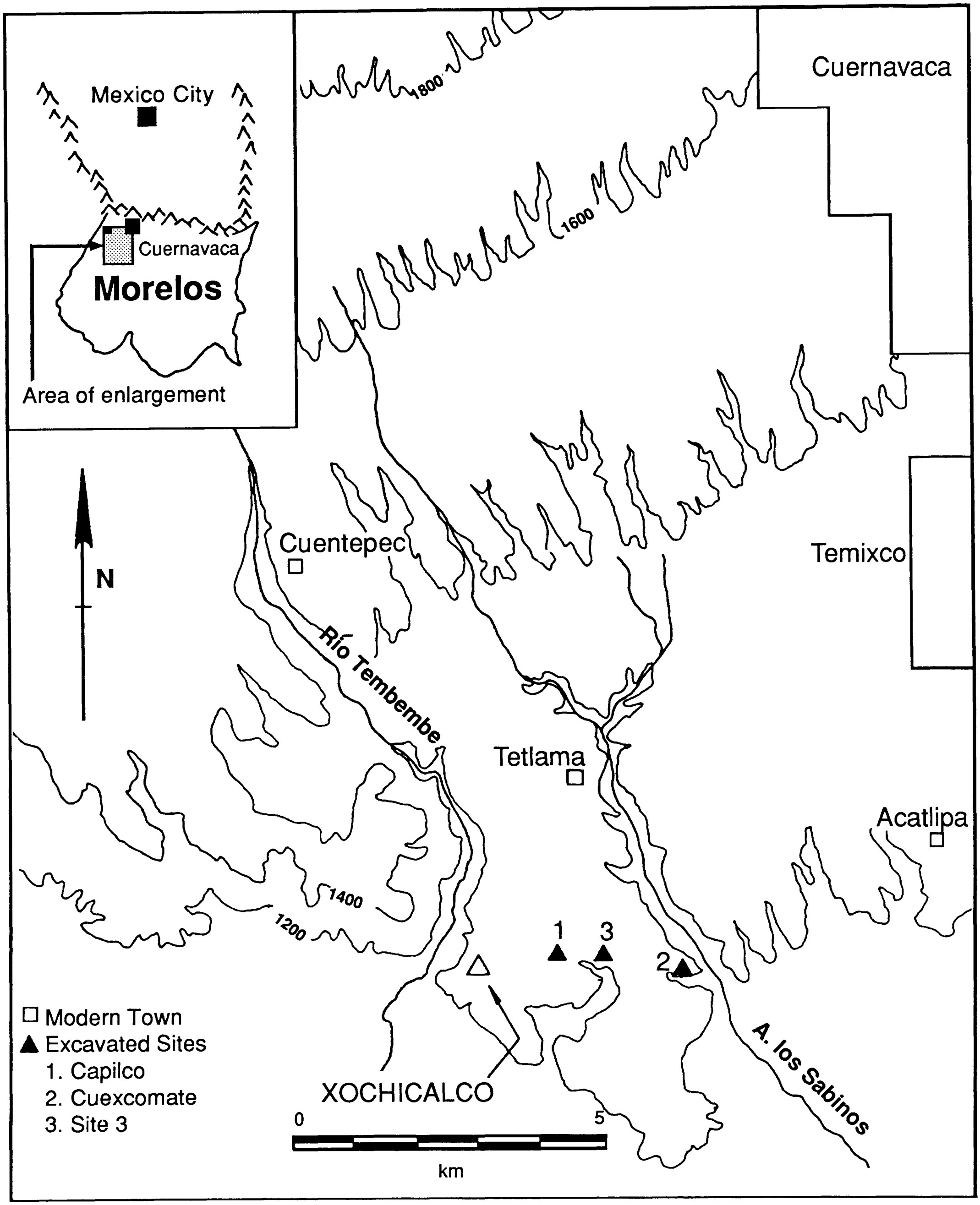

Figure 1. Map of the study area of the Postclassic Morelos Archaeological Project, showing the locations of Xochicalco, Capilco, and Cuexcomate.

areas. Third, a number of nonresidential structures and features were excavated, including a temple, several possible granaries, plazas, ritual dumps, and agricultural terraces. These excavations are described in Smith et al. (1989) and Smith (1992b); Figure 1 shows the locations of the sites relative to Xochicalco and Cuernavaca.

The chronological research of the Postclassic Morelos Archaeological Project was designed to help answer the following questions: (1) What was the rhythm of demographic change in the centuries preceding Spanish Conquest? (2) How and when did patterns of social complexity develop in rural Morelos? (3) What was the influence of external contacts—particularly Aztec conquest and long-distance trade—on rural society? These and other questions of social change called for a three-stage program of chronology building: (1) the establishment of a relative sequence of ceramic phases; (2) the assignment of excavated structures and deposits to those phases; and (3) the chronometric dating of the phases. These three stages are integral parts of the overall research process, not preliminary steps that precede consideration of social patterns and social change.

THE RELATIVE CHRONOLOGY

Establishment of the Postclassic Chronology at Xochicalco

The Postclassic ceramic sequence for western Morelos is shown relative to other central Mexican chronologies in Figure 2. Division of the Postclassic period (A.D. 900–1520+) into five phases makes this the most fine-grained Postclassic ceramic chronology to date in all of Mesoamerica. It was established in two steps, the first of which preceded the Postclassic Morelos Archaeological Project. This earlier work, based on ceramics excavated at Postclassic contexts at Xochicalco, is reviewed here briefly; more detail may be found in Smith (1983).

Xochicalco is best known as a large and important urban center during the Gobernador phase of the Epiclassic period, A.D. 700–900 (Hirth 1984, 1991). After the collapse of the Epiclassic polity, small localized areas around the site continued to be occupied throughout the Postclassic period. Two of these areas were excavated by Hirth's Xochicalco Mapping Project in 1977 (Hirth 1991; see also Smith 1983). Study of the Xochicalco Postclassic ceramics and their stratigraphic context permitted the definition of three phases corresponding to the Early, Middle, and Late Postclassic periods. While this initial sequence corresponded to the Postclassic chronology in the well-studied Basin of Mexico and permitted comparisons between the two areas, it was not sufficiently refined to address issues related to the Aztec conquest of Morelos, which occurred around A.D. 1438. This date is in the middle of the Late Postclassic period (A.D. 1350–1520+; see Figure 2), but the stratigraphic study of the Xochicalco ceramics did not permit a clear subdivision of the Late Postclassic into Pre- and Postconquest intervals. Because the Aztec conquest and its effects on local populations was an important research question, a second stage of chronological refinement—quantitative seriation—was undertaken to clarify the issue.

Ceramic seriation focused on 21 excavated ceramic collections from Postclassic contexts at Xochicalco. These are collections of excavated sherds from unmixed stratigraphic levels. With one exception, only collections with 100 or more total sherds were used in the quantitative analysis. Nearly 100 quantitative measures were considered initially, including percentages of descriptive types, frequencies of paste categories and vessel forms, and various other numerical indices. Variables with known or suspected temporal significance were retained, as were other variables that were correlated with them. The final seriation employed 32 variables (see Table 1). Most of these are percentages and other ratios, while some are ordinal scales and other indices. Euclidean distances were calculated among all pairs of ceramic collections using these variables, and the distances were scaled using the ALSCAL software for nonmetric multidimensional scaling. The two-dimensional scaling solution yielded a horseshoe-shaped curve that clearly models the passage of time.

Figure 3 shows the two-dimensional scaling plot for the 21 ceramic collections. Chronological structure is indicated by lines drawn between the most similar ceramic collections. Pairs of collections with a Euclidean distance (or dissimilarity) between 5.0 and 6.5 are connected with thin lines, while pairs of collections with dissimilarity values less than 5.0 (i.e., the most similar collections) are connected by heavy lines. The standard assumption of similarity seriation is that the most stylistically similar collections are closest together in time, and that temporal distance increases with decreasing similarity (e.g., Cowgill 1972; Marquardt 1978). Application of this assumption to the data in Figure 3 leads to the construction of a time curve along the horseshoe-shaped path of greatest similarity (see Drennan [1976] for a similar application of multidimensional scaling to ceramic seriation).

<table>
<tr><th>Date, A.D.</th><th>Period</th><th>Basin of Mexico</th><th>Western Morelos</th><th>Cuernavaca</th><th>Eastern Morelos</th><th>Tehuacan</th></tr>
<tr><td>1500</td><td rowspan="3">Late Postclassic</td><td rowspan="3">Late Aztec</td><td>Late Cuauhnahuac</td><td rowspan="2">Tecpan</td><td rowspan="2">Tlalnahua</td><td rowspan="4">Late Venta Salada</td></tr>
<tr><td>1400</td><td rowspan="2">Early Cuauhnahuac</td></tr>
<tr><td></td><td rowspan="3">Teopanzolco</td><td rowspan="2">Tetla</td></tr>
<tr><td>1300</td><td rowspan="2">Middle Postclassic</td><td rowspan="2">Early Aztec</td><td>Temazcalli</td></tr>
<tr><td>1200</td><td rowspan="2">Tilancingo</td><td rowspan="3">Unnamed</td><td rowspan="5">Early Venta Salada</td></tr>
<tr><td></td><td rowspan="2">Early Postclassic</td><td rowspan="2">Mazapan</td><td rowspan="4">Not yet defined</td></tr>
<tr><td>1100
1000</td><td rowspan="2">Huautli</td></tr>
<tr><td>900</td><td rowspan="2">Epiclassic</td><td rowspan="2">Coyotlatelco</td><td rowspan="2">Unnamed</td></tr>
<tr><td>800</td><td>Gobernador</td></tr>
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Figure 2. Postclassic ceramic chronology for western Morelos and other parts of highland central Mexico.

The inferred time curve is shown in Figure 4. This curve was produced solely from the ceramic similarity data. Its chronological validity is established by comparison of the seriated order of the collections with their stratigraphic relations. In Figure 4, individual trenches and excavation areas are denoted by letters, and stratigraphically ordered levels (where present) are indicated by numbers. The seriation succeeds in placing nearly all of the stratigraphic levels into their correct relative order. For example, in Trench C, collection C1 is from the lowest level and C4 is from the highest level.

The seriated sequence was divided into five phases based on discontinuities in the similarity data and the presence or absence of ceramic types of known chronological significance. The five phases were labeled Huautli (originally called "Phase H"; this phase has only one collection, E1), Tilancingo (four collections, C1–D2), Temazcalli (collections E2–D4), Early Cuauhnahuac (collections C3–F), and Late Cuauhnahuac (the four B collections). The distribution of the ceramic markers across these phases at Xochicalco is presented in Smith (1987:45).

There were three weaknesses in the five-phase sequence as defined from the Xochicalco seriation. First, it was based on a limited sample of test excavations. Second, the collections classified as Late Cuauhnahuac (indicated by "B" in Figure 4) were not related stratigraphically to the Early Cuauhnahuac collections. Third, the ceramics of Early and Late Cuauhnahuac were very similar, and it was often not possible to classify a Late Postclassic ceramic collection as Early or Late Cuauhnahuac by classification or inspection. The first two problems were partially addressed by extending the

Table 1. Ceramic Variables Used in Xochicalco Seriation.

Category	Denominator	Mean Counts: Category	Mean Counts: Denominator
Ratios			
Late Aztec imports	total sherds	1.5	310.1
Guerrero imports	total sherds	1.6	310.1
Toluca Valley imports	total sherds	2.3	310.1
Teopanzolco imports	total sherds	0.8	310.1
Total decorated sherds	total sherds	27.9	310.1
Decorated jars	total sherds	4.6	310.1
Guinda (redware)	total sherds	10.0	310.1
Plain basins	total sherds	3.5	310.1
B-4 Polychrome bowls	total decorated	2.7	27.9
Complex decorated bowl forms	decorated bowl rims	2.0	10.7
Complex plain bowl forms	plain bowl rims	1.4	16.6
Unslipped jars	total jars	60.8	185.1
Black-slipped jars	total jars	13.2	185.1
Brown–black bowls	total bowls	7.1	63.8
Black-slipped-interior bowls	total bowls	5.0	63.8
Unslipped bowls	total bowls	6.0	63.8
Interior-slipped bowls	total bowls	5.2	63.8
Unslipped comals	total comals	5.6	20.4
Black-slipped comals	total comals	5.0	20.4
Tlahuica Polychrome jars	other decorated jars	0.8	3.8
Decorated hemispherical bowls	decorated conical bowls	5.3	1.8
Plain hemispherical bowls	plain conical bowls	10.0	2.8
Plain polished jars	plain unpolished jars	29.0	156.1
Comals	bowls plus jars	20.4	248.9
Bowls	comals plus jars	63.8	205.5
Ordinal Scales			
Jar rim-flare scale	—	8.2	—
Comal rim-height scale	—	5.4	—
Comal rim-break angle	—	3.6	—
Plain sherd paste-color scale	—	30.0	—
Decorated sherd paste-color scale	—	25.6	—
Plain sherd paste-texture scale	—	35.0	—
Decorated sherd paste-texture scale	—	27.9	—

results of the Xochicalco seriation to the nearby Late Postclassic site of Coatetelco (Arana 1976) through discriminant analysis (see Smith [1983] for details), but only limited stratigraphic samples were available from that site.

In summary, the quantitative ceramic seriation of Xochicalco collections may be judged successful because the seriated ordering preserves the stratigraphic relations among individual collections (the seriation was based entirely on ceramic similarity data). However, the three weaknesses mentioned above (limited sample, few stratigraphic links, and great similarity between Early and Late Cuauhnahuac ceramics) still remained after the work on the Xochicalco and Coatetelco ceramics (see Smith 1983), hampering research on processes of change.

Confirmation of the Sequence at Capilco and Cuexcomate

The excavations of the Postclassic Morelos Archaeological Project resolved the first two of these problems with the relative chronology and made progress on the third. We now have hundreds of individual ceramic collections for each of the Early and Late Cuauhnahuac phases from a number of kinds of depositional contexts, including middens and sealed architectural deposits. The two conditions of demographic growth and continuity of house occupation have produced many cases

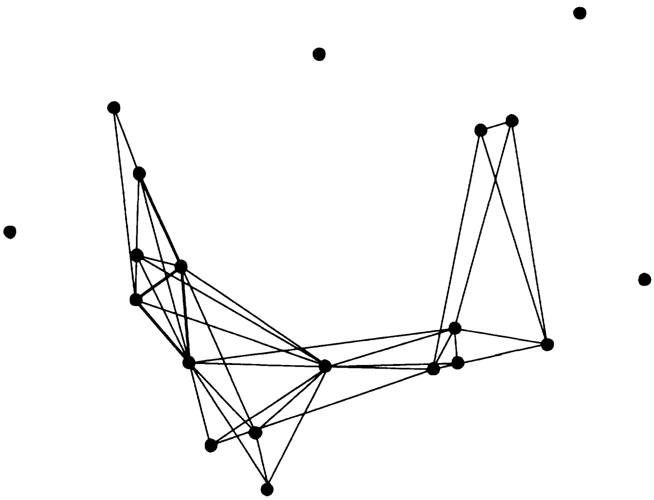

Figure 3. Multidimensional-scaling plot of Xochicalco ceramic collections. Lines connect the collections that are most similar to one another as measured by Euclidean distance. Thin lines denote dissimilarity values between 5.0 and 6.5, and thick lines denote the most similar pairs of collections (with dissimilarity values less than 5.0).

of direct stratigraphic superposition of Late Cuauhnahuac refuse deposits over Early Cuauhnahuac deposits, and two cases of Early Cuauhnahuac over Temazcalli deposits (only two Temazcalli occupations were encountered in the excavations).

Figure 5 is a cross section of excavation unit 101 at Capilco showing two stages of construction of a house and three phases of stratified refuse. The Temazcalli deposit (layer 10) is probably associated with a boulder platform several meters east of this section. The earlier stage of the house is dated to Early Cuauhnahuac by subfloor fill (layer 3) and associated refuse (layer 8), while the upper floor is similarly dated to Late Cuauhnahuac. The uppermost deposits (layers 1, 4, and 6)

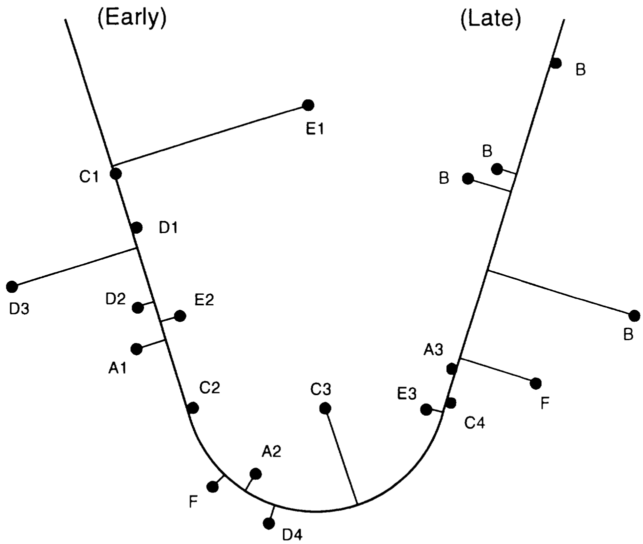

Figure 4. Multidimensional-scaling plot of Xochicalco ceramic collections with the inferred time curve. Letters denote excavation trenches or areas, with stratigraphic ordering within trenches indicated by numbers. For example, excavation C has four stratigraphically ordered collections, with C1 the lowest and C4 the highest.

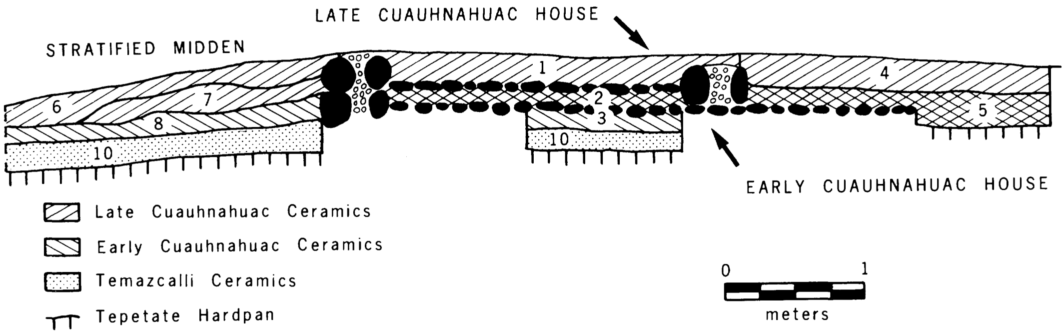

Figure 5. North-south cross section of excavation unit 101 at Capilco, showing the stratigraphic relations among Temazcalli, Early Cuauhnahuac, and Late Cuauhnahuac deposits. Architectural stones from floors and walls are indicated by black shading.

contain Late Cuauhnahuac ceramics, at least some of which probably derive from artifacts incorporated into adobe bricks that originally sat on top of the stone foundations. In an adjacent house, also with Early and Late Cuauhnahuac construction stages (unit 103), the uppermost layer (above a Late Cuauhnahuac floor) has Early Cuauhnahuac sherds. This is one of the clearest cases of a deposit formed from melted adobe bricks (see Smith [1992b] for discussion).

The stratigraphy at unit 101 and many other houses at Capilco and Cuexcomate provides abundant confirmation of the chronological relation of the Early and Late Cuauhnahuac phases as first identified from quantitative seriation. Both of these methods are essential in the establishment and confirmation of the relative chronology. Stratigraphic relations alone at Xochicalco and Coatetelco were insufficient to refine the sequence beyond three phases, but stratigraphy from the more recent excavations was crucial in the confirmation of the more fine-grained seriation sequence. However, the problem of the great similarity of Early and Late Cuauhnahuac ceramics remained.

PHASING THE DEPOSITS AT CAPILCO AND CUEXCOMATE

Although there is strong stratigraphic and quantitative support for interpretation of Early and Late Cuauhnahuac as distinct chronological ceramic phases, their ceramics are nearly identical (the ceramics are described and illustrated in Smith [1991a, 1991b]). The phase transition does not involve any major technological, stylistic, or functional shifts that might provide easy differentiation. Most identifiable types and attributes occur in both phases, but many have different frequencies. Only 2 phase "markers" (traits linked to a single phase) have been identified for each phase, and these are rare traits with mean frequencies below 1 percent. The 4 markers are: Tlahuica Polychrome bowl type B-7 and Teopanzolco Polychrome bowls for Early Cuauhnahuac (both occur as imports), and Tlahuica Polychrome bowl type I and a distinctive jar rim form (#142) for Late Cuauhnahuac (both local traits). Because of the small number of markers and their rarity, more ceramic collections were phased initially to "general Cuauhnahuac" than to either Early or Late (by ceramic collection we mean the sherds from a single excavated level). For example, of the 123 ceramic collections from 29 test pits in the random sample of houses, only 50 could be phased with confidence, and another 28 were phased with some doubt. The remaining 45 collections were classified as general Cuauhnahuac.

A major goal of the project was to make comparisons between the artifacts and conditions of the Early and Late Cuauhnahuac phases, therefore we felt that a success rate of only 40 percent in phasing the excavated deposits was inadequate. We therefore turned to the statistical procedure of discriminant analysis as a method for increasing the number of ceramic collections that could be phased (we used the SYSTAT statistical package). Before describing the analyses, we briefly outline the nature of the ceramic classification employed by the project.

A hierarchical procedure of ceramic classification was employed in order to balance the need for detailed data on the artifacts against the restraints of time and labor in the project laboratory in Cuernavaca, Morelos. All 1,215 excavated ceramic collections were examined. For 74 of these (6 percent) we only counted the sherds; these are collections of low importance like fill from well-dated deposits. Another 445 collections (37 percent) were subject to an initial gross classification into vessel forms (bowls, jars, etc.), with decorated sherds then classified by type and several additional measures (e.g., weight by form class, degree of erosion) also recorded. This level of classification permits collections to be phased (if markers are present) but does not provide sufficient data for functional inferences or statistical manipulation. The next level of analysis was the classification of sherds into descriptive types based on vessel form and surface finish in order to carry out computer phasing; another 389 collections (32 percent) were classified to this level. An additional 184 collections (15 percent) were also classified by type, and then an estimate of minimum number of vessels was made for each type. These vessel estimates are being used for comparisons of houses aimed at the study of functional and wealth-related variation at the sites. Finally, the 123 collections from the random sample test pits (10 percent) also were classified by type and minimum vessels, and then each "vessel" was subjected to an attribute analysis where detailed data on form, paste, finish, size, and use wear were recorded; these data are being used to characterize the ceramics of each phase and to make functional inferences.

In summary, of the 1,215 ceramic collections, 696 are fully classified into types. This number is reduced to 427 collections used in the quantitative phasing by eliminating collections with fewer than 100 sherds, collections from mixed stratigraphic contexts, and many collections from depositional contexts other than refuse or middens. Of the 427 collections, 191 were judged by Smith to be "well phased," and these are used in the function-definition stage of discriminant analysis; the other 236 collections are then classified by those functions into 1 of the 3 phases (Temazcalli, Early, or Late Cuauhnahuac). Table 2 lists the number of ceramic collections (cases) used in the initial, function-definition, stage of discriminant analysis. The variables in the discriminant analysis are the descriptive types mentioned above, expressed as percentages (Table 3). Bowl types and jar types are calculated as percent of total noneroded bowls and jars respectively; other types are figured as percent of total sherds. We use only the 28 most abundant types because of the statistical unreliability of very rare categories. For this reason, the variable "Teopanzolco Polychrome bowls" is the only 1 of the 4 marker types to be included as a variable in the discriminant analysis. The mean values of the variables, figured by site and phase, are listed in Table 4.

The use of discriminant functions to classify ungrouped cases into groups (i.e., to assign unphased collections to phases) is only justified if those functions do a good job of separating or discriminating between the original groups. This is determined by having the initial cases classified by the functions. If most cases are assigned to their correct group, then the functions are successful, and confidence can be placed in their subsequent classification of ungrouped cases. Our initial discriminant analysis using all 191 well-phased collections and 3 groups (Temazcalli, Early and Late Cuauhnahuac) was not as conclusive as we would have liked, having a success rate of 81 percent. However, this was not unexpected, as the ceramics of Capilco and Cuexcomate differ in a significant respect: Those at Cuexcomate are more highly eroded owing to postdepositional chemical conditions in the soil at that site (e.g., a lower pH). On many sherds surfaces have completely eroded away, thereby preventing classification into types that are based partly on surface finish and decoration. This difference in the degree of erosion led us to separate the collections of the 2 sites and run independent analyses on each set. These new discriminant analyses were more successful in assigning the well-phased collections to their proper phase: At Capilco 87 percent are classified correctly, and the figure for Cuexcomate is 96 percent. The loadings of each variable on each function are listed in Table 4.

The abilities of the discriminant functions to separate ceramic collections from each phase are illustrated graphically in Figures 6 and 7. At Capilco (Figure 6), all three phases are represented and thus there are two discriminant functions (the number of functions is always one less than the number of groups, i.e., phases in this case). The first function separates Late Cuauhnahuac from the other two phases while function 2 separates Temazcalli from the others. While the phase separation in this discriminant space is far from perfect, the ceramic collections from each phase clearly can be distinguished by the statistical procedure. A few of the overlapping collections turned

Table 2. Number of Cases and Mean Sherd Totals for Excavated Levels Used in Discriminant-Analysis Phasing.

Component	Number of Cases[a]	Mean Number of Sherds
Capilco		
Temazcalli phase	12	269
Early Cuauhnahuac phase	36	494
Late Cuauhnahuac phase	23	427
Cuexcomate		
Early Cuauhnahuac phase	21	411
Late Cuauhnahuac phase	99	614

[a] Each case represents the collection of sherds from a single unmixed excavated level.

out to be coding or phasing errors, but the others provide statistical evidence of the similarity between the ceramics of each phase. Cuexcomate was not occupied in the Temazcalli phase, and with only two phases there is a single discriminant function. Figure 7 shows the scores on this function, again with the pattern of distinct yet slightly overlapping phases.

Given the success of the discriminant functions in distinguishing between the ceramic collections of the three phases, we proceeded by having the 203 unphased collections classified by these functions. Nearly all of the resulting assignments are reasonable in that there are very few impossible phasings (e.g., Late Cuauhnahuac collections from contexts stratigraphically below undisturbed Early Cuauhnahuac layers), and newly phased collections match the occupation dates of houses previously dated

Table 3. Variables Used in Discriminant-Analysis Phasing.

Name	Description	Denominator
PBLT	total bowls	total sherds
POLT	total jars	total sherds
PBST	total basins	total sherds
PCMT	total comals	total sherds
PMS81	small spindle whorls	total sherds
PBL10	eroded bowls	total bowls
PBL11	plain bowls	noneroded bowls
PBL12	plain, polished bowls	noneroded bowls
PBL13	Brown–black bowls	noneroded bowls
PBL15	B-4 Polychrome bowls	noneroded bowls
PBL16	Teopanzolco Polychrome bowls	noneroded bowls
PBL17	eroded Tlahuica Polychrome bowls	noneroded bowls
PBL18	Guinda (polished redware) bowls	noneroded bowls
PBL21	Aztec III Black-on-orange bowls	noneroded bowls
PBL27	Black-rim orange bowls	noneroded bowls
POL30	eroded jars	total jars
POL31	plain jars	noneroded jars
POL32	polished jars	noneroded jars
POL33	Tlahuica Polychrome jars	noneroded jars
POV63	Texcoco Molded/Filleted incense burners	total "other vessels"
POV64	other long-handled incense burners	total "other vessels"
POV65	large incense burners	total "other vessels"
POV66	local spinning bowls	total "other vessels"
POV67	Aztec spinning bowls	total "other vessels"
POV68	Texcoco Fabric-marked salt vessels	total "other vessels"
POV69	Guinda (polished redware) pitchers	total "other vessels"
POV70	Guinda (polished redware) *copas*	total "other vessels"

Table 4. Phase Means and Function Loadings for Variables Used in the Discriminant-Analysis Phasing.

Vari-able	Site of Capilco					Site of Cuexcomate		
	Phases[a]			Function Loadings		Phases		Function Loading
	1	2	3	# 1	# 2	2	3	# 1
PBLT	.34	.29	.30	−.03	.32	.28	.26	.08
POLT	.43	.48	.51	.22	−.24	.57	.55	.04
PBST	**[b]	.01	**	−.13	−.10	**	**	.00
PCMT	.16	.17	.14	−.25	.03	.10	.14	−.19
POVT	.06	.05	.05	−14	.14	.05	.04	.20
PMS81	**	**	**	.06	−.15	**	**	.07
PBL10	**	.04	.08	.20	−.18	.10	.38	−.43
PBL11	.24	.18	.25	.19	.12	.30	.36	−.10
PBL12	.21	.16	.17	.02	.18	.15	.15	−.00
PBL13	.15	.17	.17	.01	−.09	.12	.17	−.11
PBL15	.02	.15	.14	.02	−.48	.06	.03	.10
PBL16	.08	.05	**	−.54	.48	.02	**	.48
PBL17	.12	.18	.20	.17	−.27	.14	.14	−.02
PBL18	.10	.07	.04	−.31	.30	.13	.12	.01
PBL21	**	.01	.01	−.02	−.22	.05	.01	.35
PBL27	.03	.01	**	−.22	.31	.01	.01	.02
POL30	.05	.07	.12	.16	−.12	.18	.54	−.42
POL31	.75	.76	.79	.07	−.04	.85	.89	−.06
POL32	.21	.22	.20	−.05	−.01	.12	.09	.06
POL33	.03	.01	**	−.28	.42	.01	**	.23
POV63	.04	.03	.09	.22	−.01	.07	.03	.12
POV64	.26	.22	.20	−.04	.09	.21	.16	.09
POV65	.02	.01	.01	.02	.17	.10	.04	.16
POV66	.10	.12	.18	.20	−.11	.10	.17	−.16
POV67	**	.10	.10	.04	−.34	.10	.07	.01
POV68	.02	.02	.02	−.12	.16	.30	.34	−.05
POV69	.01	**	**	−.21	.25	.10	.09	−.05
POV70	**	**	**	−.12	.02	.03	.04	−.03

[a] Key to phases: 1 = Temazcalli; 2 = Early Cuauhnahuac; 3 = Late Cuauhnahuac.
[b] "**" denotes variables whose mean frequencies are below .005.

by inspection alone. Furthermore, site-occupation patterns observed in the well-phased collections also emerged from the newly phased material. The most important of these patterns are processes of residential stability and population growth. With a single exception, all houses occupied in Early Cuauhnahuac continued to be occupied in Late Cuauhnahuac, while many houses have only a Late Cuauhnahuac occupation.

With the results of the initial typological phasing and the new discriminant-function phasing in hand, we reviewed the stratigraphy of every excavated structure and assigned phases to the remaining unphased strata. In most cases this was simple and straightforward given the new results, because the collections phased by the statistical procedure (i.e., those subjected to the full classification) were initially selected to represent nearly all of the important cultural strata at the two sites. In a few cases where the data were contradictory, archaeological experience and judgment won out over quantitative classification.

DATING THE PHASES

Radiocarbon Dates

The Postclassic Morelos Archaeological Project undertook a program of chronometric dating in order to anchor the relative ceramic sequence in time. Twelve radiocarbon dates and 154 obsidian-

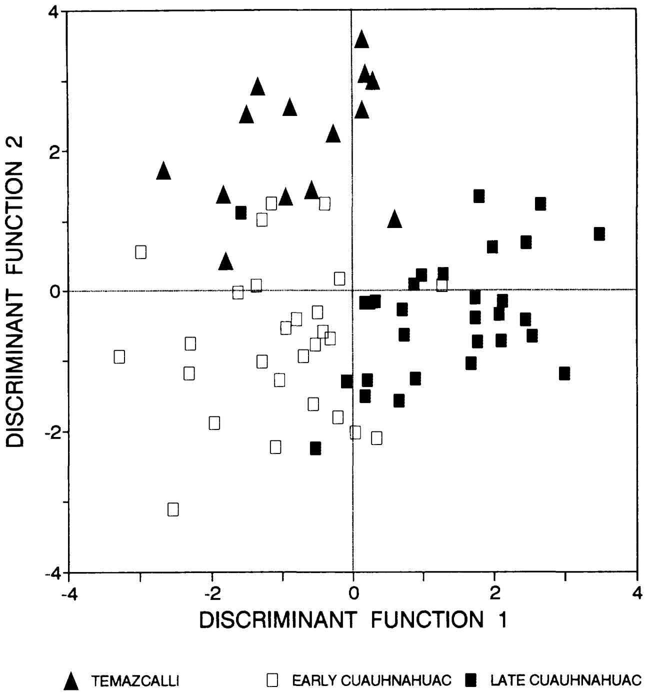

Figure 6. Plot of discriminant-function scores for well-phased ceramic collections at Capilco. Each point represents one ceramic collection.

hydration dates were obtained; we had planned to use archaeomagnetic dating also, but no appropriate burned-clay deposits were encountered. The carbon samples provide a basis for assigning dates to the ceramic phases, but problems with the obsidian results prevent their use as an independent source of dates. The radiocarbon dates, along with two additional dates from a Postclassic house in eastern Morelos, are listed in Table 5; they are portrayed graphically in Figure 8. All samples but one are carbonized wood. The western Morelos radiocarbon dates were processed by the Radiocarbon Laboratory of the Institute for the Study of Earth and Man, Southern Methodist University, under the direction of Herbert Haas, and they are presented here for the first time. The samples from eastern Morelos were done by the Illinois State Geological Survey under the direction of Dennis Coleman (Norr 1987).

The western Morelos dates are corrected for isotope fractionation, and all of the dates are calibrated using the computer program of Stuiver and Reimer (1987), employing the high-precision 10-year determination scale (Stuiver and Becker 1986). Radiocarbon ages, their associated errors, and the calibration intercepts are all reported to the nearest decade following the standard reporting guidelines of the journal *Radiocarbon*. The original unrounded ages and errors were used as input in the calibration software. The Postclassic period is a time when the calibration curve fluctuates, producing multiple intercepts for some samples. All intercepts are listed in Table 5 and Figure 8, and the figure also indicates the level of probability for each interval as given by the calibration software. The dates in Figure 8 are arranged in chronological order (keeping eastern and western Morelos separate), with a space separating clusters of dates attributed to each phase.

Although no carbon samples were obtained from the two Temazcalli deposits at Capilco, we attribute sample SMU-2180 from an Early Cuauhnahuac level in unit 102 to that phase. Its intercept of 1280 is over a century earlier than other Early Cuauhnahuac dates, and the Temazcalli phase is linked by tradewares to the Tetla phase (ca. A.D. 1200–1400). Sample SMU-2180 is from a stratum that overlies a Temazcalli deposit and may represent a construction beam from a Temazcalli house

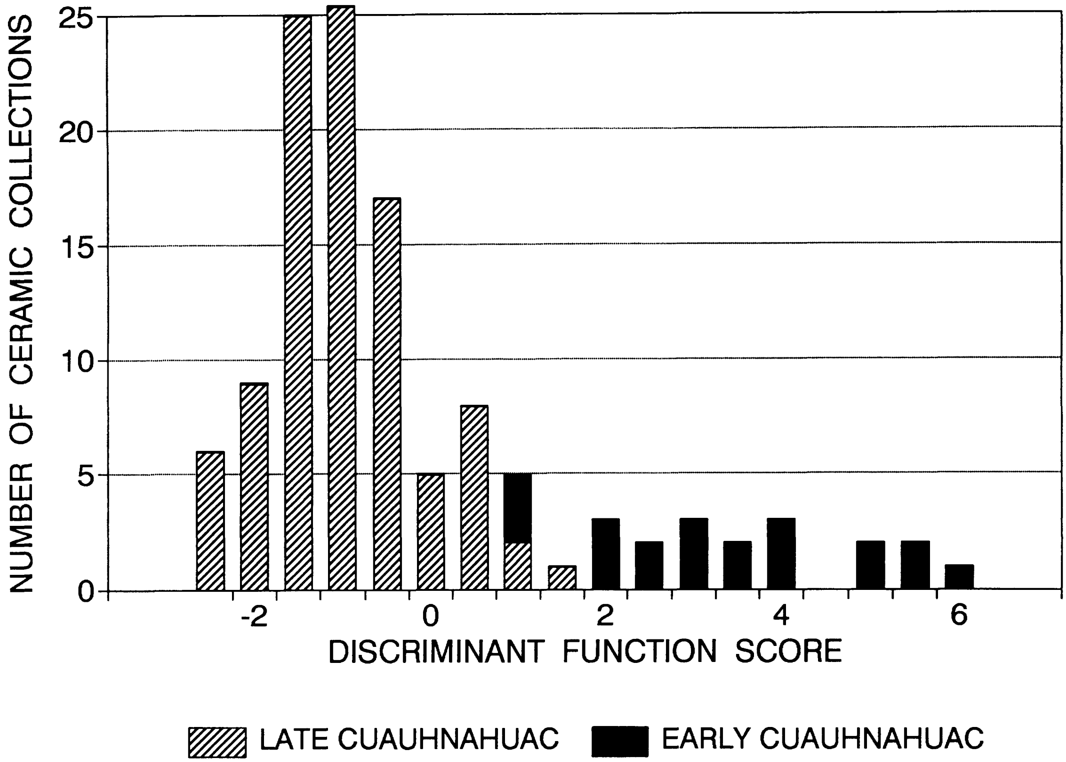

Figure 7. Plot of discriminant-function scores for well-phased ceramic collections at Cuexcomate.

that was discarded during one of the two Early Cuauhnahuac architectural modifications of the unit 102 house. Sample SMU-2213 is from carbonized plant material that was part of an offering at Site 3, a farmstead located between Capilco and Cuexcomate. The very few sherds recovered at this site could pertain to any of the three phases under consideration here, but the intercepts around 1200 suggest that this may be a Temazcalli deposit (the large sigma makes interpretation difficult). The two other samples from Early Cuauhnahuac levels have intercepts of 1420 and 1425. If these are accepted as valid dates for that phase, then two dates from Late Cuauhnahuac contexts that precede 1420 should be attributed to the Early Cuauhnahuac time span. Again, the deposition of "old wood" in midden deposits (see Schiffer 1986) may signal the discard of deteriorating roof beams (there are Early Cuauhnahuac houses very close to the Late Cuauhnahuac middens where these samples were recovered).

The other two Late Cuauhnahuac carbon samples give calibrated dates of 1430 and 1440, with two unphased or general Cuauhnahuac samples having intercepts of 1480 and 1490. These four samples can be used to date Late Cuauhnahuac. One sample from a culturally ambiguous context (SMU-2212) has three colonial period intercepts. This sample is from a deposit of Early Cuauhnahuac platform fill that had eroded out of the deteriorating platform in either Late Cuauhnahuac or colonial times, and the carbonized wood may derive from trees that grew on the mound. One sample with a very early date is not shown in Figure 4. Sample SMU-2207 from plaza fill at Cuexcomate yielded a Classic period date. Small rural sites were common in this area at the time (Hirth 1991), though no Classic occupation was found in the immediate vicinity of Cuexcomate.

Calendar-year dates for the ceramic phases are based primarily on the radiocarbon dates discussed above, with supplemental support from crossties to the radiocarbon-dated Tetla phase. Crossties

Table 5. Postclassic Radiocarbon Dates from Morelos.

Sample	Age[a]	Date[b] (A.D.)	Phase[c]	Site[d]	Provenience	Context
SMU-2180	740 ± 30	1280	EC	1	102-702-02	midden
SMU-2181	540 ± 40	1410	LC	1	157-223-06	midden
SMU-2206	500 ± 100	1425	EC	1	102-302-03	midden
SMU-2207	1505 ± 70	570	LC	2	240-043-03	plaza fill
SMU-2208	430 ± 40	1440	LC	1	101-652-03	midden
SMU-2209	500 ± 40	1420	EC	2	202-142-06	midden?
SMU-2210	620 ± 30	1310 1370* 1390*	LC	2	202-182-02	midden
SMU-2211	350 ± 70	1490	GC	2	241-013-02	offering
SMU-2212	320 ± 40	1530* 1560* 1630	—	2	204-672-02	architectural collapse
SMU-2213	850 ± 210	1190 1200 1210	—	3	320-027-01	offering
SMU-2363	470 ± 40	1430	LC	2	224-042-03	ritual dump
ETH-6309	380 ± 60	1480	GC	2	230-063-06	agricultural terrace
ISGS-508	720 ± 75	1280	Tt	4	—	housefloor
ISGS-509	610 ± 75	1320 1370* 1390*	Tt	4	—	intrusive feature

[a] Radiocarbon ages, errors, and calibrated dates are all reported to the nearest decade in accordance with standard reporting guidelines established for the journal *Radiocarbon*. Error factors are expressed for one standard deviation.

[b] The date column lists the calibration curve intercept(s) as given in the computer program of Stuiver and Reimer (1987). Where there are multiple intercepts, those with an asterisk lie within the interval of highest probability (see Figure 4).

[c] Phase refers to the ceramic phase assigned to the context from which the carbon sample was taken. The phases are: EC = Early Cuauhnahuac; LC = Late Cuauhnahuac; GC = General (unphased) Cuauhnahuac; and Tt = Tetla.

[d] The sites are: 1 = Capilco; 2 = Cuexcomate; 3 = Site 3; and 4 = Tetla.

to the poorly dated relative chronologies of the Basin of Mexico and the Cuernavaca area are also relevant. *Temazcalli* is dated at A. D. 1200–1350. The starting date is based partly on the radiocarbon dates and partly on the existence of the stratigraphically earlier Tilancingo phase (at Xochicalco), which has crossties to Early Aztec in the Basin of Mexico (see Table 1; the Tilancingo phase is discussed in Smith [1983]). Temazcalli deposits have trade sherds from three Middle Postclassic ceramic complexes (Tetla, Teopanzolco, and Early Aztec), confirming its general dating. A date of 1350 for the Temazcalli/Early Cuauhnahuac transition is offered as a reasonable estimate. *Early Cuauhnahuac* should begin earlier than about 1370 because it represents the initial occupation of Cuexcomate, and date SMU-2210 from that site has high-probability intercepts of 1370 and 1390. The tight clustering of the four Early Cuauhnahuac carbon samples suggests that the phase does not begin too much earlier than 1370, however. While this phase transition could conceivably be pushed as far back as 1300, a date of 1350 appears more reasonable at this point.

The Early to *Late Cuauhnahuac* transition is placed at A. D. 1430 to postdate the final Early Cuauhnahuac dates and to precede the dates of 1430 and 1440 for Late Cuauhnahuac. SMU-2363 (1430) may be less likely to represent old or reused wood than most other samples because of the nature of this deposit. Unit 224 is a "ritual dump" where large numbers of domestic artifacts were discarded in an apparent single episode, perhaps signaling a New Fire calendrical ceremony as described in Aztec ethnohistoric sources (see Smith [1992b] for discussion). The carbonized wood in this deposit was probably part of a domestic tool or perhaps firewood rather than a discarded

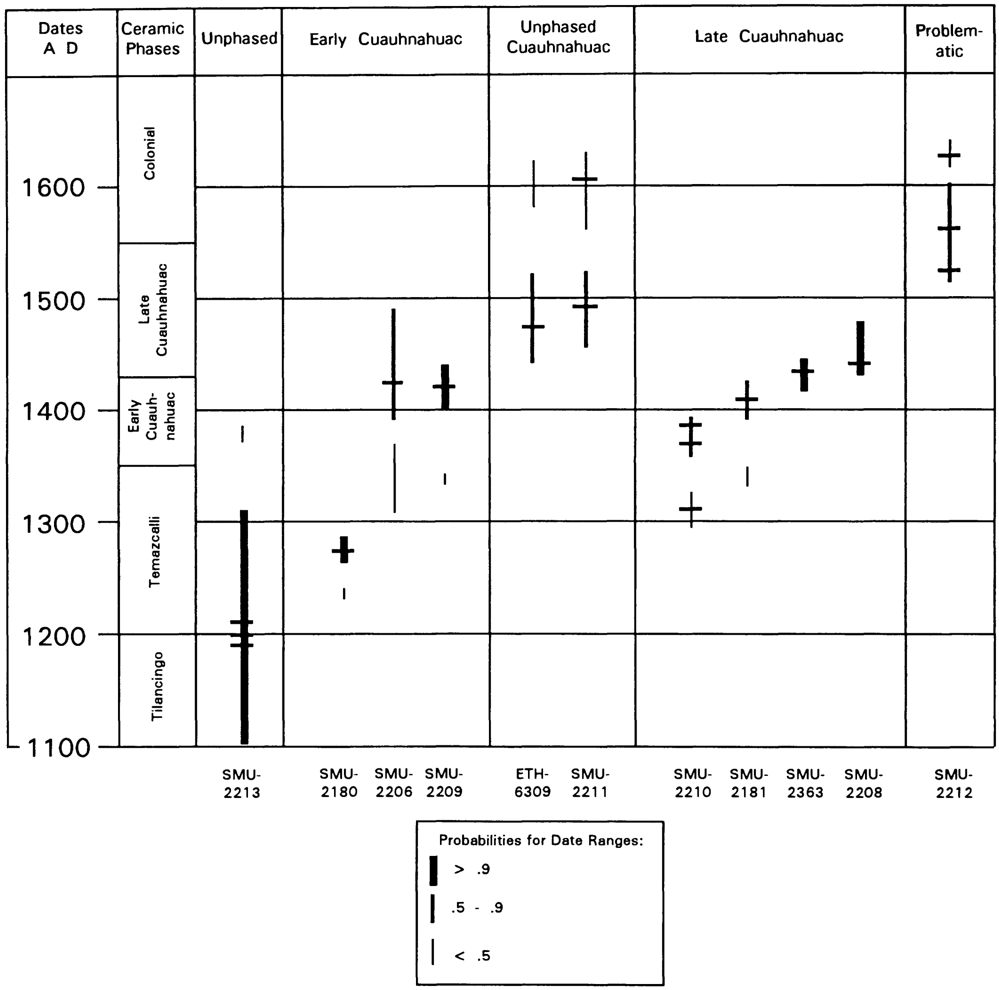

Figure 8. Calibrated radiocarbon dates for Postclassic contexts in Morelos. Horizontal-line segments depict the unrounded calibration curve intercept(s) for each date (some dates have more than one intercept; see text for discussion). The intercepts, intervals, and the probabilities associated with each interval are calculated using the computer program of Stuiver and Reimer (1987).

roof beam, suggesting the start of Late Cuauhnahuac not long before 1430. The date of 1442 (SMU-2208) comes from stratum 7 at unit 101 (Figure 1), the lower of two Late Cuauhnahuac layers, suggesting its placement early in that phase.

The Late Cuauhnahuac phase probably continues until some point after 1521, the date of the Aztec surrender to Cortés, but it is not yet possible to date the end of the phase. The only post-1521 radiocarbon date (SMU-2212) is from a very ambiguous context, and in all likelihood this sample does not in fact date any occupation at the site (the house group from which the sample comes was abandoned prior to the Late Cuauhnahuac phase). The only colonial artifacts at these sites are a few ceramic figurines that appear to be in Spanish early colonial style (Cynthia Charlton, personal communication 1989). Historical documents may hold the key, because Capilco and Cuexcomate were almost certainly abandoned by Spanish administrative order, with the surviving inhabitants moving to the nearby *congregación* site of Tetlama. Although specific documentation is lacking, Gerhard (1972:97, 1977) indicates that there was a series of *congregaciones* (forced population nucleation) in the area in the 1550s. We therefore assign a date of 1550 for the end of the Late Cuauhnahuac phase at Capilco and Cuexcomate.

In summary, we propose the following dates for the ceramic phases: Temazcalli, 1200–1350; Early Cuauhnahuac, 1350–1430; and Late Cuauhnahuac, 1430–1550. These dates should be viewed as approximations for three reasons: (1) they are based upon a limited number of radiocarbon dates, (2) the radiocarbon dates are intervals with varying probabilities rather than points, and (3) the actual changes from one ceramic phase to another were subtle and probably gradual in nature.

Obsidian-Hydration Dates

In an attempt to provide a second and independent set of chronometric dates for the phases, 154 obsidian-hydration dates were run from 22 well-phased contexts at Capilco and Cuexcomate (this work was done by Christopher Stevenson of Archaeological and Historical Consultants). Although we followed recommended procedures for successful obsidian dating (see Freter 1988; Michels 1986; Stevenson et al. 1989), the results suggest a limited usefulness for obsidian hydration as an independent source of dates for these contexts. Artifact samples were limited to the distinctive green obsidian known to come from the Pachuca source area (Charlton and Spence 1982) in order to eliminate intersource variation in hydration rates. Seven artifacts were selected from each of 22 excavated contexts (most contexts are excavated levels in midden deposits) to provide multiple-date estimates for each context. The contexts were selected to cover the three ceramic phases and to compare with the radiocarbon dates. Soil temperature was measured by thermal cells buried in the cultural deposits near patio group 10 at Cuexcomate. Finally, a new induced-hydration experiment was done by Stevenson on a piece of Pachuca obsidian supplied by Thomas Charlton and Deborah Nichols (see Stevenson et al. [1989] on the method used).

In spite of following these procedures designed to maximize the chances of successful hydration dating, there are two major problems with the dates. First, Cuexcomate registers dates consistently more than 100 years earlier than Capilco for each phase. A cultural origin for this time lag is ruled out by the close proximity of the sites, the identity of their ceramic assemblages, and the radiocarbon dates. The explanation probably lies in differences between the soil temperatures or soil types at the two sites. In New Mexico, Ridings (1991) reports significant soil-temperature differences between (and within) nearby sites that are due to differences in vegetation cover, elevation, and slope aspect. In the absence of multiple direct soil-temperature readings at each site (as advocated by Ridings), the possible effects of these factors are difficult to evaluate for Capilco and Cuexcomate. The sites' elevations are within 20 m of each other, and surface vegetation does not differ signficantly, but Capilco is on an east-facing slope while most of the deposits at Cuexcomate are on a ridgetop.

Another possibility concerns differences between soil conditions at the two sites. Cultural deposits at Capilco occur in both the A and B horizons, which consist primarily of clay loams and sandy clay loams over a C horizon of loamy sand hardpan known as *tepetate*. At Cuexcomate, on the other hand, the archaeological deposits occur in the A horizon that rests on a B horizon of culturally sterile heavy clay. The A horizon soils have a high clay content and are more acidic than soils at Capilco, and these conditions might lead to a more rapid hydration rate at Cuexcomate due to hydrological and/or pH considerations. Ericson (1988:215) points out that, "beyond effective temperature, the effects of environmental variability on the rates of hydration [of obsidian] have not been determined." McGrail et al. (1988) show that soil chemistry affects the hydration rate of archaeological obsidian, and Ridings (1991) discusses the effects of local hydrology on the hydration process. Unfortunately, these factors cannot be incorporated into the calculations of site-specific hydration rates given current understanding of the method.

A second problem with the hydration dates is that the seven obsidian dates from each context exhibit unacceptably large variations, generally on the order of three centuries (the average standard deviation of the seven dates from each context is 160 years). Stratigraphy, seriation, and radiocarbon dating results rule out a cultural explanation for this dispersion (i.e., houses were not occupied for many centuries, deposits are not heavily disturbed, etc.). A likely cause is variation in hydration rates within the Pachuca obsidian flow. The green obsidian is found in outcrops over an extensive area (Charlton and Spence 1982), and preliminary studies have identified significant chemical variations within the source (Glascock et al. 1989). The nature and extent of this variation is not yet known in detail, but it may very well lead to differences in hydration rates for the quickly hydrating Pachuca obsidian.

In spite of these problems, the mean dates per phase at Capilco (but not Cuexcomate) are not unreasonable: 1274 for Temazcalli, 1384 for Early Cuauhnahuac, and 1481 for Late Cuauhnahuac. However, only four of the seven contexts at Capilco and three of 15 at Cuexcomate have mean dates that would fit with the radiocarbon and cross-dating chronology. Furthermore, obsidian dates from contexts yielding radiocarbon samples do not match the calibrated carbon dates very closely. Thus while the obsidian dates may appear to provide a rough level of support for the radiocarbon chronology, the extreme dispersion of dates within contexts, phases, and sites indicates an overall low level of precision or resolution for obsidian hydration at these sites. As pointed out by a number of authors (e.g., Ericson 1988; McGrail et al. 1988; Ridings 1991), there are serious methodological obstacles, particularly involving the influence of local environmental variation on hydration rates, that must be overcome before obsidian hydration can be considered an accurate chronometric-dating method.

DISCUSSION

Correlation with Ethnohistory

Written documentation for Postclassic chronology and social change in Morelos is scanty, consisting mainly of scattered remarks in native historical texts from the Basin of Mexico. The major events are described in Smith (1984, 1986, 1987) along with suggestions concerning their archaeological implications. Our current chronological research provides firm support for what had been tentative hypotheses. The following is a brief summary of the major correlations.

The start of the Temazcalli phase has been correlated with the arrival of the Tlahuica ethnic group who were most likely the first Nahuatl speakers to settle in Morelos. This event is dated by ethnohistoric sources to the very early thirteenth century (Smith 1984). While our research provides only limited information on the Tilancingo–Temazcalli transition, the hypothesized date of A.D. 1200 is quite reasonable in light of the radiocarbon dates, and our ceramic and obsidian data confirm two components of this correlation: the abundant presence in Temazcalli deposits of Tlahuica polychromes and trade objects from the Basin of Mexico. The Temazcalli–Early Cuauhnahuac transition does not correlate with any known specific event, but two of the major artifactual trends—a dramatic rise in imports from the Basin of Mexico coupled with a decline in imports from the west—match closely the documentary record of growing interaction between Cuauhnahuac and the polities of the Basin of Mexico (Smith 1986).

The correlation between the Early to Late Cuauhnahuac transition and the Mexica (Aztec) conquest of Morelos in 1438 is discussed in detail in Smith (1987). The primary contribution of our research here is to replace the "guess" date of the archaeological change (1440) with an estimate based on radiocarbon evidence (1430). Even if this date were to be moved up several decades, the overall correlation would still stand. Artifactual and other archaeological changes are still being analyzed, but while they appear to confirm earlier findings (Smith 1987) it appears at this point that incorporation of the area into the Mexica empire may have had little direct economic effect on rural society (Smith 1992b). One difficulty in studying this issue is the loose nature of Mexica imperialism and the low levels of impact it had on conquered populations compared to many other ancient empires (Smith 1986; Smith and Berdan 1991). The Spanish conquest of central Mexico in 1521 had no clear immediate impact on the excavated sites, apparently paralleling the situation documented by Charlton (1976) for the Teotihuacán Valley. However, the radiocarbon dates are consistent with the historical suggestion that the sites were abandoned in the mid-sixteenth century.

Chronology Building and Social Change

The chronological research described above was undertaken for both empirical and theoretical reasons. Empirically, the archaeological and ethnohistoric records for Postclassic central Mexico both reveal major and rapid processes of social change, and archaeological findings from Morelos need to be dated and compared with other areas. Theoretically, the work of Braudel and others tells us that archaeologists need finer temporal resolution in order to address such processes as imperialism, urbanization, and economic intensification. Effective comparisons of archaeological findings with results in other areas and with independent sources such as ethnohistory require that local archaeological chronologies be established on their own merits before comparisons or correlations are attempted (Smith 1987). This avoids the circular reasoning that occurs when hybrid sequences are compared with one another and increases the reliability of comparative work.

Several serious problems remain with the Morelos Postclassic chronology. First, the great similarity of the ceramic complexes of Early and Late Cuauhnahuac can prevent the phasing of small or mixed collections. We excavated a series of agricultural terraces but cannot phase them beyond "General Cuauhnahuac," and thus it is difficult to relate their construction to specific demographic and social changes between the phases. Similarly, surface collections at these sites cannot be effectively phased (even using discriminant analysis), limiting the temporal resolution of settlement-pattern work in the area. A second problem is the ambiguity associated with the obsidian-hydration dates. Further methodological refinements including controlled comparisons with other dating methods and incorporation of soil chemistry into the hydration equation are needed before obsidian hydration can be considered a reliable independent chronometric technique for these sites.

A third problem is the low level of temporal resolution in other parts of Morelos and central Mexico. For several decades, the Basin of Mexico has stood out as an island of chronological control in a sea of very long ceramic phases, making comparisons and macroregional interpretations difficult if not impossible. Western Morelos now represents a similar zone of refined phases (see also Hirth 1991) within a large area south and west of the Basin of Mexico where the "Postclassic" is often treated as a single temporal unit. For that area, refined phases on the order of 200 years in length are needed before even large-scale issues like demographic change can be addressed. For the Basin of Mexico, where 200-year phases have long existed, a finer sequence is required as scholars turn from questions of population growth and settlement patterns to issues such as Aztec imperialism or the changing configurations of city-states and market systems.

The refined chronology described here permits the analysis of processes of social and economic change in Morelos with a finer temporal resolution than is possible in other areas like the Basin of Mexico. One benefit of this is the discovery of a two-century-long agrarian cycle that operated from the Temazcalli through Late Cuauhnahuac phases in western Morelos. The peasants of western Morelos went through a period of population growth, colonization of new lands, expansion of terraced agriculture, and an increase in trade, all leading to a period of general economic prosperity in the Temazcalli and Early Cuauhnahuac phases. Then as the limits of agricultural and economic growth were reached without a drop in population growth, there was a decline in overall standards of living and a time of economic retraction in the Late Cuauhnahuac phase (see Smith 1992b; Smith and Heath-Smith 1991). This agrarian cycle, which resembled parallel "boom-and-bust" developments in other preindustrial states (e.g., Le Roy Ladurie 1972; Miller and Hatcher 1978), would be submerged in the Postclassic phases of two or more centuries that characterize most regions of Mesoamerica. Just as social and economic issues such as the impact of Aztec imperialism led to the chronology-building efforts described above, the new refined chronology permits finer-grained processes (like the hypothesized agrarian cycle) to be discovered and studied.

Chronology building and the study of social change stand in a dialectical relation to one another, and advances on one side should lead to further advances on the other (Plog and Hantman 1990). Chronological research is thus not an autonomous activity but rather an integral part of the entire archaeological research process.

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