21. Formative Period Settlement Patterns in the Río Amatzinac Valley

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The analyses of regional settlement patterns can make a valuable contribution to the understanding of the cultural and social evolution of a particular region. The location of human groups within their environments and the way in which this changes through time are the products of a multifaceted decision-making process. The location of settlements in relation to naturally occurring resources may be an indication of a variety of economic activities, either primary (agriculture, hunting and gathering, mining) or secondary (manufacturing, etc.). Settlements are also spaced in relation to existing social relationships, with competitive settlements tending to be more distant from one another than those which are strongly linked.

This chapter traces the growth and development of regional population organization in the Río Amatzinac Valley between 1250 and 150 BC. In doing so I try to hold to the distinction made between "settlement patterns" and "settlement systems" (Flannery 1976c: 162) to the extent that surface reconnaissance permits. The "settlement system" is the set of rules behind the location of communities in the region. It is these rules which generate the actual configuration of sites found throughout the region which we call the "settlement pattern." In this research the configuration was identified through an extensive surface reconnaissance. Our understanding of the settlement system was derived from a qualitative and quantitative analysis of all site-specific and regional ecofacts measured both during and subsequent to the survey.

METHODOLOGY

The purpose of the settlement reconnaissance was to determine the relationship of Chalcatzingo to its larger physiotopographic region, the Río Amatzinac Valley, described in Chapter 2. Approximately 80–85 percent of the valley was surveyed with the intent of locating and mapping every site on the valley floor, establishing their chronological relationships, and reconstructing a picture of demographic development up until the Spanish conquest. In line with the overall objectives of the Chalcatzingo Project, particular emphasis was placed on the reconstruction of Formative period settlement systems.

Saturation coverage was the main objective of the survey. This guaranteed that enough small sites would be included in the site sample to accurately delineate the nature of relationships between ceremonial centers and their rural hinterlands. An intensive field methodology was selected which very closely resembles the type used in the Valley of Mexico surveys (Sanders 1965; J. Parsons 1971; Blanton 1972). A more vigorous strategy for sampling surface debris was employed, however. Every field in the study area was inspected, and collections of ceramics and chipped stone tools were made at each site. This enhances our ability to narrow our settlement phases as chronologies in central Mexico are refined in the future. Other modifications included the standardization of size/density measurements and ratios used in projecting population estimates, and the identification and control of conditions which can cause errors in the description and periodization of sites.

The Amatzinac Valley was surveyed as a cohesive unit without employing a probabilistic sampling design. We felt that it was worth the time and effort to obtain as large a contiguous sample around Chalcatzingo as possible since this was the first intensive survey ever conducted in Morelos. This also allowed us to use the Nearest Neighbor spatial statistic in later stages of the analysis, whereas random, cluster, or stratified designs using quadrant or transect sampling frames (see Plog 1976a) create a boundary problem for this spatial statistic which greatly reduces its descriptive capacity (Earle 1976; Haggett 1965).

Boundary effects were also decreased by rapidly surveying small areas along the edges but outside of the intensive coverage area. The largest of these zones of minimal coverage is shown as MC on Figures 21.2–21.4 and 21.6.

A variety of conditions guided our selection of specific field procedures. Maps suitable for use in the field were not available for the Río Amatzinac region, so aerial photos were used to locate and record sites. These could be purchased at scales of 1:30,000 and 1:5,000. Relatively permanent agricultural parcels partitioned the landscape into units which are readily distinguishable both on the aerial photographs and on the ground. Sites could be located using numerous visible points of reference, and the fields could be used as individual collection units.

Although much of the valley area occupied during prehispanic times is unpopulated today, special care had to be taken in the Zacualpan-Amilcingo area in the northern part of the valley, where contemporary population is dense. While traces of large and medium-sized sites could be located without difficulty, it is my impression that modern habitation has obliterated many of the small sites in this area. My estimates of population in the northern Pithecellobium Woodland zone may therefore be underestimated for some time periods.

Ground cover throughout the survey zone was thin except across sloping hill and mountain areas used largely for grazing and collecting firewood. Erosion and the redeposition of soil have not contributed significantly to the destruction of sites throughout the region. Agricultural disturbance is relatively consistent. Oxen plowing is the dominant cultivation technique. Deep tractor plowing has increased in frequency since 1973, spreading from the irrigated areas to most portions of the valley.

Field Procedures

Flat terrain and high ground visibility allowed us to use a "dragnet" approach. The daily work group was a team of five to eight trained crew members who were spaced at intervals of between 20 and 60 m during the sweeps. A total of 454 km^2 were surveyed during the five-month period between January and May of 1973.

The field spacing of survey crew members varied with the nature of terrain and type of work planned that day. A major goal was for the survey unit to work as a team. Each investigator was responsible for a wide range of general observations as well as a number of specific ones depending on his or her particular field of expertise (plant ecology, drainage, soil, etc.). Many sites needed the combined effort of two or three people to collect the necessary data in the shortest period of time. Small sites could be collected by one or two people, while village sites called for four or five. This procedure allowed us to maintain a degree of consistency in the way in which we collected the sites.

Site boundaries were established by following out the extent of surface debris, which was plotted onto the large-scale aerial photographs carried into the field. Collection areas were laid out, and a variety of other data was recorded on standardized site forms. Surface collections were taken at each site, and information on the quantity and type of archaeological material is summarized in site descriptions located in Appendix H.

We encountered a slight problem in defining sites in portions of the valley where fields were frequently irrigated. Although in situ materials could be located, individual sherds would occasionally be found in irrigation canals up to 500 m or more from the nearest site. Small collections were made of these materials, although in no way were they presumed to be in situ. When in situ materials were found, field boundaries and other points of reference were used to stratify the sites into a checkerboard of potential collection units. Collection units were standardized into units of approximately 2,500–3,500 m^2 in area, i.e., roughly 50 × 50 or 50 × 70 m units.

Because of the large area of our survey, we biased our collection toward getting a good sample of diagnostic materials. These included vessel rims, bases, handles, supports, and all painted or slipped body sherds, plus a good array of chipped stone artifacts. Approximately 300,000 sherds were collected. The quantity and nature of the ground stone artifacts were recorded, but the artifacts themselves were not removed from the site. Although these data can provide a rough idea about cultural affiliation, site function, and chronological periodization, they do not allow for more exhaustive analyses of site interaction and integration.

The density of ceramic debris was recorded in quantity-per-meter counts. These counts, along with the site area, were used to generate population estimates for the sites following the procedure outlined by Jeffrey R. Parsons (1971: 22–23) for the Valley of Mexico. Although there are numerous sources of potential error involved in using estimates of this sort, they do reflect differential human activity, and in the absence of alternative methods for calculating population can be useful heuristic measurements for testing a wide range of hypotheses.

Estimates were made by correlating Parsons' subjective categories such as "wide scattering" and "marked buildup" with our quantity-per-meter counts, represented in Table 21.1. These density types were then correlated with Parsons' estimates of persons-per-hectare (Table 21.2). Calculation of upper and lower site population limits was a simple extrapolation of the site area and the respective density measurements. No double counting of site area or surface debris was allowed.

Site areas were established by plotting the continuous distribution of materials in contiguous collection units. In multicomponent sites the intensities of surface debris were divided up according to the different time periods within the sample. When material from two time periods was equally represented, the surface density per m^2 was equally divided between the two components. When this could not be determined with confidence, the lowest density level (IA) was designated for the area as a whole.

Our reason for quantifying observations instead of using subjective categories was to derive not more *accurate* population estimates, but more *consistent* ones. Quantitative measures increase the comparability of measurements taken by a wide assortment of crew personnel, and these can be reassessed as our predictive ability increases. The site-size–debris-density correlation for estimating population needs more rigorous testing before we can assume that its figures are correct. Moreover, I have elsewhere identified a number of conditions which significantly modify a population estimate of this type (Hirth 1978c). Nevertheless, these estimates do allow us to identify demographic trends within the confines of small regions over time and should be viewed as relative and not absolute indices of population activity. Their utility resides in the fact that they are more sensitive to the amount of prior occupational activity than the size of the site expressed only in hectares. Although direct interregional comparisons of population levels are not possible, we can compare the general settlement composition and demographic trends of one region to another, and this is therefore a useful technique.

Vegetation and Landform Zones

In addition to recording basic data on sherd counts, architectural features, etc., we made other observations concerning the vegetation and generalized topographic zones. The vegetation zone classification has already been presented in Chapter 3. I have deviated from that classification in only one respect. The River Bottomland and Barranca categories have been combined into a Riverine Zone for purposes of statistical manipulation.

It would have been preferable to examine the independent effects of these zones on site location, since we know that the distribution of river bottom soil is often an important variable in determining the distribution of early agriculturalists. Unfortunately, time and project financing did not allow for the identification and mapping of regional soil types and agricultural productivity which would have allowed for reliable statistical manipulation. Since the River Bottomland is restricted in area and occurs as a subset of the broader Barranca category, it was felt that only a minimum amount of information would be lost by handling the data in this way.

The landform typology used was patterned after that of E. Hammond (1963). The topographical features observed in this typology are slope and local relief. These were combined to form eight categories: Flat Plains, Irregular Plains with

Slight Relief, Irregular Plains, Hills, High Hills, Low Mountains, Open Low Hills, and Low Hills (Hirth 1974: 70–71).

More than 90 percent of the survey area falls within the Plains categories, the predominant landform type in the valley. Irregular Plains with Slight Relief comprises possibly 10 percent of the valley, usually occurring between areas of greatly differing relief and where erosion is fairly active. Irregular Plains is found in only two locations, both in the southwest area of the valley. The Mountain and Hill categories are found most often along the valley borders, although isolated hills are also found in the middle of the valley. These latter, the Cerros Jantetelco, Delgado, Chalcatzingo, and Tenango, are all High Hills.

Settlement Hierarchy

Population estimates together with architectural features allowed us to construct an array of site types depicted in Table 21.3. Regional Centers are the largest and most densely nucleated communities in the region; as a result, they probably relied on a larger proportion of the surrounding hinterland for their subsistence requirements than did small communities. Regional Centers are always characterized by some degree of economic specialization, although whether full or part-time specialization cannot always be determined. These sites always have substantial complex civic-ceremonial architecture with high frequencies of associated material remains.

Villages are the most difficult settlement type to characterize in descriptive terms, since their composition varies and may change through time. During the Early, Middle, and Late Formative, individual villages were the residences of ranked lineages and loci of integrative ceremonial and economic activities.

The primary criterion for the Village category was population size: 101–1,000 persons, using our estimation technique. Sites were typically over 5–6 ha in area, a size which coincides fairly well with the normal range of sizes noted by Joyce Marcus (1976) for Early and Middle Formative villages throughout Mesoamerica. In the Río Amatzinac Valley, civic-ceremonial architecture could be present or absent at village communities. Such architecture ranged from platform mounds to residential terraces.

The category of villages was subdivided into large and small types on the basis of size criteria. Although important for later periods, the only instance of a Large Village during the time periods discussed here occurred during the Cantera phase: RAS-20, which grew into a Regional Center during the subsequent Late Formative period.

We also distinguished between "nucleated" villages, where only a fraction of the subsistence crops are grown in the residential area, and "dispersed" villages, where the opposite condition holds (J. Parsons 1971: 22). Settlements were considered to be dispersed when village population levels were reached with only C-type ceramic densities (Table 21.2).

Hamlets and Isolated Residences are the smallest communities in the settlement classification and appear to be the most sensitive to environmental diversity. Hamlets show clear indications of having been permanently occupied settlements, and surface indications range from house mounds to scatters of construction debris. Isolated Residences, on the other hand, are the smallest of sites, many under 0.25 ha, which generally lack indications of permanent structures. The relative and absolute frequencies of population residing in each of these settlement types during each particular phase are summarized in Table 21.4 and Fig. 21.1.

A set of hierarchical relationships between the communities is implied by these site categories, especially if we adopt a view of culture as an energy system along the lines suggested by Leslie White (1949), in which the most impor-

Table 21.1. **Sherd Density Types**

Type	*Sherd Count/Meter*	*Parsons' Categories*
IA	0.2–9	Very light to light
IB	10–19	Light to moderate
II	20–39	Moderate
III	40–59	Moderate
IV	60–79	Heavy
V	80 or more	Heavy

Source: Parsons 1971: 22–23.

Table 21.2. **Correlation between Population Size and Sherd Densities**

Population Designator	*Sherd Density Type*	*Population/Hectare*
A-type	Predominantly II, III, IV, V	25–50
B-type	Occasional IA, predominantly IB and II	10–25
C-type	IA, IB only	5–10

Source: Parsons 1971: 22–23.

Table 21.3. **Río Amatzinac Settlement Types**

Settlement Type	*Population*	*Architectural Features*
Regional Center	Over 1,000	Complex civic-ceremonial constructions
Large Village	501–1,000	Simple civic-ceremonial constructions
Small Village	101–500	With or without civic-ceremonial constructions
Hamlet	21–100	Usually no constructions beyond house mounds
Isolated Residence	5–20	No clear evidence of constructions

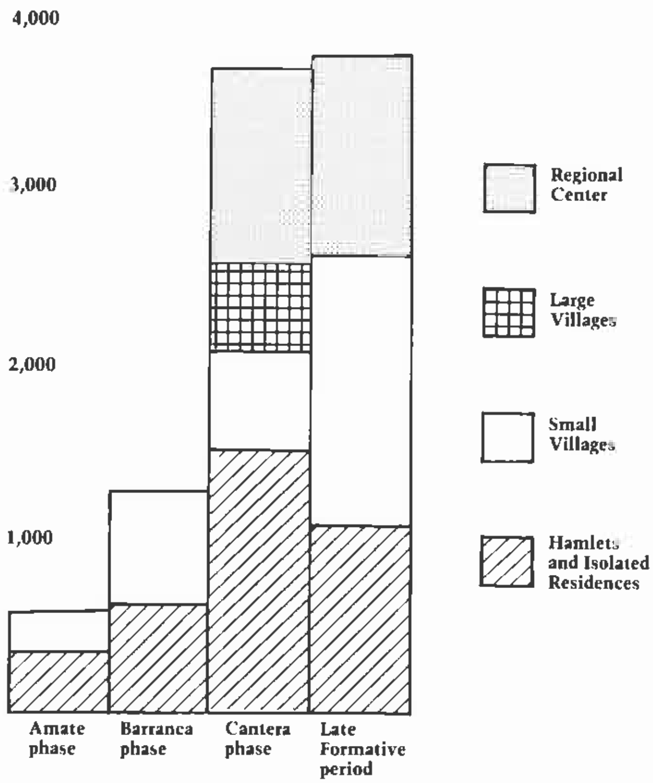

Figure 21.1. Proportions of total population by site hierarchy.

Table 21.4. **Percentage of Total Population by Site Type Hierarchy for All Phases**

Site Category	*Amate Phase*	*Barranca Phase*	*Cantera Phase*	*Late Formative*
Regional Center			30	31
Large Village			14	
Small Village	35	52	15	40
Hamlet	52	34	28	14
Isolated Residence	13	14	13	15

tant aspects of the society will be those which facilitate the conversion and utilization of energy. From this perspective, social institutions move energy throughout the society in an orderly and predictable fashion and are reflected archaeologically in the "numbers and distribution of people . . . their differential control of the total energy supply . . . [and] their utilization of various types of material objects" (Price 1974:451).

The size, internal plan, spacing, elaboration, and contents of settlements help us to establish the range of differences between communities. Although they do not specifically clarify *how* they were integrated or ranked within a settlement hierarchy, elite residences and public architecture do give us clues. As Barbara Price (1978:169) states, "The underlying rationale is that these dwellings represent differential expenditures of energy. Any construction in any center of any size in any site stratification hierarchy represents energy first produced, then taken out of circulation. A civic center represents the surplus energy produced by a population and consumed or spent in this essentially public form."

The settlement typology used here does not in and of itself explain the functional relationships between different sites or identify the number and boundaries of distinct sociocultural energy systems. Ethnographic studies have demonstrated, however, that only in extremely rare circumstances do communities exist in total ignorance of, or without interaction with, their neighbors. The ordering of settlements from large to small allows speculation about the dominant, subordinate, or independent relationships of communities with each other. In this study it is assumed that the relationship which exists, for example, between a seasonal microband camp (possibly manifested by an isolated Residence) and the permanent village to which its members belong is in some sense hierarchical. An "administrative" hierarchy may be said to exist when we find the autonomy of one group becoming subordinated to that of another.

Unfortunately, the processes which give rise to site hierarchies are poorly understood and hard to demonstrate archaeologically. Kent Flannery (1976c: 168–170) has suggested the founding of daughter communities by cadet lineages as a probable cause for the emergence of hierarchies during the Middle Formative. My discussion and reconstructed development of site hierarchies later in this chapter is based largely on the size, spacing, internal complexity, and location of settlements in relation to scarce resources. Implicit in the analysis is the assumption that large communities were normally more heterogeneous in composition and contained a greater amount and variety of service functions than smaller communities. Although this assumption of a strong positive correlation between community size and the number of activities found within communities still requires rigorous testing before we can accurately assess its appropriateness for ranked societies, it has been repeatedly shown to be true for modern communities at all levels of socioeconomic development (Berry and Garrison 1958).

This lawlike generalization does not specify, nor is it assumed in the course of this analysis, that all settlements of the same size had identical sets of functions or that larger centers had all the same functions as smaller centers. The reconstruction of site hierarchies and intrasite relationships is an uncertain business with the data at hand. The settlement reconstruction presented here awaits assessment by a research project which specifically examines the relationships between sites at the regional level, using excavation and intensive systematic surface collection.

Statistics

Several statistical techniques were used to interpret the settlement pattern and to discover previously unexpected associations among the many variables considered. A correlation statistic, Pearson's *r* (Blalock 1960:286), was used to examine the form and strength of relationship between a number of environmental and other variables (listed in Table 21.5). The environmental variables, such as landform type, drainage conditions, and vegetation zones, were included to help gain insights into subsistence strategies. Other variables, such as the size, spacing, length of occupation, and type of site, were added either as variables to be explained in the analysis or as factors in the social environment which were also important for site location. Correlation matrices for the different phases are found in Tables 21.6, 21.7, 21.8, 21.9.

The Nearest Neighbor (NN) statistic is a descriptive measure of the spatial relationships between sites and was useful in helping us to interpret at least a por-

Table 21.5. Variables Used in Statistical Tests

DSP	Distance to springs	PBAR	Percentage of the site's 1 km catchment in the Riverine vegetation zone
DRIV	Distance to rivers	PHUIZ	Percentage of the site's 1 km catchment in the Huizache Grassland vegetation zone
PITH-1	Pithecellobium Woodland vegetation zone within the 200 m site catchment	PCBS	Percentage of the site's 1 km catchment in the mixed Cerro–Barranca–Pithecellobium Woodland vegetation zone
BAR-1	Riverine vegetation zone within the 200 m site catchment	PFP	Percentage of the site's 1 km catchment in the Flat Plains topographic zone
HUIZ-1	Huizache Grassland vegetation zone within the 200 m site catchment	PIP	Percentage of the site's 1 km catchment in the Irregular Plains topographic zone
CER-1	Cerro (Interior Valley Cerros) vegetation zone within the 200 m site catchment	POLH	Percentage of the site's 1 km catchment in the Open Low Hills topographic zone
FP	Flat Plains topographic zone	PHHLMT	Percentage of the site's 1 km catchment in the High Hills and Low Mountains topographic zones
IPSR	Irregular Plains with Slight Relief topographic zone	POP	Maximum population estimates per site
PITH-2	Pithecellobium Woodland vegetation zone within the 1 km site catchment	HIER	Hierarchical classification by site
BAR-2	Riverine vegetation zone within the 1 km site catchment	CONOC	Continuous occupation at the site, Amate phase to Late Formative
HUIZ-2	Huizache Grassland vegetation zone within the 1 km site catchment		
CER-2	Cerro (Interior Valley Cerros) vegetation zone within the 1 km site catchment		
PPITH	Percentage of the site's 1 km catchment in the Pithecellobium Woodland vegetation zone		

Table 21.6. Pearson Correlation Coefficients—Amate Phase (N = 10)

	POP	HIER
DSP	−0.6304 (P = 0.025)	−0.5682 (P = 0.043)
DRIV	−0.0889 (P = 0.403)	−0.3191 (P = 0.184)
PITH-1	0.8256 (P = 0.002)	0.6881 (P = 0.014)
BAR-1	0.6035 (P = 0.032)	0.8001 (P = 0.003)
HUIZ-1	0.1775 (P = 0.312)	0.1846 (P = 0.305)
FP	−0.1775 (P = 0.312)	−0.1846 (P = 0.305)
IPSR	−0.2464 (P = 0.246)	−0.3015 (P = 0.199)
PITH-2	0.3510 (P = 0.160)	0.2632 (P = 0.231)
BAR-2	0.2464 (P = 0246)	0.3015 (P = 0.199)
HUIZ-2	0.3696 (P = 0.147)	0.4523 (P = 0.095)
CER-2	0.8043 (P = 0.003)	0.6784 (P = 0.016)
PPITH	0.0831 (P = 0.410)	−0.0457 (P = 0.450)
PBAR	0.2918 (P = 0.207)	0.3385 (P = 0.169)
PHUIZ	−0.3202 (P = 0.184)	−0.1098 (P = 0.381)
PCBS	0.5008 (P = 0.070)	0.3583 (P = 0.155)
PFP	−0.2048 (P = 0.285)	−0.2767 (P = 0.219)
PIP	−0.3452 (P = 0.164)	−0.2858 (P = 0.212)
POLH	0.8261 (P = 0.002)	0.7035 (P = 0.012)
PHHLMT	0.7690 (P = 0.005)	0.6339 (P = 0.025)
POP	1.0000 (P = 0.000)	0.9308 (P = 0.000)
HIER		1.0000 (P = 0.000)

Table 21.7. Pearson Correlation Coefficients—Barranca Phase (N = 22)

	POP	HIER	CONOC
DSP	−0.6328 (P = 0.001)	−0.8132 (P = 0.000)	0.3051 (P = 0.084)
DRIV	−0.0920 (P = 0.342)	−0.0875 (P = 0.349)	0.0870 (P = 0.350)
PITH-1	0.1330 (P = 0.278)	0.1840 (P = 0.206)	0.0713 (P = 0.376)
BAR-1	0.2020 (P = 0.184)	0.1800 (P = 0.211)	0.2232 (P = 0.159)
HUIZ-1	−0.2381 (P = 0.143)	−0.1840 (P = 0.206)	0.2424 (P = 0.139)
CER-1	0.3279 (P = 0.068)	0.2970 (P = 0.090)	0.1656 (P = 0.231)
FP	−0.2711 (P = 0.111)	−0.1955 (P = 0.192)	0.2281 (P = 0.154)
IPSR	−0.1814 (P = 0.210)	−0.2390 (P = 0.142)	−0.0247 (P = 0.457)
PITH-2	0.0293 (P = 0.448)	0.0476 (P = 0.417)	0.2214 (P = 0.161)
BAR-2	0.1252 (P = 0.289)	0.1650 (P = 0.232)	−0.1704 (P = 0.224)
HUIZ-2	0.1252 (P = 0.289)	0.1650 (P = 0.232)	−0.1704 (P = 0.224)
CER-2	0.2678 (P = 0.114)	0.2443 (P = 0.137)	0.1275 (P = 0.286)
PPITH	0.0278 (P = 0.451)	0.0376 (P = 0.434)	0.0189 (P = 0.467)
PBAR	0.1015 (P = 0.327)	−0.0059 (P = 0.490)	0.0664 (P = 0.385)
PHUIZ	−0.1644 (P = 0.232)	−0.1892 (P = 0.199)	−0.0492 (P = 0.414)
PCBS	0.3537 (P = 0.053)	0.3793 (P = 0.041)	0.0518 (P = 0.410)
PFP	−0.3007 (P = 0.087)	−0.2675 (P = 0.114)	0.0918 (P = 0.342)
PIP	−0.3553 (P = 0.052)	−0.4679 (P = 0.014)	0.0101 (P = 0.482)
POLH	0.7907 (P = 0.000)	0.4399 (P = 0.020)	−0.2045 (P = 0.181)
PHHLMT	0.4722 (P = 0.013)	0.3653 (P = 0.047)	0.0926 (P = 0.341)
POP	1.0000 (P = 0.000)	0.8056 (P = 0.000)	−0.4867 (P = 0.011)
HIER		1.0000 (P = 0.000)	−0.2755 (P = 0.107)
CONOC			1.0000 (P = 0.000)

Table 21.8. Pearson Correlation Coefficients—Cantera Phase (N = 49)

	POP	HIER	CONOC
DSP	−0.6725 (P = 0.000)	−0.7653 (P = 0.000)	0.6948 (P = 0.000)
DRIV	−0.0923 (P = 0.264)	−0.1274 (P = 0.192)	0.1378 (P = 0.173)
PITH-1	0.2046 (P = 0.079)	0.2341 (P = 0.053)	−0.3066 (P = 0.016)
BAR-1	0.2044 (P = 0.079)	0.3261 (P = 0.011)	−0.1417 (P = 0.166)
HUIZ-1	−0.1864 (P = 0.100)	−0.1405 (P = 0.168)	0.2501 (P = 0.042)
CER-1	0.2883 (P = 0.022)	0.1987 (P = 0.086)	−0.0913 (P = 0.266)
FP	−0.1156 (P = 0.214)	−0.0202 (P = 0.445)	−0.0580 (P = 0.346)
IPSR	−0.1440 (P = 0.162)	−0.2239 (P = 0.061)	0.2577 (P = 0.037)
PITH-2	0.1310 (P = 0.185)	0.0995 (P = 0.248)	−0.2057 (P = 0.078)
BAR-2	0.1666 (P = 0.126)	0.3078 (P = 0.016)	−0.2858 (P = 0.023)
HUIZ-2	0.1047 (P = 0.237)	0.1935 (P = 0.091)	−0.1229 (P = 0.200)
CER-2	0.2177 (P = 0.066)	0.2063 (P = 0.077)	−0.1299 (P = 0.187)
PPITH	0.0577 (P = 0.347)	0.0339 (P = 0.408)	−0.1303 (P = 0.186)
PBAR	0.1976 (P = 0.087)	0.2035 (P = 0.080)	−0.1219 (P = 0.202)
PHUIZ	−0.1933 (P = 0.092)	−0.1529 (P = 0.147)	0.2371 (P = 0.050)
PCBS	0.3261 (P = 0.011)	0.2278 (P = 0.058)	−0.1859 (P = 0.100)
PFP	−0.0665 (P = 0.325)	0.0784 (P = 0.296)	−0.0813 (P = 0.289)
PIP	−0.2059 (P = 0.078)	−0.2722 (P = 0.029)	0.2248 (P = 0.060)
POLH	−0.0669 (P = 0.324)	−0.1885 (P = 0.097)	0.2785 (P = 0.026)
PHHLMT	0.3976 (P = 0.002)	0.2883 (P = 0.022)	−0.1777 (P = 0.111)
POP	1.0000 (P = 0.000)	0.8292 (P = 0.000)	−0.5369 (P = 0.000)
HIER		1.0000 (P = 0.000)	−0.6847 (P = 0.000)
CONOC			1.0000 (P = 0.000)

tion of the social environment as it may have existed. The statistic was originally described by P. Clark and F. Evans (1954), and their method for computation and interpretation was followed. A basic assumption in the interpretation of the NN statistic is that the physical spacing of sites is a function at least in part of the interaction between sites and the environment.

Three conditions can be identified from this measure: randomness of site location, the degree of clustering, or the degree of regularized spacing of communities. Clustering results from the effect of key resources on settlement location or from new site formation as groups move away from existing communities and settle nearby. Regular spacing can result from situations of competition between sites where there is a conscious attempt to maintain the maximum distance between all settlements in an area to reduce or avoid potential antagonism.

The NN statistic will customarily range above and below the value of 1.0, which represents the random spacing of points. Values below 1.0 represent degrees of clustering where 0 is the point of maximum aggregation and all events are situated in one point. Values above 1.0 indicate degrees of regular spacing with 2.1491 approximating the norm of a hexagonally ordered point pattern. It is customary to eliminate sites whose Nearest Neighbor is farther away than that site is from the boundary of the study area, since including these sites in the analysis biases the results away from clustered patterns toward regular spacing. In this study, NN statistics reflect boundary elimination unless otherwise indicated. Results by phase for the Amatzinac Valley and for the Pithecellobium Woodland vegetation zone within the valley are presented in Tables 21.10 and 21.11.

THE EARLIEST OCCUPATION: AMATE PHASE

At the moment, the earliest evidence for human occupation in the Río Amatzinac Valley dates to ca. 1500 BC. The valley thus differs from neighboring regions such as the Valley of Mexico, the Tehuacan Valley, and the Valley of Puebla, where there is archaeological evidence for human occupation in the Archaic period. There are reasons for this, of which the most obvious may be the lack of research on the preceramic period. Outside of our own project there has been little attempt to detect Archaic occupations in Morelos.

Within the Río Amatzinac Valley, however, we can also identify a number of ecological variables which would have negatively influenced human activity during this period. For example, the area lacks contrasting environmental zones of the type favored by Archaic bands. A number of wild plant species which were staples of Archaic bands are rare or absent (Bugé 1978). There are some seasons when very few "collectagens" are available, although there is an overabundance at other times of the year, which would have presented problems in resource scheduling, making the valley less attractive for year-round occupation.

Periodically throughout the Archaic period, microbands from adjacent areas probably established temporary camps in the valley to exploit some of the seasonally abundant resources. Unfortunately, whatever cultural residue they may have left was not of sufficient magnitude to be detected during the course of the reconnaissance. A possible preceramic site has been found near Xalostoc (Grove, personal communication) immediately west of the survey area, although it has not been intensively investigated to determine the extent and duration of actual habitation.

A total of ten Amate phase sites (1500–1100 BC) were located during the surface survey, and these are shown in Figure 21.2. All are Hamlets or Isolated Residences with the exception of one Small Village located at the base of the Cerro Chalcatzingo (Table 21.12). Very little can be said about the range of activities in any Amate phase settlement from our surface collections alone. Eight of the ten sites are clustered in the northern half of the valley in prime agricultural areas which were densely inhabited during the Postclassic (Hirth 1974) and which have been under irrigation since at least Aztec times (Palerm 1954).

In addition to these sites, Francisco Plancarte y Navarrete (1934) reported Amate phase material from around Tepalcingo. Traces of this site could not be located, but it is possible that the site is now covered by the modern pueblo which spreads up the sides of the narrow river valley onto the neighboring hillside.

Most of the Amate phase material comes from multicomponent sites where it was either badly mixed with artifacts of later periods or recovered from such doubtful contexts as mound fill or freshly

Table 21.9. **Pearson Correlation Coefficients—Late Formative (N = 57)**

	POP	*HIER*	*CONOL*
DSP	−0.6028 (P = 0.000)	−0.6378 (P = 0.000)	0.6376 (P = 0.000)
DRIV	−0.2112 (P = 0.057)	−0.2459 (P = 0.033)	0.2213 (P = 0.049)
PITH-1	0.0190 (P = 0.444)	0.0308 (P = 0.410)	−0.1877 (P = 0.081)
BAR-1	0.2366 (P = 0.038)	0.2399 (P = 0.036)	−0.2896 (P = 0.014)
HUIZ-1	−0.0044 (P = 0.487)	0.0528 (P = 0.348)	0.0858 (P = 0.263)
CER-1	0.0178 (P = 0.448)	0.3248 (P = 0.007)	−0.3838 (P = 0.002)
FP	−0.0121 (P = 0.464)	−0.1050 (P = 0.219)	0.2011 (P = 0.067)
IPSR	−0.0928 (P = 0.246)	−0.1878 (P = 0.081)	0.1346 (P = 0.159)
PITH-2	−0.0127 (P = 0.463)	−0.0334 (P = 0.403)	−0.1573 (P = 0.121)
BAR-2	0.1326 (P = 0.163)	0.1695 (P = 0.104)	−0.1557 (P = 0.124)
HUIZ-2	0.1089 (P = 0.210)	0.1629 (P = 0.113)	−0.2348 (P = 0.039)
CER-2	−0.0098 (P = 0.471)	0.2824 (P = 0.017)	−0.4887 (P = 0.000)
PPITH	−0.0538 (P = 0.345)	−0.0595 (P = 0.330)	−0.0472 (P = 0.364)
PBAR	0.0866 (P = 0.261)	0.1188 (P = 0.189)	−0.1454 (P = 0.140)
PHUIZ	0.0404 (P = 0.383)	0.0116 (P = 0.466)	0.1397 (P = 0.150)
PCBS	−0.0317 (P = 0.408)	0.1655 (P = 0.109)	−0.3458 (P = 0.004)
PFP	0.0910 (P = 0.250)	0.1261 (P = 0.175)	0.0356 (P = 0.396)
PIP	−0.1500 (P = 0.133)	−0.2915 (P = 0.014)	0.1174 (P = 0.192)
POLH	−0.0832 (P = 0.269)	−0.0449 (P = 0.370)	0.0377 (P = 0.390)
PHHLMT	0.0167 (P = 0.451)	0.3056 (P = 0.010)	−0.4291 (P = 0.000)
POP	1.0000 (P = 0.000)	0.7827 (P = 0.000)	−0.5200 (P = 0.000)
HIER		1.0000 (P = 0.000)	−0.6293 (P = 0.000)
CONOL			1.0000 (P = 0.000)

Table 21.10. **Nearest Neighbor Statistics for All Measured Distances within the Amatzinac Valley (454 km²)**

	Amate Phase	*Barranca Phase*	*Cantera Phase*	*Late Formative*
All sites (Level I)	0.646	0.663	0.772	0.692
Pithecellobium Woodland	0.646	0.546	0.669	0.490
Huizache Grassland	NC	0.898	0.904	0.965
Level II sites (>75 persons)	0.938	1.271	1.03	1.960
Level II without boundary elimination	NC	1.315	1.209	2.051
Level IV sites (<75 persons)	0.476	0.663	0.766	0.763
Level IV without boundary elimination	0.551	NC	NC	NC

NC: no calculation.

Table 21.11. **Nearest Neighbor Statistics for All Measured Distances within the Pithecellobium Woodland Vegetation Zone, Amatzinac Valley (55 km²)**

	Amate Phase	*Barranca Phase*	*Cantera Phase*	*Late Formative*
Level I (all sites)	1.702	1.270	1.379	1.119
Level II sites (>75 persons)	2.472	2.960	2.343	4.481
Level IV sites (<75 persons)	1.255	1.195	1.528	1.288

Note: Nearest Neighbor measurements for Level II and Level IV sites were calculated using the same r_E for all sites in the Pithecellobium Woodland.

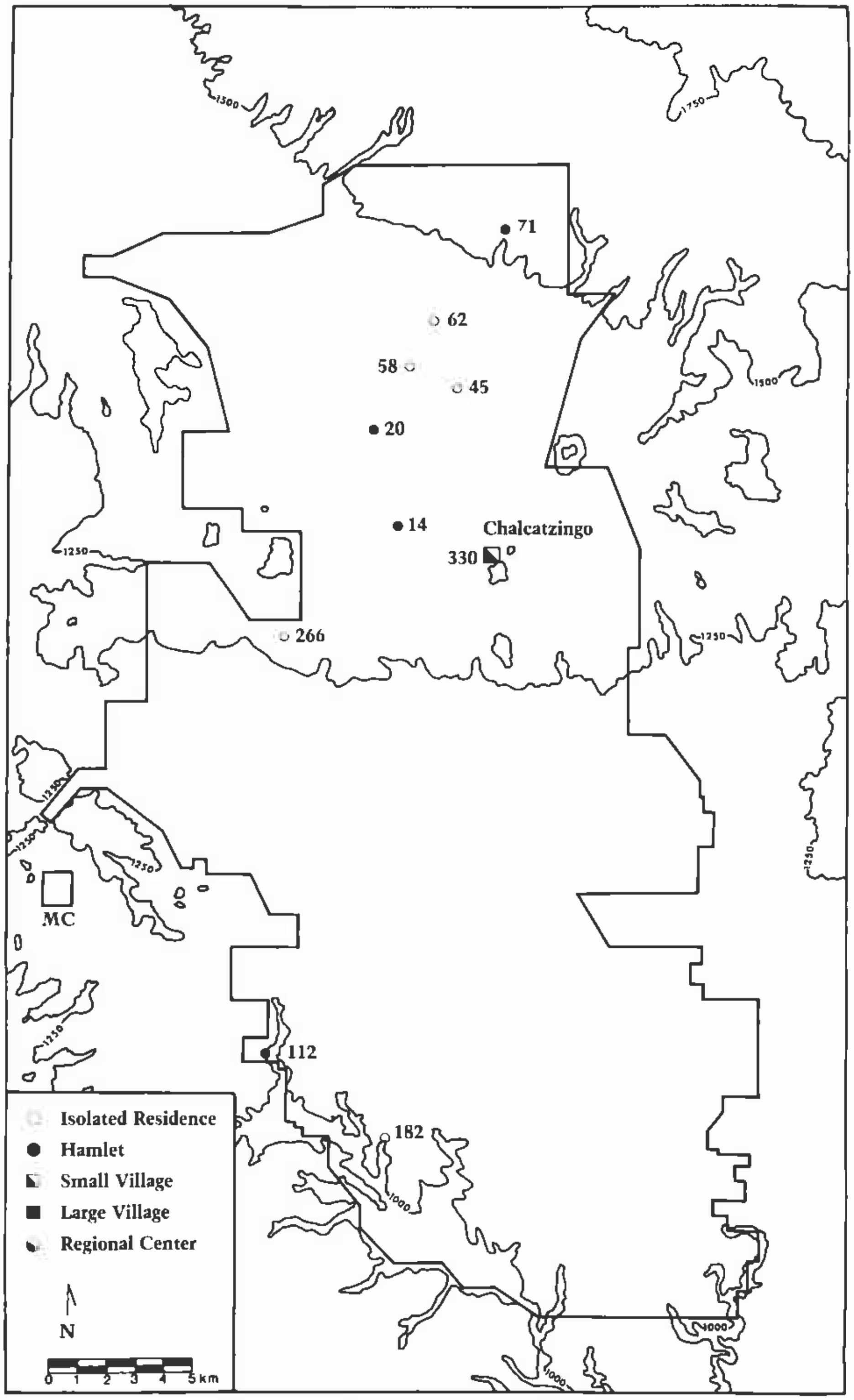

Figure 21.2. Amate phase settlements in the survey area.

eroded deposits in irrigation canals. At Chalcatzingo the Middle Formative settlement has obliterated virtually all surface signs of the Amate phase occupation, and all of our information on the size and function of the site has come from project excavations.

Although we lack comparable survey data from other areas of Morelos, we know that the Río Amatzinac Valley was definitely more thinly populated than central Morelos or the Valley of Mexico. Four of the twelve sites reported in the Valley of Mexico during the Coapexco-Ayotla subphase (1200–1000 BC) were substantial settlements of between 200 and 500 inhabitants (Tolstoy 1975). During the Manantial phase (1000–950 BC), which is roughly contemporaneous with our late Amate occupations, the number of large village sites increased to eight, and there were almost twice that number of hamlet communities averaging between 40 and 180 persons in each. Population for the entire Río Amatzinac Valley is estimated to have been between 210 and 575 individuals (Table 21.12). Even if we adjust this estimate for incomplete site recovery and underestimating the sizes of sites, a generous figure for regional population would not surpass 1,000 inhabitants. This places regional population density at less than 2 persons per km^2.

The largest community in the Río Amatzinac Valley was the Small Village at Chalcatzingo, at the southern extent of the Pithecellobium Woodland. Here the combination of drainage patterns, varied topography, and the presence of a spring created a complex mixing of plant communities (see Chapter 3). Nearly the full range of exploitable ecological niches found within the valley occur here in a single locale and, together with good agricultural land, would have offered a strong stimulus for residence at this site. I estimate that 100–200 people resided at the site by the end of the Amate phase. Excavation data place the area of occupation at 4–6 ha. In addition, Chalcatzingo is the only site known in the region with public architecture at this time (Chapter 6).

Settlement location and palynological analyses (David Bugé, personal communication) suggest that maize agriculture had become the dominant subsistence activity in the valley by this time. Six sites including Chalcatzingo (RAS-14, -20, -45, -112, -266, -330) are located at or within 200 m of perennial springs, indicating the importance of accessible water in the overall settlement strategy. In addition, all but two sites (RAS-182, -266) occur within areas of fertile agricultural land. This coincides with what we know about contemporary settlements in western and central Morelos, where farming villages are found adjacent to the agricultural lands of the floodplains of major rivers. The result then as now is a greater concentration of population in these areas.

In other areas of Morelos large sites are situated either at springs (Gualupita, Oaxtepec) or on terraces adjacent to rivers (Atlihuayan, Pantitlan, La Era, Nexpa, San Pablo). In the Río Amatzinac Valley permanent rivers flow the length of their courses within relatively inaccessible, sharply incised barranca channels. Only in the southern valley do the barranca sidewalls widen to create small pockets of rich farmland. Across the rest of the valley floor, runoff is rapid and soils do not readily retain moisture. On the whole, settlement is concentrated in those few locales where subsurface moisture is higher and retained longer. Under these conditions we might predict an early occupation of the small fertile zones of River Bottomland in the southern valley (see Chapter 3). Unfortunately, no evidence was recovered during the survey to suggest they were being utilized at this time. We have not found any traces of incipient irrigation systems, but we cannot discount the possibility of pot irrigation or small canals at the springs to facilitate year-round cropping. Hunting and seasonal collecting undoubtedly continued to be important supplemental activities for the diet throughout this period.

Roughly 90 percent of the Amate phase population was clustered in the northern half of the valley where we find the moister Pithecellobium Woodland zone. Two variables appear to be important in determining site size and location during this phase. There is a strong positive correlation between population and the number of sites located at or within 200 m of the Pithecellobium Woodland and Riverine zones (0.8256 and 0.6035, Table 21.6). Permanent water sources, especially springs, likewise may be important as seen in the inverse correlation between site size (HIER) and the distance to springs (DSP) (−0.5682). This simply means that sites near water sources exhibit a greater potential for growth. High correlations of population with a number of other variables (PCBS, POLH, CER-2, PHHLMT) reflect the utilization of these interrelated environmental zones by the large population aggregate at Chalcatzingo.

***Table 21.12.* Amate Phase Population Summary, Río Amatzinac Valley**

RAS Site	*Size in Hectares*	*Site Class*	*Population*
14	2–3	Hamlet	21–100
20	2–3	Hamlet	21–100
45	≤1	Isolated Residence	5–15
58	≤1	Isolated Residence	5–15
62	≤1	Isolated Residence	5–15
71	1–2	Hamlet	21–50
112	1–2	Hamlet	21–50
182	≤1	Isolated Residence	5–15
266	≤1	Isolated Residence	5–15
330	4–6	Small Village	101–200
		Total population	210–575

Specific site categories appear segregated by environmental zones. The Small Village and Hamlets occur adjacent to the Riverine zone alongside permanent rivers. There is also a strong tendency for Hamlet and Small Village communities to occur within 1 km of the Huizache Grassland zone, while only in one instance does a Hamlet occur within the zone itself (RAS-112), and this is where a spring issues forth. All but one of the Isolated Residences are found within 1 km of the Riverine zone but never at permanent water sources. Isolated Residences were not found within the Interior Valley Cerros, Cuajiotal, or Tetlalera zones.

The above settlement pattern is very similar to those described by Richard S. MacNeish, Frederick A. Peterson, and James A. Neely (1972:386–396) and by Kent Flannery (1976b) for regional exploitation in the valleys of Tehuacan and Oaxaca. The Small Village and Hamlet communities in the Río Amatzinac Valley were probably year-round communities. The Isolated Residences may represent microband camps of persons from permanent communities in the valley who engaged in seasonal activities, either foraging or cultivation in specialized zones. There is a strong positive correlation between site size and the presence of exploitable vegetation zones (PITH-1, BAR-1) within a 200 m radius (Table 21.6). Isolated Residences are restricted to single environmental zones, while the larger Hamlets and Small Village are found along the interface of zones where more collectable resources may have helped to augment agricultural activities and facilitated more permanent settlement. All of the Isolated Residences lack vestiges of residential architecture, storage vessels, or ground stone implements for processing food which would indicate any sort of permanent occupation. In addition, these camps are located more than 5 km from the nearest large settlements, the normal distance necessitating overnight encampments.

Except for RAS-266, all of the Isolated Residence/microband settlements are found some distance from permanent water. The location of RAS-266 at the Atotonilco springs would have provided favorable conditions for agriculture, and from the pattern elsewhere in the valley we should expect to find a permanent Hamlet community there. Unfortunately, prehispanic and contemporary occupation may have destroyed the remains of a much larger settlement and biased our data.

I believe that sites RAS-45, -58, and -62 are related to hunting and collecting of wild plants in the Pithecellobium Woodland zone. The importance of collectable resources from the Pithecellobium Woodland may have led to the establishment of a specialized resource hamlet or microband camp at RAS-71. This is the only community in the northernmost portion of the Pithecellobium Woodland zone, and its inhabitants could also have collected a variety of resources from the Upland Forest zone, which begins higher on the slopes of Popocatepetl, about 5 km to the north. RAS-182 probably fulfilled a similar function in the southern valley along the shallow-sided barranca which carries water only during the rainy season.

Settlement clustering within the Pithecellobium Woodland zone appears to be a function of environmental variables in combination with regional population growth and community budding. Nearest Neighbor analysis indicates that within this zone all communities tend to be regularly spaced. Differential spacing of communities within the same environmental zone has been discussed by Timothy Earle (1976) for Formative period settlements in the Valley of Mexico. In similar circumstances Earle feels that regular spacing in key resource zones is a function of maximizing regional exploitation for key resources while minimizing competition between communities (ibid.: 205–206). The periodicity and sensitivity of small microband camps (Isolated Residences) to specific microenvironmental conditions is further characterized by their tendency to be more tightly clustered with respect to one another (0.476 for Level IV sites; Table 21.10) than to the larger and more permanent Hamlet and Village settlements (0.646 for all sites; Table 21.10).

Amate phase settlement patterns compare most strongly with what occurs in the Tehuacan and Puebla-Tlaxcala valleys at the same time. In the Tehuacan Valley, permanent year-round settlements appeared after 1500 BC (MacNeish, Peterson, and Neely 1972). The basic unit of residence in this area was the small hamlet, and larger settlements did not appear until after 850 BC. Communities were located on the valley floor where they could engage in maize agriculture, which MacNeish suggests formed a large proportion of their subsistence. To supplement the maize diet, small groups from the hamlet communities traveled to base camps in neighboring ecozones for seasonal foraging and hunting activities.

In the Puebla-Tlaxcala Valley early population clusters are reported along river courses and valley slopes during the Tzompantepec phase as early as 1400 BC (García Cook 1974; Mora 1975). The principal community type was the small agricultural hamlet numbering between 40 and 100 residents. Larger sites with populations up to 350 inhabitants have been identified during the subsequent Tlatempa phase (García Cook 1973). By contrast, however, all three of these regions—the Río Amatzinac Valley, the Tehuacan Valley, and the Valley of Puebla-Tlaxcala—differ from what we know of population density in the Valley of Mexico, where large village communities with populations as large as 500 persons are reported as early as 1200 BC (Tolstoy 1975; Tolstoy et al. 1977).

MIDDLE FORMATIVE SETTLEMENT PATTERNS

The Barranca Phase

A total of twenty-two Barranca phase sites were located during the survey (Fig. 21.3). Regional population is estimated at between 513 and 1,262 persons (Table 21.13), which is slightly more than double the Amate phase estimate. The annual growth rate necessary to produce such an increase, however, is less than 0.5 percent per year when spread over the 400 year phase. This assumes, of course, that all sites were contemporaneous and continuously occupied during these 400 years, which in itself is problematical.

During this phase population spread throughout the valley, and three cells or clusters of different community composition become evident—a tripartite division that continues into and becomes more sharply differentiated during the subsequent Cantera phase. The three clusters are a northern cluster of equivalently sized small Hamlets and Isolated Residences, a central cluster of high population density and settlement diversity with a wide range in the size of communities, and a southern cluster of dispersed settlement where Small Villages occur along with Hamlet-sized communities.

The central cluster is situated along the interface of the Pithecellobium Woodland and Huizache Grassland zones essentially along a line between RAS-300 and RAS-20 (Fig. 21.3). Soils in the central zone are deep, fertile, high in moisture retention, and easily cultivated using simple agricultural technology. All the settlements in this cluster, with the exception of RAS-5, are located in prime agricultural areas and were probably full-time agricultural communities.

Chalcatzingo (RAS-330), located in this cluster, was the largest community in the valley. A large portion of the site was terraced, and check dams were built to divert surface runoff away from the terraces. It is likely that simple feeder canals radiating out from the spring at the north end of the site were used to create several hectares of extremely productive agricultural land which could be cultivated year-round. The Chalcatzingo

Table 21.13. **Barranca Phase Population Summary, Río Amatzinac Valley**

RAS Site	*Size in Hectares*	*Ceramic Density*	*Site Class*	*Population*
1A	2.5	C	Hamlet	13–25
1B	2.8	B	Hamlet	28–70
5	0.6	C	Isolated Residence	5–15
14	3.5	B	Hamlet	35–88
20	6.5	B	Small Village	65–163
53	≤0.5	C	Isolated Residence	5–15
62	≤0.5	C	Isolated Residence	5–15
71	≤0.5	C	Isolated Residence	5–15
75	≤0.5	C	Isolated Residence	5–15
78	4.0	C	Hamlet	40–100
107	≤0.5	C	Isolated Residence	5–15
112	6.5	B	Small Village	65–163
144	1.5	C	Isolated Residence	8–15
164	2.5	B	Hamlet	25–63
182	≤0.5	C	Isolated Residence	5–15
189	1.5	B	Isolated Residence	8–15
232	≤0.5	C	Isolated Residence	5–15
243	1.1	C	Isolated Residence	5–15
266	5.0	C	Hamlet	25–50
326	3.5	C	Hamlet	18–35
328	1.5	C	Isolated Residence	8–15
330	13.0	B	Small Village	130–325
			Total population	513–1,262

elite would have had control over the most productive agricultural land in the region. The land and the concentration of wild collectagens found only at this site made the small area around Chalcatzingo the optimal zone for subsistence resources in the valley.

Residential debris was scattered across approximately 13 ha, and a population density of 10–25 persons/ha yields an estimated population of 130–325 persons. Chalcatzingo's size and the presence of public architecture make it among the most important sites in central Mexico at this time.

Paul Tolstoy (1975) reports up to fifteen sites from the Valley of Mexico which are over 10 ha during the First Intermediate period, but all of them lack evidence of public architecture. Generally speaking, communities over 20 ha were rare in Mesoamerica prior to 500 BC.

Equally interesting is the population clustering in the area immediately surrounding Chalcatzingo. Eight small Hamlets and Isolated Residences are found within a 5 km radius of the site. They range from less than 1 ha up to 3.5 ha in size. These communities were probably settled by groups either from Chalcatzingo or one of the other two Amate phase settlements in the central valley (RAS-14, -20) which continued to grow throughout this phase.

Village fissioning is symptomatic of weak and politically decentralized groups because the residents are unable to maintain internal order among the various kin-related segments (Chagnon 1968). If the population clustering immediately around Chalcatzingo is the result of group fissioning, it would also appear that Chalcatzingo was able to maintain at least a partial linkage between kin-groups after the fissioning took place. What is important to note is that settlements cluster around Chalcatzingo early in its development.

All of the sites within a 6 km radius of Chalcatzingo (including the older sites of RAS-14 and -20) lack civic-ceremonial constructions. Only three of the seven new sites in Chalcatzingo's immediate periphery had any sizable population (RAS-1A, -1B, -326). It is clear that during the Barranca phase Chalcatzingo developed the capacity to integrate and maintain a concentrated population in a single locale.

Sites in the northern valley area occur within the Pithecellobium Woodland zone, and only four small Isolated Resi-

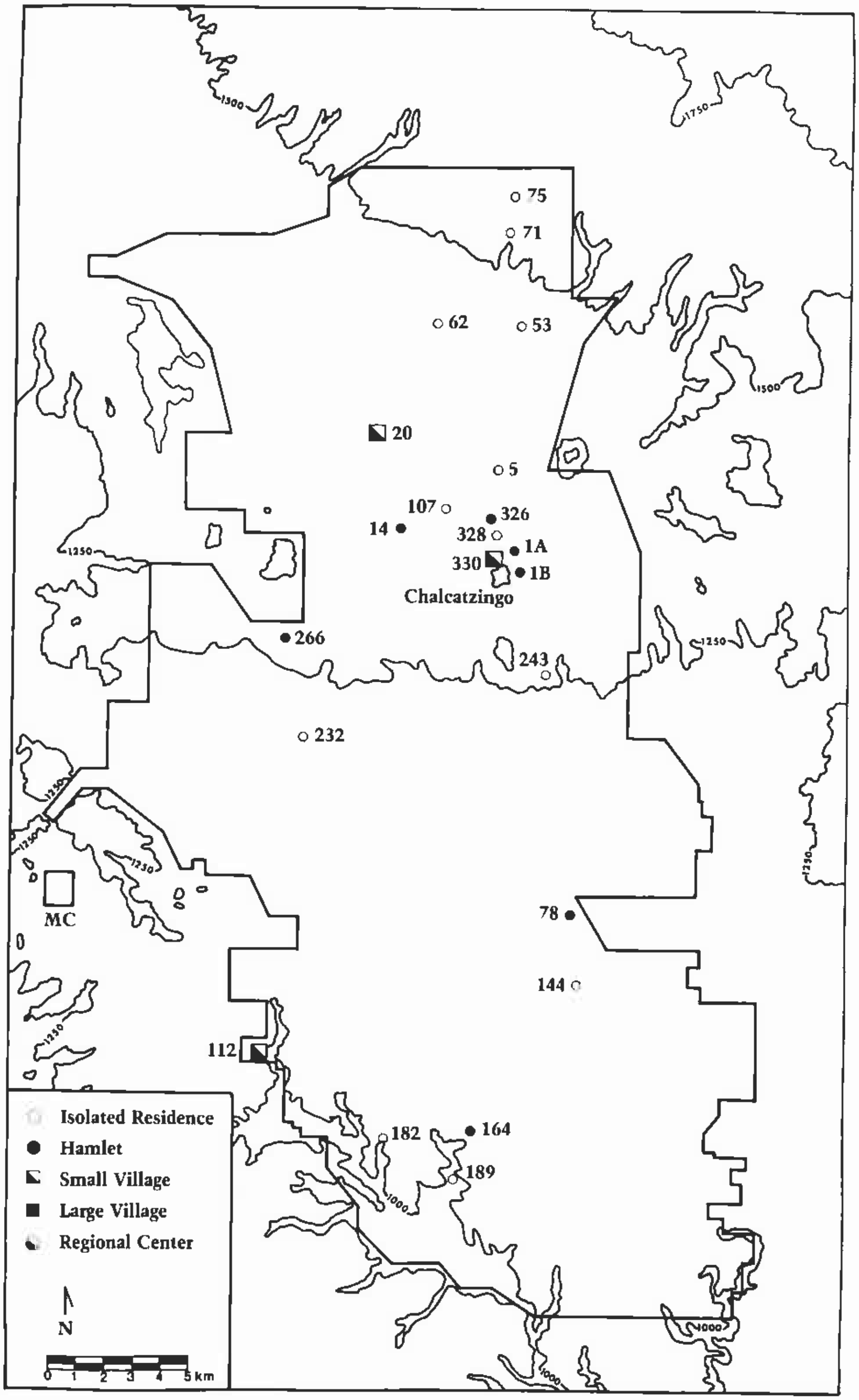

Figure 21.3. Barranca phase settlements in the survey area.

dences are found here for this phase. The population density was about the same as during the preceding Amate phase, although site location had changed. The small sites in this zone were probably agricultural communities which also engaged in seasonal collecting during the summer and fall. Although the northern valley receives proportionately greater amounts of rainfall than other areas of the valley, soils have higher clay content, making them more difficult to cultivate using simple digging stick technology.

Eight sites are located in the valley south and west of Chalcatzingo, along or below the 1,250 m contour interval. These sites occur within the Huizache Grassland environment, and the relative proximity of two sites (RAS-232, -266) to Chalcatzingo suggests that they may have been settled through population growth and village fissioning of groups in the central valley. Settlements are dispersed at uneven intervals throughout the southern valley, although the presence of springs is a key factor in determining the location of some sites (RAS-112, -164, -266). The site RAS-78 is located near the only area of River Bottomland along the Río Amatzinac where the river channel widens, the *barranca* sidewalls descend, and cultivation is possible along the river margin. The largest community in the south is RAS-112, which covered 6.5 ha and had a probable population between 65 and 163 inhabitants.

Each of the four largest communities in this zone (RAS-112, -164, -266, -78) is located in prime agricultural land and has as its nearest neighbor an Isolated Residence (RAS-266/-232; -112/-182; -164/-189; -78/-144). These smaller sites are all located at considerable distances from permanent water sources (1.5–2.5 km) and may have had specialized functions similar to the Amate phase Isolated Residences, which I suggested were microband camps utilized to expand resource procurement through seasonal collecting, rainfall agriculture, or both. Whatever the seasonal periodicity of these small sites, their pairing with larger sites was an important aspect of subsistence strategies in the Huizache Grassland environment. Many of these Isolated Residences grew in size and appear to have become permanent year-round settlements during the subsequent Cantera phase. Terraces for residential structures may have been constructed during the Barranca phase at RAS-112, but we have no evidence for Barranca phase public architecture in the valley outside of Chalcatzingo.

There is strong continuity between the Amate and Barranca phase settlement patterns. Areas where there are springs continued to be favored for site location, and all Barranca phase Hamlet and larger communities except one are found at such locales. Deviation from this pattern occurs only within the Chalcatzingo site cluster. The site of RAS-326 does not have a spring nearby, and the sites of RAS-1A and -1B are located a small distance from a spring on the eastern slopes of the Cerro Chalcatzingo. Variation within the Chalcatzingo site cluster is of interest because it suggests a deviation from purely environmental constraints related to agriculture which may be the result of enhanced social linkages (sharing, gift giving, or redistributions) between lineage members in different sites.

One measure of the continuity within the system through time is the extent to which earlier decisions regarding settlement location continue to be followed in subsequent phases. The continuous occupation variable (CONOC) was utilized in the correlation matrix to examine the continuity of settlement decisions in the Río Amatzinac Valley. In Table 21.7, high correlations between CONOC and other variables demonstrate that a continuity did exist. Negative values indicate the importance of relationships established during earlier periods, while positive values demonstrate the relationships between variables due to more recent decisions about site location. During the Barranca phase we find a positive correlation between the appearance of new sites and the distance to springs (0.3051) as sites are founded in areas without high water tables. At the same time there is a negative correlation with total population in the region (−0.4867). The large sites in the valley continue to be the older sites, those first occupied during the Amate phase (−0.2755) and which still contain the majority of regional population (−0.4867).

One of the obvious trends during the Barranca phase was a decrease in the correlation between single vegetation zones and small sites. Isolated Residences do not appear to specialize or cluster in single environmental zones as they did during the Amate phase. There is a substantial increase in the number and type of sites that have access to multiple environmental zones. Fifteen of the twenty-two sites from this phase (68 percent) are located within 200 m of two or more vegetation zones, which probably reflects a decrease in the exploitation of a small spectrum of resources through site specialization.

Population is more evenly spread throughout the region during the Barranca phase than in the Amate phase. A number of factors other than the simple selection of optimal agricultural zones appears to have influenced population movement throughout the valley, since many highly productive areas remained unoccupied until the subsequent Cantera phase. Nearest Neighbor analysis indicates only a slight decrease in the spatial relationship between all sites which remain highly clustered throughout the region (0.646 to 0.663, Table 21.10). There is a decrease in regular spacing for all sites in the Pithecellobium Woodland zone (1.702 to 1.270, Table 21.11).

When we look at particular types of sites, a number of additional trends become apparent. There is, for example, a trend for the small sites of less than seventy-five persons (Level IV sites, Tables 21.10, 21.11) to cluster more with respect to larger sites than to one another. This supports the arguments for the functional linkage of several large and small sites discussed above. There is an increase in the regular spacing of sites with seventy-five or more persons (Level II sites, Tables 21.10, 21.11) which may reflect the appearance of community boundaries and their competition over regional resources (e.g., Earle 1976). We must be careful in the extent to which we take this latter interpretation at face value, since the regular spacing of Level II communities is due at least in part to the relative location of springs throughout the valley.

Excavation data from the Valley of Mexico help to clarify some of the settlement trends observed during the Barranca phase. Tolstoy et al. (1977 : 99–100) report the importance of subsistence activities other than maize cultivation during the Early Horizon (Amate phase contemporary) in that area. During the First Intermediate Phase One-A, however (Barranca phase contemporary), there was a decrease in auxiliary hunting activity of deer, mud-turtle, and wild coot. These decreases, along with improved strains of maize during this time, suggest an overall increase in the productivity of maize agriculture.

A similar pattern is apparent in our region. Site selection strongly favored locales with good agricultural potential where there was also access to the broad spectrum of vegetation zones. More data will be needed from excavation contexts, but it appears that seasonal collecting continued to play an important role in the regional subsistence cycle.

The Cantera Phase

The Cantera phase settlement pattern is illustrated in Fig. 21.4. A total of forty-nine sites were located during the reconnaissance; regional population based on site size and density estimates is projected to have been between 1,429 and 3,623 persons (Table 21.14). This increase is impressive when graphed (Fig. 21.5) and represents almost a tripling of population from the Barranca phase to the Cantera phase. Although a dramatic increase for the period as a whole, the entire population increase for the two-hundred-year phase could be accommodated by an annual rate of population increase just under 0.75 percent per year. It must be re-emphasized that even this low rate of growth may be an overestimate if all the settlements were not fully contemporary or if some of the smaller settlements were periodic microband camps composed of groups from nearby permanent settlements.

There is strong continuity in settlement patterns between the Barranca and Cantera phases, and the tripartite division of settlement into distinct clusters (in the north, central, and southern portions of the valley) persisted. The main population cluster was still in the central valley, between the 1,400 and 1,350 m contour intervals. Chalcatzingo remained the dominant ceremonial and demographic center in the region, growing to its largest size during this phase. Continuous surface scatter at the site covers just under 0.5 km^2 (43.25 ha). Using the surface-area–debris-density correlations, I have roughly estimated the on-site population to have been between 433 and 1,081 persons. This is a higher estimate than that given in Chapter 6, which calculates the population using only excavation criteria.

Chalcatzingo was one of the largest sites in central Mexico at this time. Other sites reported thus far which may have been comparable in size were Cuicuilco and Chimalhuacan in the Valley of Mexico. Although we know relatively little about Cuicuilco, Chimalhuacan

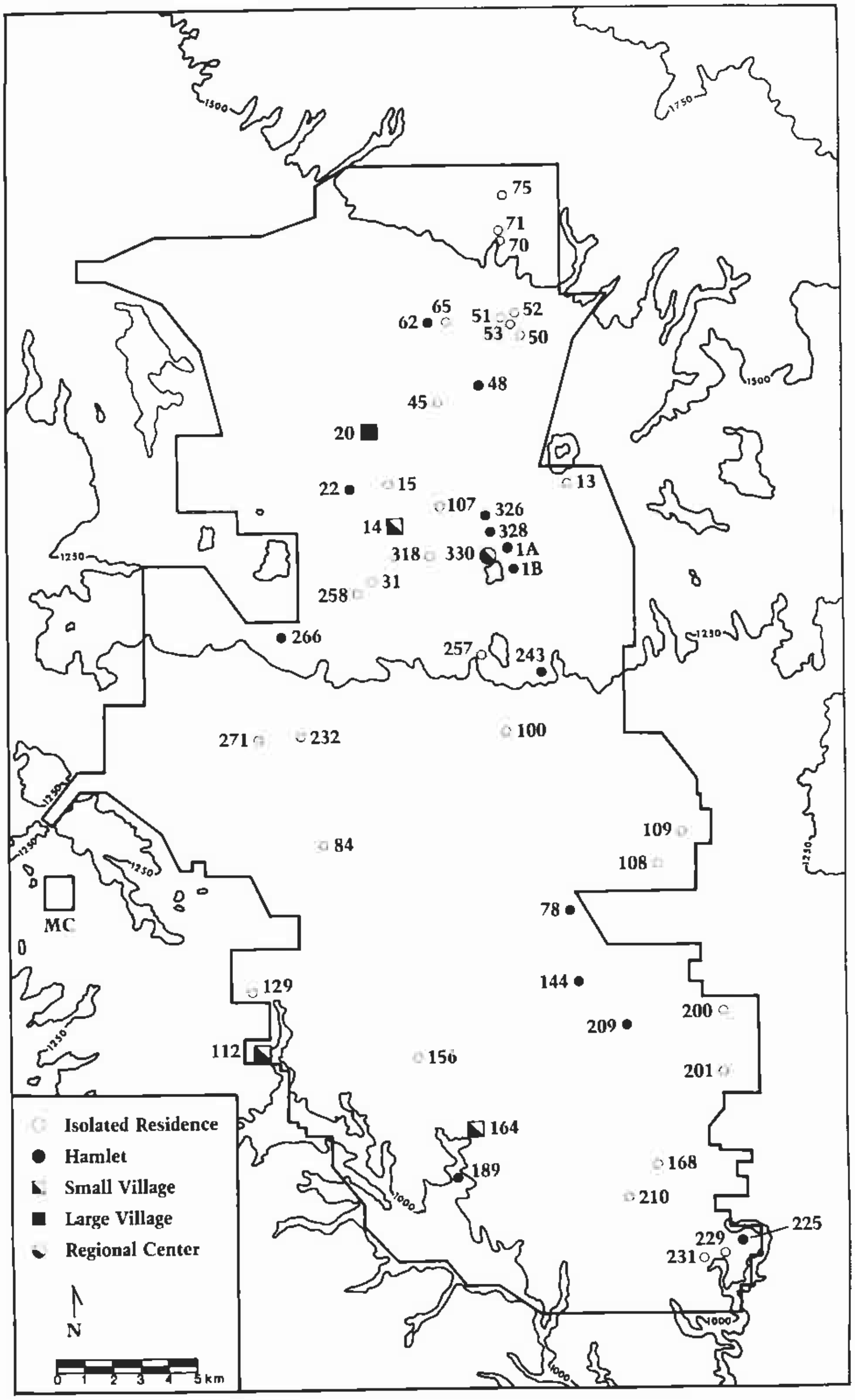

Figure 21.4. Cantera phase settlements in the survey area.

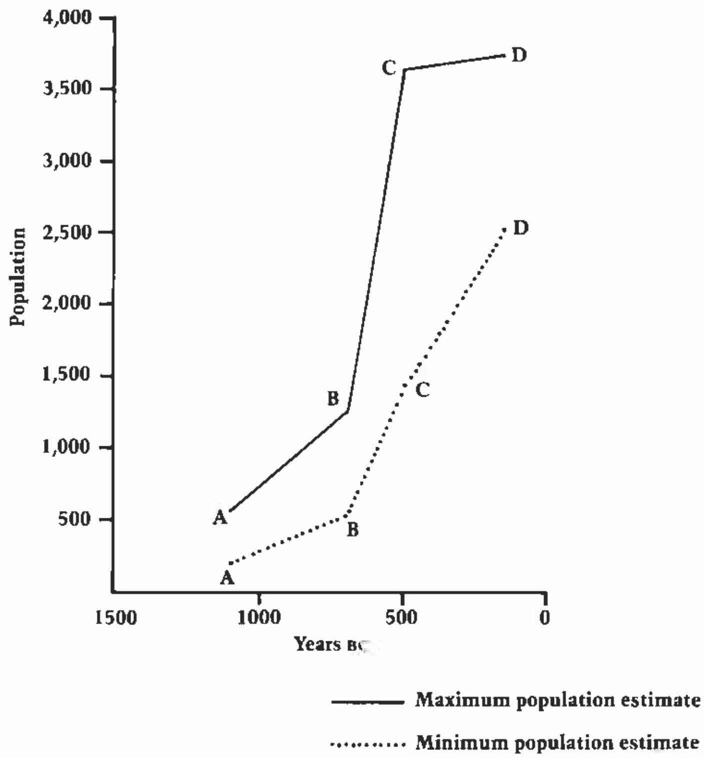

Figure 21.5. Change in regional population through time: *A*, Amate phase estimate; *B*, Barranca phase estimate; *C*, Cantera phase estimate; *O*, Late Formative estimate.

appears to have covered a total of 45 ha, for which Jeffrey R. Parsons (1971:28) calculates a population of 600–1,200 inhabitants. Although Chimalhuacan appears to have been slightly larger than Chalcatzingo, it lacks evidence for the sophisticated internal socioeconomic differentiation and complex civic-ceremonial architecture which would indicate a position of regional importance. The reverse is true for Chalcatzingo, which seems to have played a very important role at the regional level.

At least four small Hamlet communities are located within 1 km from the outer boundaries of Chalcatzingo (RAS-1a, -1b, -326, -328). These sites certainly interacted with the residents of Chalcatzingo on a regular basis and should perhaps be included within the calculation of Chalcatzingo's size. This conclusion is based on studies of contemporary agriculturalists by Michael Chisholm and others (Chisholm 1968; Abrams 1943), who place an outer spatial limit on probable daily interaction between 3 and 5 miles (5 and 8.35 km). These four sites increase the size of the community of Chalcatzingo by an additional 12 ha.

Heavy Classic and Postclassic occupation on the east slope of the Cerro Delgado (Tetla, RAS-1) may have obliterated Middle Formative residences there. This is most unfortunate since the RAS-1 residence areas may easily have been two or three times the magnitude reported here (see Table 21.14). Minimally therefore, we can possibly consider Chalcatzingo a "community" of about 55 ha. This would place Cantera phase Chalcatzingo on an even footing with such early large centers as San Lorenzo (53 ha at 900 BC) and Chiapa de Corzo II (49 ha at 500 BC) (Marcus 1976:88). Cuicuilco may have been equally large by this time, but we do not have the data to evaluate its development in the Valley of Mexico.

On the regional level, there are a number of important developments. If our population estimates are correct, roughly 25 percent of the entire regional population resided at Chalcatzingo during the Barranca phase. By 500 BC (the end of the Cantera phase), this percentage had increased only to 30 percent. Chalcatzingo had continued to grow throughout the Cantera phase, but at a slower rate than the appearance of new Small and Large Villages. The increase in intermediate-sized communities suggests an increase in social integration at the village level. At the same time there was an increase in the number of persons living in Hamlet and Isolated Residence communities which may suggest greater specialization in particular procurement activities.

The central valley appears to have been well integrated and directly under the control of Chalcatzingo. It is the most densely populated area in the valley and contains the complete range of settlement types found throughout the region, including Isolated Residences, Hamlets, a Small Village (RAS-14), and a Large Village (RAS-20) in addition to Chalcatzingo.

Both RAS-14 and RAS-20 contained relatively small civic-ceremonial constructions. The site of RAS-20 (Campana de Oro) had one or perhaps two small platform mounds which date to the end of the Cantera phase. The dimensions of these constructions were ca. 10 × 10 × 1 m and ca. 9 × 12 × 1.25 m. Sherds used in dating the larger of these structures came from an old looter's pit dug into the construction fill. The smaller structure had been largely destroyed before the survey started by farmers who were leveling the platform to amplify the area of their fields. Part of a small platform with Cantera phase offerings was encountered at Las Pilas (RAS-14) by investigators from the INAH Centro Regional de Morelos y Guerrero, who were excavating Classic period structures there.

There were also changes in the population structure of the northern and southern portions of the valley. The number of settlements in the northern Pithecellobium Woodland increased to eleven as compared to four during the preceding Barranca phase. Although this is a considerable increase in the number of settlements, all were still small Hamlets or Isolated Residences. Many of these sites appear to have been permanent year-round settlements where the primary activity was seasonal maize agriculture.

The number of sites increased from 9 to 24 in the southern valley below Jonacatepec. The southeast corner of the valley was occupied for the first time, and a new Small Village (RAS-164) appeared. There is definite evidence for platform mounds at RAS-112 and RAS-144, and two other settlements (RAS-164, -78) may also have had public architecture, indicating an increase in ceremonialism within these southern communities.

Residential terraces very similar to those at Chalcatzingo were constructed at RAS-112 (El Palacio). Some of these may date to as early as the Barranca phase. Classic and Postclassic occupation at this site destroyed most of the Middle Formative occupation; however, one badly destroyed low platform mound which covered approximately 300 m² could be identified as a Cantera phase construction. Telixtac (RAS-144) is a small site, covering about 5 ha, with two platform mounds. Excavations at this site are discussed in detail in Chapter 22.

Collections of Cantera phase materials were also made from small platform mounds at both RAS-78 and RAS-164. I believe that the structures date to the Cantera phase despite our inability to make more definitive assessments because of the Late Formative occupations at these sites. Middle Formative vessels were observed in private collections of residents of San Ignacio (RAS-78) and were reported to have been found with burials in a low platform where the town's new school was built.

The main population centers are again the oldest sites in the valley (Table 21.8, CONOC-POP coefficient of −0.5369). Although there is continuity in settlement location with the Barranca phase, there are many indications to suggest the increasing use of *temporal* (rainy-season) agriculture. New sites occur at greater distances from areas with high subsurface water tables (springs, permanent rivers) than during the preceding phases. During the Cantera phase six permanent Hamlet communities appear for the first time in areas where only *temporal* agriculture can be practiced.

Of these six hamlet communities, two are located in the north (RAS-62, -48), one is in the central valley (RAS-22), and three in the south (RAS-144, -189, -209). The Río Amatzinac passes close by RAS-48 within deeply incised barranca channels which prohibit simple diversion systems from being implemented or cultivation along the river margins within the barranca. RAS-22 and RAS-62 likewise do not have access to water for agricultural usage. The Río Frío-Tepalcingo becomes a permanent flow

Table 21.14. Cantera Phase Population Summary, Río Amatzinac Valley

RAS Site	*Size in Hectares*	*Ceramic Density*	*Site Class*	*Population*
1A	3.8	B	Hamlet	38–95
1B	2.5	B	Hamlet	25–63
13	≤0.50	C	Isolated Residence	5–15
14	6.3	B	Small Village	63–158
15	≤0.50	C	Isolated Residence	5–15
20	21.0	B	Large Village	210–525
22	4.1	C	Hamlet	21–41
31	0.75	C	Isolated Residence	5–15
45	≤0.50	C	Isolated Residence	5–15
48	3.3	C	Hamlet	25–58
50	≤0.50	C	Isolated Residence	5–15
51	0.90	C	Isolated Residence	5–15
52	≤0.50	C	Isolated Residence	5–15
53	1.0	C	Isolated Residence	5–15
62	1.5	B	Hamlet	15–38
65	≤0.50	C	Isolated Residence	5–15
70	≤0.50	C	Isolated Residence	5–15
71	0.55	C	Isolated Residence	5–15
75	≤0.50	C	Isolated Residence	5–15
78	4.00	B	Hamlet	40–100
84	0.63	C	Isolated Residence	5–15
100	0.70	B	Isolated Residence	7–18
107	≤0.50	C	Isolated Residence	5–15
108	0.75	C	Isolated Residence	5–15
109	≤0.50	B	Isolated Residence	5–15
112	10.0	B	Small Village	100–250
129	0.90	C	Isolated Residence	5–15
144	2.10	B	Hamlet	21–53
156	0.51	B	Isolated Residence	5–15
164	6.00	B	Small Village	60–150
168	0.70	C	Isolated Residence	5–15
189	3.5	B	Hamlet	35–88
200	0.75	C	Isolated Residence	5–15
201	≤0.50	C	Isolated Residence	5–15
209	1.95	B	Hamlet	20–49
210	≤0.50	C	Isolated Residence	5–15
225	3.80	B	Hamlet	38–95
229	≤0.50	C	Isolated Residence	5–15
231	≤0.50	C	Isolated Residence	5–15
232	≤0.50	C	Isolated Residence	5–15
243	2.50	B	Hamlet	25–63
257	≤0.50	C	Isolated Residence	5–15
258	≤0.50	C	Isolated Residence	5–15
266	6.00	B	Hamlet	60–150
271	≤0.50	C	Isolated Residence	5–15
318	≤0.50	C	Isolated Residence	5–15
326	3.50	B	Hamlet	35–88
328	2.50	C	Hamlet	13–25
330	43.25	B	Regional Center	433–1,081
			Total population	1,429–3,623

only below RAS-22, where it is fed by spring seepage in the barranca channel. RAS-144 and RAS-189 are over a full kilometer from the nearest permanent water source. Finally, RAS-209 overlooks the Río Amatzinac in a locale where there is approximately 2 ha of cultivable land within the floodplain.

Topographic zones Irregular Plains and Irregular Plains with Slight Relief were apparently also important for settlement during this period. These are slightly rolling landscapes where differences in the immediately surrounding topography do not exceed 33 m (Hirth 1974:70). They can be important areas for early agriculturalists, since the slight differences in elevation allow for the spot accumulation of surface runoff during the rainy season. Seven new communities appeared in areas with slight relief during the Cantera phase (RAS-51, -52, -318, -168, -200, -201, -209). The total number of sites in these zones increased from four during the Barranca phase to ten during the Cantera phase, lending support to the proposition that *temporal* agriculture was growing in importance.

There are also indications that certain site categories, particularly Isolated Residences, once again tended to be located within specific ecological zones. During the Cantera phase the number of Isolated Residences occupying single niche environments increased from five to sixteen. Throughout the Río Amatzinac Valley, Isolated Residences tended to be located away from the Pithecellobium Woodland and Riverine zones, while Hamlets gravitated toward these zones. The increase in both the number of Isolated Residences and the percentage of population residing in them (Tables 21.8, 21.15) suggests a reintensification of environmental exploitation by small groups during this phase, possibly to facilitate resource collection by residents from larger Hamlet and Village communities.

Population growth during the Cantera phase probably stimulated pioneer settling of less favored zones throughout the valley where the most productive exploitative activity was rainfall agriculture. These included areas of the southern Huizache Grasslands, where runoff accumulated in a few natural pockets, and throughout the Riverine zone, where a few hectares of river margin land could be used in conjunction with *temporal* agriculture to the most productive ends (RAS-209 and the cluster of RAS-225, -229, and -231).

***Table 21.15.* Additions to Site Categories and Old Site Abandonments in the Río Amatzinac Valley by Phase**

	Barranca Phase		*Cantera Phase*		*Late Formative*	
Site Category	*New*	*Abandoned*	*New*	*Abandoned*	*New*	*Abandoned*
Isolated Residences	9	2	25	2	30	21
Hamlets	6	0	9	0	8	7
Small Villages	2	0	2	0	2	0

An examination of Middle Formative microband camps in the Tehuacan Valley indicated that seasonal collection of wild plants continues to be part of the yearly subsistence strategy coexisting with maize agriculture (Flannery 1976b:111–116). This is of interest here because, by analogy, growing Cantera phase populations may likewise have been putting stress on available subsistence resources to the point which stimulated the (re)appearance of food procurement systems other than sedentary maize agriculture.

Within the Amatzinac Valley there is a re-emphasis on locating sites in areas where seasonal collecting could be practiced as a supplement to agricultural activities. Seasonal (impermanent) microband camps may have re-emerged as an important exploitative adaptation on the part of groups from larger Hamlet and Village communities. This probably was an often repeated pattern during the initial stages of *temporal* agriculture when yields could still vary considerably from year to year. Using this model we must be careful in our interpretations since not all of the new Isolated Residences found during this period may have been occupied permanently throughout the year. Unfortunately, there are few excavation data on the maize productivity and function of the small outlying sites in the Amatzinac Valley to test this hypothesis.

Nearest Neighbor analysis reveals some interesting changes in the spacing of the communities at the beginning of the Cantera phase. One is the decrease in site clustering throughout the valley. There is also a change in the relationships between communities in some of the older, more continuously occupied areas. We note, for example, decreases in clustering for all sites in both the Pithecellobium Woodland and Huizache Grassland vegetation zones from what they had been during the Barranca phase (Table 21.10).

There are also significant changes in spacing of particular site categories one to another. There is a decrease in the regularity of spacing between Level II communities (those with seventy-five or more inhabitants); the pattern which emerges closely approximates what we would expect under conditions of random location. The situation for Level IV communities (under seventy-five inhabitants) reflects a clear tendency away from clustering toward more random spacing (Table 21.10). This is particularly clear in the Pithecellobium Woodland zone (Table 21.11).

I believe Nearest Neighbor trends point to two separate developments. The relaxation of regular spacing between settlements at the upper level of the hierarchical spectrum partly reflects the greater social cohesions which existed in the valley. Competition is not between elites as much as it is between individual households or communities engaged in subsistence activities. Greater regularization of spacing between Level IV communities, for example throughout the Pithecellobium Woodland zone, suggests increased exploitation and competition over scarce resources. This is exactly the predictable spacing behavior which results when an ecozone begins to fill up. Equidistant spacing is a means of minimizing competition when the possibility for such exists, and should not necessarily be construed as representing a disharmonious social climate (Hudson 1969).

Numerous questions remain to be answered as to how the regional socioeconomic network evolved and operated, and what links, if any, were established between the elite at Chalcatzingo and those throughout the rest of the valley. It is interesting to note that the degree to which Chalcatzingo's material culture is shared with other sites in the valley is more a function of similar internal complexity than of mere proximity to Chalcatzingo. The distribution of material throughout the valley corresponds fairly well to that predicted by a gravity model, which proposes that the amount of interaction between communities is directly proportional to their population sizes or position within the ceremonial hierarchy and inversely proportional to the distance which separates them (Haggett 1965:35–40).

The quantity of coincidental occurrences of the same traits or artifacts at different sites is felt to be a function of interaction. During the Barranca and Cantera phase, we see a number of important influences emanating from Chalcatzingo and spreading out into the surrounding valley. A fairly homogeneous cultural assemblage is found among the sites which cluster around Chalcatzingo, while inequalities appear at sites in the northern and southern portions of the valley. Small sites in each of these latter zones, such as RAS-144 (Telixtac) and RAS-62 (Huazulco) (see Chapter 22), more closely resemble Chalcatzingo as partial pictures of its complete assemblages than they do one another.

An attempt was made during our research to measure the interaction between communities by using ceramic design variability as an indicator of social contact. The kinds of design elements best suited for such analyses include the complex incised motifs which can be found along vessel rims of the Amatzinac White wares. A similar study was conducted on Middle Formative White wares by Stephen Plog (1976b) for the Valley of Oaxaca. Our analysis was only partially successful because of the small number of elements recovered in our surface collections and the variability which existed in both the sample size and the recovery contexts of our surface collections. Nevertheless, a number of interesting irregularities exist which need to be analyzed further.

One area of artifact patterning relevant to our discussion is the distribution of ceramic types in the valley (Table 21.16). Amatzinac White and Peralta Orange ceramics occur in a multiplicity of forms throughout the region. Like most Middle Formative ceramics, they were probably manufactured locally by individual households or lineage groups. This is a reasonable assumption (Plog 1976b:262), especially in the absence of data to suggest the presence of pottery workshops operated by full-time specialists who distributed their wares at the regional level. The Amatzinac and Peralta ceramics are

Table 21.16. **Summary of Major Ceramic Types by Settlement Clusters**

	Amatzinac White	*Peralta Orange*	*Laca*	*Pavon Fine Grey*	*Carrales Coarse Grey*
Northern Valley Sites					
45	X			X	
48	X	X			
50	X				
51		X			
52	X				
53	X				
62	X	X			X
65	X				
70		X			
71	X	X			
75	X	X			
Central Valley Sites					
1A	X	X	X	X	
1B	X	X			
13	X	X			
14	X	X	X	X	
15	X				
20	X	X	X	X	X
22	X	X		X	
31	X			X	
107	X				
258	X				
318		X			
326	X	X		X	
328	X	X	X		
330	X	X	X	X	X
Southern Valley Sites					
78	X				X
84	X				X
100	X	X			
108		X			
109	X	X			X
112	X	X	X	X	X
129	X				
144	X	X		X	X
156	X	X			
164	X	X	X		X
168	X				
189	X	X			
200	X				X
201	X				
209		X			
210	X				
225	X	X			X
229		X			
231		X			
232		X	X		
243	X	X	X		
257	X	X			
266	X				
271	X				

found at all sites throughout the region and are the principal types recovered from Hamlet and Isolated Residences communities.

A number of other types have more restricted distributions which may suggest more specialized functions. These include Laca, Pavón Fine Grey, and Carrales Coarse Grey. The Laca and Pavón Fine Grey ceramics share similar discrete and overlapping distributions. They are both most heavily concentrated in the northern half of the valley above the 1,250 m contour, primarily in Village and Hamlet communities in the central valley. The frequency and occurrence of these types in our surface collections dropped rapidly outside of the central cluster. In the southern valley, Laca ceramics are found in quantity only at the Small Village communities of RAS-112 and RAS-164. Solitary sherds occur at RAS-243 and RAS-232, but these occurrences may simply reflect the proximity of Chalcatzingo.

A similar situation exists for Pavón Fine Grey. This is a non-local ware (Chapter 13), which is largely restricted to the central valley. Pavón Fine Grey was found in the north only at RAS-45 and in the southern valley only at the sites of RAS-112 and RAS-144, where unusually large surface collections could be made. The opposite is true of Carrales Coarse Grey, a locally manufactured ware. It is found at only three sites in the central and northern valley (RAS-330, -20, -62) but occurs in one-third of all communities in the south.

Another kind of artifact useful for investigating intravalley integration is stone tools. Blades of imported obsidian were found at sites throughout the valley, but few sites, with the exception of Chalcatzingo, yielded evidence of cores or manufacturing debris. This suggests that Chalcatzingo may have been the main site for obsidian procurement (see Chapter 23) and may have functioned as the obsidian redistribution and workshop center for the valley.

At the same time there is evidence for the independent exploitation of local silicates by groups in the southern valley for manufacturing chipped stone tools. The site of RAS-108 is located atop a small outcrop of poor quality red chert, and the occupation here appears primarily related to its exploitation. This red chert was found most frequently at Cantera phase sites in the southern valley either in rough nodules or manufactured into simple scrapers or usable flakes. It is extremely rare in workshops at Chalcatzingo and was not worked into artifacts for further trade (Susan Burton, personal communication; Chapter 18). It seems to have been used instead as a supplementary source for manufacturing simple cutting tools in the southern valley (see also Chapter 23).

The distributional data allow us to suggest a number of interesting hypotheses about the nature of cultural integration within the valley. The correlation of Laca, Pavón Fine Grey, and Carrales Coarse Grey ceramic distributions with those predicted by the gravity model gives credence to the assertion of Chalcatzingo's expanded sociopolitical position within the Río Amatzinac Valley during the Middle Formative. I would hypothesize that the central valley population cluster was directly tied to Chalcatzingo via complex exchange relations. This would account for the greater frequency of Laca and Pavón Fine Grey pottery at all community sizes within the cluster. The same may have been true of the northern cluster, although the indications are less convincing. These types are restricted to the larger and hierarchically dominant communities in the southern cluster.

The differential distribution of Pavón Fine Grey and Carrales Coarse Grey ceramics as well as chipped stone tools and debris suggest the existence of two distinct networks of economic interaction, one centered on Chalcatzingo and a second in the southern valley, operating at least semi-independently. Obsidian tools, primarily blades, were obtained in their finished form from the Chalcatzingo workshops, while scrapers and flakes occurred in a wide range of silicates, including a locally available red chert exploited by a secondary lithic industry in the southern portion of the valley.

Middle Formative Settlement Patterns in Central Mexico: An Overview

To what extent are changes in settlement patterns throughout our survey area due to the unique development of Chalcatzingo or typical of changing regional demography elsewhere throughout central Mexico? To answer this question we must briefly examine the scanty but growing body of demographic data from neighboring areas, such as the Tehuacan Valley, the Valley of Puebla-Tlaxcala, and the Basin of Mexico.

The Middle Formative occupation in the Tehuacan Valley is represented by materials from the Early Santa María phase (900–500 BC; MacNeish, Peterson, and Neely 1972). Population more than doubled during this period, and nucleated village sites appeared for the first time. Five Nuclear Villages ranged in size from 2 to 3 ha and included a small central architectural precinct. The sites are located at permanent water sources, and small hamlet communities may have clustered in their immediate vicinity, suggesting that the Nuclear Villages were the centers for small sociopolitical units, perhaps chiefdom-level societies.

In the Valley of Puebla the picture is considerably more complex (Peter J. Schmidt 1975; Aufdermauer 1970; 1973). Large regional centers are found with complex civic-ceremonial architecture. The large site of Totimehuacan south of the modern city of Puebla is an example of one of these centers which appears to have grown substantially during the period between 700 and 500 BC (Spranz 1967; 1970). Villages approximating 20 ha in size with modest architectural remains appear to have been fairly common throughout the Valley of Puebla. Recent investigations suggest that a number of large regional centers appeared throughout the area, each of which maintained its individual political autonomy (Fowler et al. 1977).

In Tlaxcala the period between 1000 and 500 BC spans the last half of the Tlatempa phase, when Canoas White ceramics first appeared (García Cook 1974), and the first half of the Texoloc phase. Lineal hamlets were the most common community type, and preferred locations were hilltops or sharply sloping hillsides near permanent water sources. Evidence of ceremonialism intensified at the start of the Texoloc phase—public architecture began to appear in the larger village sites (García Cook 1973: Fig. 2). Nuclear Villages were present by 500 BC, with up to two hundred households apiece. Maize agriculture was apparently the principal subsistence activity and was practiced in combination with elaborate terrace-irrigation systems. Seasonal collection had declined in importance but continued to be practiced throughout the phase.

Perhaps our most complete data on settlement patterns in central Mexico come from extensive reconnaissance work in the Basin of Mexico (well summarized in Sanders, Parsons, and Santley

1979: 1–12). Evidence indicates that population expanded significantly during this period, with the greatest population density in the southern half of the basin. Several large sites were found on the lakeshore fringe of Lakes Chalco-Xochimilco; another is at Chimalhuacan in the southeast corner of Lake Texcoco. These are Nuclear Villages varying between 10 and 60 ha in size and spaced at regular 8–10 km intervals around the lake fringe. Four equivalently sized communities are found in the Piedmont zone east of Lake Chalco and represent the first substantial settling of this area (J. Parsons 1976). Although the northern portion of the Basin of Mexico was settled, it remained distinctly marginal throughout the entire period.

The combination of a number of factors appears to have been important in structuring Middle Formative site location in the Basin of Mexico. These include the proximity to lacustrine resources, arable land with a natural slope and a high subsurface water table, and high rainfall in areas with the greatest number of frost-free days (J. Parsons 1974). The redistribution of economic resources at the regional level appears to have been a negligible factor, and the Basin of Mexico may have lacked the network of symbiotic-extractive interrelationships that linked communities throughout the highlands during subsequent periods. The lack of differentiation between sites in terms of environmental location suggests that there was little vertical population integration throughout the Basin at this time. Tolstoy (1975), on the other hand, has identified discrete population clusters which occupy narrow environmental settings and may represent potentially competitive sociopolitical groups.

Our settlement data show general developmental trends very similar to those of the rest of Middle Formative central Mexico. Following a low Amate phase population, a sharp demographic rise occurred during the subsequent Barranca and Cantera phases. Chalcatzingo was as large as or larger than most contemporary centers in either the Basin of Mexico or Puebla-Tlaxcala. Large village sites between 10 and 20 ha were present in the Amatzinac region, though not in the same frequency as elsewhere in central Mexico. Nuclear Villages of the type reported in Tehuacan are similar to some of the smaller villages in the Río Amatzinac Valley, such as RAS-144 or RAS-62, although they do not take the leading role in intravalley integration.

The Nuclear Settlement–Regional Center configuration appears to have been fairly typical throughout central Mexico during this period. What makes Río Amatzinac Valley pattern somewhat different is the central role which Chalcatzingo seems to have played in regional integration. Intraregional hierarchies appeared and were reinforced by the procurement and distribution of economic resources. There was a strong tendency toward population clustering in the central valley around Chalcatzingo. Judging from the size and number of sites reported thus far, the Río Amatzinac Valley appears to have maintained a larger and more diversified population profile than other regions of central Mexico. The extent to which this may or may not have been due to more efficient means of sociopolitical integration found only in eastern Morelos at this time is still undetermined.

THE LATE FORMATIVE

The settlement pattern during the Late Formative is illustrated in Fig. 21.6. Fifty-seven sites were located during the reconnaissance, and regional population rose to between 2,516 and 3,737 persons (Table 21.17). Distinct changes in regional settlement patterns occurred, possibly in conjunction with a decline in the importance of Chalcatzingo as a major site and its replacement by Campana de Oro as the major regional center. Chalcatzingo was largely abandoned, and remaining habitation was very thinly scattered. Settlement clustering within the 2 km radius around the site disappeared. Apart from Chalcatzingo, most large centers from the Cantera phase continued to be occupied, but there was a significant change in the location of rural communities.

Interesting changes in the population structure are shown in Fig. 21.5. The Late Formative population estimates show two divergent trends in the same calculation. The maximum estimate suggests a trend toward a leveling-off of population. On the other hand, the minimum estimate indicates continual population increase. Which is the case? What apparently occurred was a decrease in the number of individuals living in Hamlets and Isolated Residences even though the number of sites increased (Tables 21.4, 21.17). On the other hand, the percentage of population living in Small Villages increased and became 11 percent greater than the combined Large and Small Village total for the Cantera phase with no substantial change in the size and proportion of population living in the Regional Center. Thus, what apparently happened was not the disappearance of Hamlets but greater population density at the Village sites. Instead of sites with a light debris scatter over the surface, we find the same or slightly smaller surface area at sites but with much greater density of debris.

The number of Hamlets decreased slightly from fourteen during the Cantera phase to twelve during the Late Formative. This difference is accounted for by the fact that two Hamlets (RAS-78, -225) grew to Village proportions. Nine Hamlets were abandoned or decreased in size after the Cantera phase (RAS-1A, -1B, -62, -144, -189, -209, -266, -326, -328), but these are offset by the appearance of nine new Hamlets during the Late Formative (RAS-1C, -19, -31, -54, -84, -95, -111, -121, -264). Only three of the Cantera phase Hamlets remained at the level throughout the Late Formative (RAS-122, -48, -243). These trends seem to represent an actual increase in population density. Even when the two Middle Formative phases are lumped together, as was done during the initial stages of analysis (Hirth 1974), the Middle Formative residence pattern still appears more dispersed than that of the Late Formative.

At the end of the Cantera phase there was a significant decline in population and an abandonment of the fertile area immediately surrounding Chalcatzingo. Small Hamlets and Isolated Residences increased in number in the northern half of the valley as population around Chalcatzingo apparently dispersed throughout the Pithecellobium Woodland. The number of Hamlet-sized and smaller communities in the Pithecellobium Woodland north of Campana de Oro (RAS-20) increased from eleven at the end of the Cantera phase to twenty during the Late Formative.

Campana de Oro was the second largest site in the valley during the Cantera phase and grew to become the principal community in the valley during the Late Formative. It appears to have been a tightly nucleated settlement covering a total of 29 ha. Fourteen mounds of various sizes have been mapped for the Later Late and Terminal Formative occupation (Fig. 21.7). Five of the mounds definitely

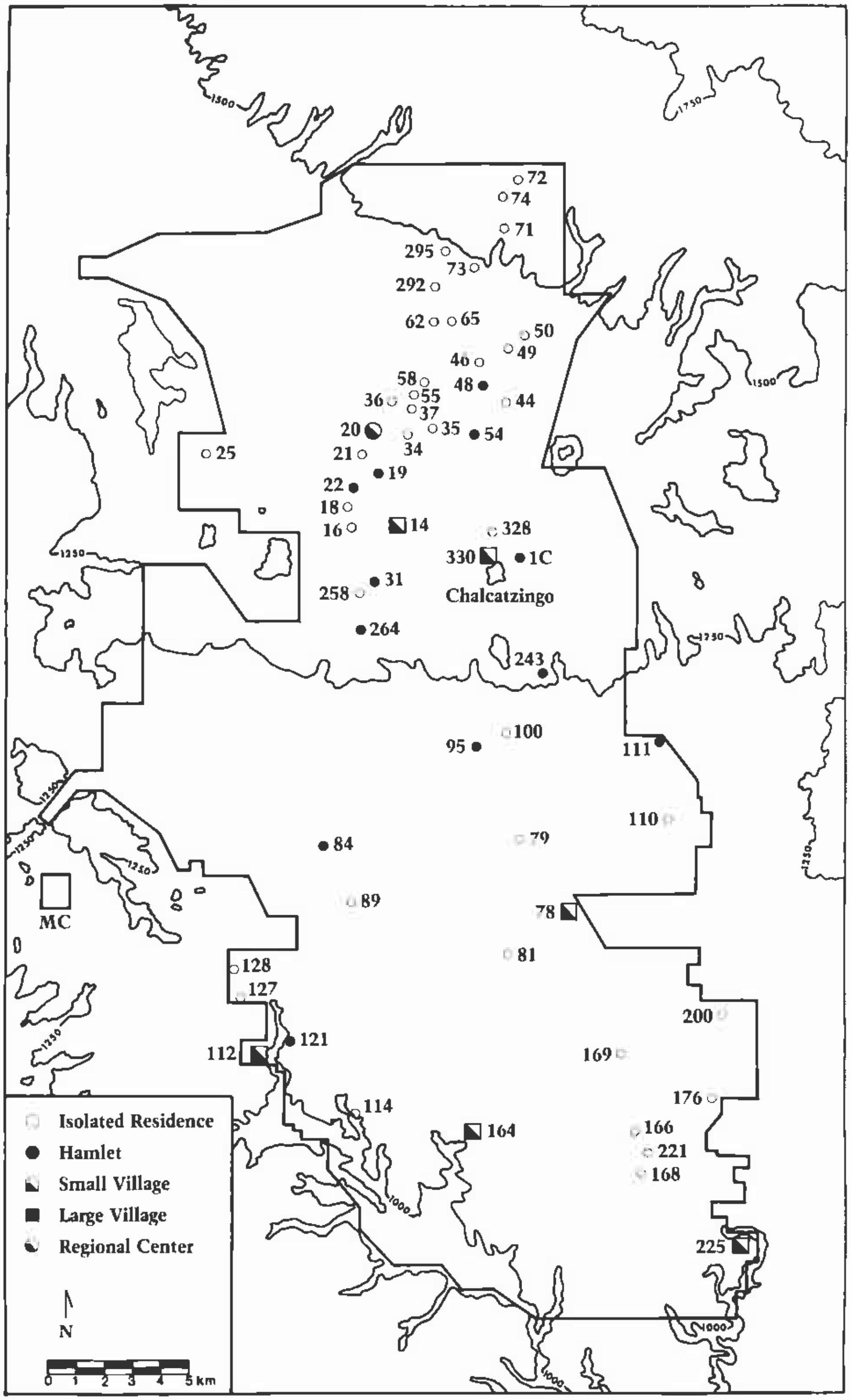

Figure 21.6. Late Formative settlements in the survey area.

appear to date to the Late Formative.

During the Cantera phase there was a high concentration of population in the northern and central portions of the valley. More than 70 percent of the regional population was located above the 1,250 m contour interval. During the Late Formative this situation changed. Population in the northern half of the valley above the 1,250 m contour interval declined from an estimated maximum of 2,610 persons during the Cantera phase to a maximum of 2,150 persons during the Late Formative. There was a more uniform distribution of population throughout the valley, although roughly 55 percent of the population was still located in the north. Four Small Villages were found in the south. Each was the focus of ceremonial activity and constructed and maintained a small-scale civic-ceremonial zone of two or three mounds.

A number of basic trends in the subsistence pattern can be detected in the Late Formative settlement configuration, including (1) the continued expansion of population throughout the valley into previously unoccupied environmental niches, (2) an increase in the number of small agriculture communities within the northern Pithecellobium Woodland environment, and (3) a greater exploitation of the southern Huizache Grassland zone with a large number of sites found for the first time away from permanent water sources and in areas of low ground water. In the north, there was a dense population clustering throughout the Pithecellobium Woodland as much of the area "filled up" with small Hamlet communities. In the south, settlements were linearly arranged due to their location along shallow-sided barrancas which contain water during the rainy season of each year. No less than four such linear arrangements occurred: (1) RAS-100, -95, -79, -78; (2) RAS-111, -110; (3) RAS-84, -89; and (4) RAS-169, -166, -221, -168. This linear arrangement is absent in the north because there are very few shallow-sided barrancas of any length there. Where they are found, some degree of linearization is found, as in the case of RAS-31, -258, -264.

These linear patterns may reflect the inception of diversion irrigation systems in conjunction with *temporal* agriculture. Although such systems are extremely difficult to document archaeologically, they do appear to have played an important role in the southern half of the valley from this time on. The number of Hamlet communities located adjacent to shallow-sided barrancas increased into the Classic period, when they were part of a well-organized agricultural network whose primary function appears to have been the production of subsistence commodities for Teotihuacan (Hirth 1978b).

These changes in settlement location may be a response to changes in environmental conditions which affect regional agricultural practices. Investigators in the Valley of Mexico (e.g., Sanders, Parsons, and Santley 1979:406) suggest that climatic conditions became increasingly drier during this period. Alternative data available from the Puebla-Tlaxcala area suggest that climatic conditions during the Late Formative were wetter than during the Middle Formative (Heine 1973). If conditions were drier during the Late Formative, it would be reasonable to expect that seasonal collecting would have again become an important subsistence activity which would favor site location in areas of microenvironmental diversity.

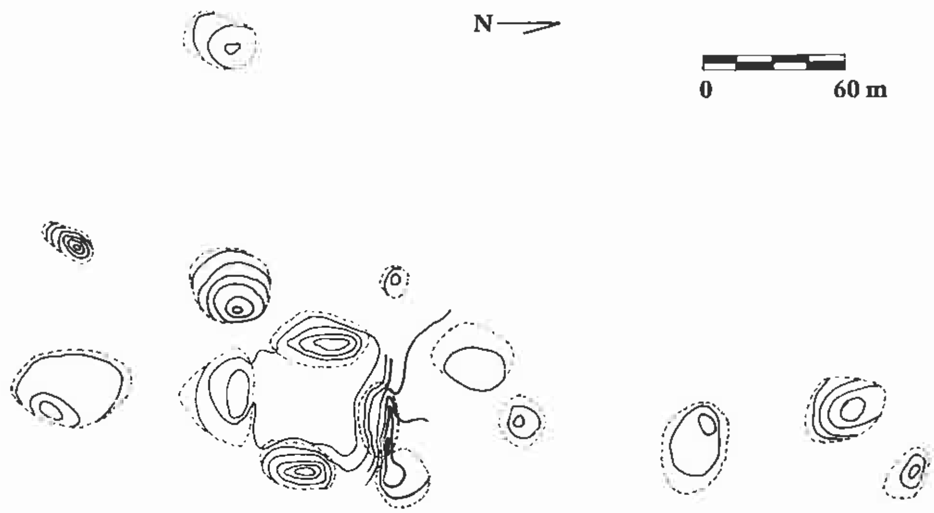

Figure 21.7. Campana de Oro (RAS-20). Contour interval 0.5 m.

Data for the Amatzinac Valley support the interpretation of wetter environmental conditions, at least insofar as there is no apparent correlation between population size or site type with specific environmental variables (Tables 21.8, 21.9). Although the largest sites in the valley are still found adjacent to permanent water sources, there is a decrease in the occupation of sites having multiple vegetation zones within a 1 km radius. On the whole, environmental zones within the valley appear to decrease in importance as site location criteria, as wetter conditions permitted rainfall agriculture to be practiced on a broader scale.

For reasons not altogether clear, Chalcatzingo rapidly decreased in size after 500 BC. The population clustered around Chalcatzingo during the Cantera phase was dispersed throughout the valley with a major spillover into the northern Pithecellobium Woodland. Thirty-six sites were newly established during the Late Formative. Although the rates of new site foundings are roughly identical during the Cantera phase and the Late Formative, the rates of old site abandonment differ significantly. The rate of site abandonment between the Barranca and Cantera phases was about 9 percent, as compared to 57 percent between the Cantera phase and the Late Formative.

Population shifts throughout the valley present a picture of increased settlement clustering at the regional level when viewed from the perspective of Nearest Neighbor analysis (Table 21.10). This is especially true in the Pithecellobium Woodland after the population reductions in the central valley. There is, however, an increase in the regular spacing of Level II communities, perhaps a result of slightly greater competition between village level sites associated with a decrease in regional social cohesion following Chalcatzingo's decline. Small sites for the first time are less clustered with respect to one another than they are to the larger sites (0.763 as compared to 0.692 in Table 21.10). This clustering of small sites around large sites suggests the appearance of clearly defined social territories at the village level throughout the region.

The Late Formative period throughout central Mexico was a period of continual population growth and differentiation. In the Tehuacan Valley the Late Santa María phase was one of substantial demographic change represented by an increase in total site area. A total of thirty-eight sites have been found in the valley, with regional population swelling to between five thousand and eight thousand individuals. Large Villages appeared for the first time, referred to as Nuclear Towns (MacNeish, Peterson, and Neely 1972:397). These are large permanent settlements with two or more plazas, public architecture, and a variety of structures which may have housed full-time specialists. These sites grew as large as 12 ha in size and included up to fourteen mounds.

In Tlaxcala the Late Formative period corresponds to the last half of the Texoloc phase (García Cook 1973; 1974; Mora 1975) and the first century of the subsequent Tezoquipan phase (Davila 1975). Population grew substantially in this region. During the Late Texoloc, terrace-canal systems incorporating diversion dams are found with increasing frequency on sloping hillsides. After 300 BC there was an increase in complex irrigation systems, and canal grid-works appeared in conjunction with the growth of larger, more complex sites. The growth of regional chiefdoms is evident in both the number and the complexity of large sites throughout the region, and we see the beginnings of such large centers as Tlalancaleca (García Cook 1973).

The same pattern is evident in Puebla. Large Regional Centers such as Amalucan appeared. Amalucan is just under 1 km^2 in size and has an impressive early irrigation system (Fowler 1969). Village and Hamlet communities clustered within a 1–3 km radius in and around the large centers. Six such clusters have been reported from the Valley of Puebla, and it is suggested that these clusters symbolize the development of symbiotic

Table 21.17. **Late Formative Population Summary, Río Amatzinac Valley**

RAS Site	*Size in Hectares*	*Ceramic Density*	*Site Class*	*Population*
1C	4.00	C	Hamlet	20–40
14	5.5	B	Small Village	55–138
16	≤0.50	C	Isolated Residence	5–15
18	≤0.50	C	Isolated Residence	5–15
19	1.0	B	Hamlet	10–25
20	31.0	A/B	Regional Center	543–1,163
21	≤0.50	C	Isolated Residence	5–15
22	5.0	C	Hamlet	25–50
25	≤0.50	C	Isolated Residence	5–15
31	1.00	B	Hamlet	10–25
34	0.75	C	Isolated Residence	5–15
35	≤0.50	C	Isolated Residence	5–15
36	≤0.50	C	Isolated Residence	5–15
37	≤0.50	C	Isolated Residence	5–15
44	≤0.50	C	Isolated Residence	5–15
46	≤0.50	C	Isolated Residence	5–15
48	9.20	C	Hamlet	46–92
49	0.92	C	Isolated Residence	5–15
50	1.0	C	Isolated Residence	5–15
54	2.0	C/B	Hamlet	15–30
55	0.68	C	Isolated Residence	5–15
58	1.5	C	Isolated Residence	8–15
62	≤0.50	C	Isolated Residence	5–15
65	≤0.50	C	Isolated Residence	5–15
71	≤0.50	C	Isolated Residence	5–15
72	≤0.50	C	Isolated Residence	5–15
73	≤0.50	C	Isolated Residence	5–15
74	≤0.50	C	Isolated Residence	5–15
78	30.00	C	Small Village	150–300
79	≤0.50	C	Isolated Residence	5–15
81	≤0.50	C	Isolated Residence	5–15
84	1.00	B	Hamlet	10–25
89	1.50	C	Isolated Residence	8–15
95	2.10	B	Hamlet	21–53
100	≤0.50	C	Isolated Residence	5–15
110	≤0.50	C	Isolated Residence	5–15
111	3.50	C	Hamlet	18–35
112	10.00	A/B	Small Village	175–375
114	≤0.50	C	Isolated Residence	5–15
121	2.10	C	Hamlet	11–21
127	≤0.50	C	Isolated Residence	5–15
128	0.75	C	Isolated Residence	5–15
164	9.10	A	Small Village	228–455
166	0.60	C	Isolated Residence	5–15
168	≤0.50	C	Isolated Residence	5–15
169	0.80	C	Isolated Residence	5–15
176	≤0.50	C	Isolated Residence	5–15
200	≤0.50	C	Isolated Residence	5–15
221	≤0.50	C	Isolated Residence	5–15
225	4.50	B	Small Village	45–113
243	8.50	C	Hamlet	43–85
258	≤0.50	C	Isolated Residence	5–15
264	1.26	B	Hamlet	13–32
292	≤0.50	C	Isolated Residence	5–15
295	≤0.50	C	Isolated Residence	5–15
328	1.10	C	Isolated Residence	5–15
330	11.0	C	Small Village	55–110
			Total population	2,516–3,737

"demographic zones" in the valley (Fowler et al. 1977).

In the Basin of Mexico the Late Formative period (500–200 BC) is represented by the Ticoman and Cuanalan ceramic assemblages. Population quadrupled, and continued cultural development is seen in the appearance of civic-ceremonial architecture and increasing differentiation of community types. Cuicuilco grew to become the largest and most important settlement in the valley, much of its growth resulting from the relocation of population out of the southern shore line of Lake Xochimilco and into the center (J. Parsons 1976).

Two general trends characterize the Late Formative settlement pattern: the expansion of population into ecological zones which had not been previously settled and the maximization of productive activities through site specialization (J. Parsons 1976:78). There is evidence for a movement of population away from lakeshore areas to Lower Piedmont zones, and several sites in the Texcoco and Ixtapalapa regions were situated below the conquest period lake level. If the Late Formative was drier than preceding periods, the high subsurface water table enjoyed by sites along the Lakeshore Plain would have been lost. Piedmont zones would then have become favored because of their fertile loose-grained soils and the seasonal runoff from higher elevations, which could have been utilized to irrigate crops.

The Late Formative in the Basin of Mexico documents the transition between simple and complex chiefdoms. Small, politically autonomous centers were established throughout the greater Texcoco, Chalco, Ixtapalapa, and Cuicuilco regions. These centers were the focal points of regional resource pooling and redistribution throughout their newly formed but economically unstable hinterlands. Although characterized by both dispersed and aggregated population hierarchies, the Late Formative "contrasts with the Middle Formative situation where there was a single large community in a prime ecological niche with only scattered occupation over the rest of the area" (J. Parsons 1971:184). There was an increase in the number of communities which were part of a more cohesive economic network emerging at this time throughout the Basin of Mexico.

The Río Amatzinac Valley lost its important role in central Mexico after the decline of Chalcatzingo. It now lacked a Regional Center of pan-Mesoamerican importance, and its population profile became similar to those of neighboring portions of the central highlands. Definite indications of hydraulic agriculture are not found until the subsequent Terminal Formative period (Hirth 1980). Sites are tightly nucleated, and MacNeish's concept of the Nuclear Town (see above) is an appropriate hallmark for the phase as a whole, suggesting an increase in social solidarity at the community level. The larger settlements existed in a symbiotic relationship with smaller communities clustered in the immediately surrounding area.

Recent research in western Morelos indicates similar developmental processes in the Coatlan region, with Regional Centers reaching 70–80 ha in size. Whether the Late Formative population clusters found in Morelos, Puebla, Tlaxcala, and the Basin of Mexico represent small chiefdom societies still remains to be tested. The suggestion is a plausible one, however, which would account for a general trend toward larger and architecturally more complex sites during this period.

CONCLUSIONS

The original intent of the Río Amatzinac Survey was to determine the relationship of Chalcatzingo to its larger physiographic region. A methodology was devised so that the greater extent of the region could be covered, locating all sites where traces of surface residue still existed. Finer-scale analyses of intersite variability and composition had to be forsaken for the broader picture. A multistage methodology was considered in which the initial survey could be followed by intensive problem surface collection; unfortunately the lack of time, money, and trained personnel did not allow its implementation. As a result, the reliability of the conclusions reached from this study rest upon the overall comparisons of the relative size, spacing, periodization, and location of settlements in the region with like data from neighboring areas in central Mexico. Additional speculations are the result of narrative luxury and should be viewed as hypotheses to be tested through further investigation.

During the Amate phase there was a light sprinkling of population in the northern half of the Amatzinac Valley. Chalcatzingo appears to have been the oldest continually occupied settlement in the region and by 1100 BC had become the principal community in the valley, with modest public architecture. There were also different-sized sites located in different resource zones. This has led me to suggest that some of the small outlying sites were impermanent camps engaged in seasonal resource collection or rainy season maize agriculture. However, many of these settlements may not have been simultaneously occupied during the Amate phase. The function of these sites has been inferred from their relative environmental relations; the precise nature of activities carried out in each and the functional linkages between them can be established only from intensive excavation.

The Amate phase settlement configuration conforms fairly well to settlement patterns found elsewhere in central Mexico at this time. Early populations clustered in the most productive agricultural zones. Permanently occupied villages in the best agricultural areas may have exploited seasonally available resources in adjacent zones by establishing impermanent camps to harvest additional or alternative products (Flannery 1976b:112–117). As population increased and/or social pressures within permanent villages could not be mediated, group fissioning may have led to the establishment of permanent settlements in these same diversified resource zones. Under these conditions the functional relationships between activity sites would have changed through time from locales occupied by the same group to linked communities occupied by different groups.

Ongoing work in the Valley of Mexico has supported the idea of seasonal resource collecting during the Early Formative (Tolstoy et al. 1977). Nevertheless, the presence of lake and lakeshore environs and the greater number of exploitable resource zones which they provided made the Valley of Mexico different from other areas of central Mexico at this time. Seasonal collecting appears to have been more important as a supplement to agriculture in the Valley of Mexico (Tolstoy 1975) than it was in either Morelos or Puebla. As a result denser population nucleation would have been possible there as an incipient agricultural complex was combined with lacustrine resources to produce a protein-rich diet which included quantities of fish, waterfowl, insect larvae, and waterfowl eggs.

During all phases, groups residing in the Amatzinac Valley faced a narrower set of exploitable environmental resources and must have relied upon agriculture for a greater amount of their total subsistence base. Despite a slow beginning, regional population densities soared during the Cantera phase, surpassing contemporaneous levels in the Valley of Mexico. This presents an interesting question. Was the growth of Cantera phase populations and society due in part to a burst in *tierra templada* maize productivity with a commensurate lag in its adaptation to the higher and colder Valley of Mexico? It is impossible to resolve this question with the limited amount of paleobotanical material presently at our disposal. I would suggest that Chalcatzingo's development was due primarily to modifications in social relationships, although changes in subsistence strategies and their productivity may also have been involved.

The growth of social networks throughout the Barranca and Cantera phases appears to have been based on a combination of the exploitation of scarce resources, community budding, and the maintenance of relationships between lineage members. The diversity of environmental zones at Chalcatzingo provided a mosaic of exploitable microenvironments available to early agriculturalists. An unusually high proportion of the regional population was clustered in the immediate vicinity around Chalcatzingo during the Barranca phase, and I would suggest that many of these settlements were probably formed by groups which budded off from Chalcatzingo.

I believe that the earliest ceremonial activity at Chalcatzingo was probably aimed at maintaining an integrative equilibrium in the resident population. Social conflict within communities often led to group fissioning among Early and Middle Formative societies. Social controls that appeared at Chalcatzingo during the Barranca phase allowed the site to grow to large proportions and maintain an integrated society well into the Cantera phase. The expansion of the site's ceremonial zone during the Barranca phase coincides with the first significant penetration of settlement into all of the region's environmental zones. It is possible that formal social linkages were maintained between sites in different environmental zones to maximize regional resources at the same time that overt competition was diminished. If such links existed, they probably would have been based on lineage ties and cemented by group ceremonialism using the special-purpose facilities at Chalcatzingo. Chalcatzingo's central social importance can perhaps be related in part to the formalization of socioeconomic relationships which first appeared during the Amate phase.

Civic-ceremonial architecture outside of Chalcatzingo does not appear until the Cantera phase and even then does not suggest a lessening in Chalcatzingo's role as the region's major ceremonial center. To the contrary, it may well reflect the formalization of its hierarchical position. A greater diversity of ceremonial paraphernalia and long distance trade items are found in a wider array of sites than during the Barranca phase. Cantera phase population increases, but there is no break in settlement continuity which would suggest developing frictions between competing elites within the valley.

The Middle to Late Formative transition presents a number of problems which can be resolved only by future investigation. Considerable differences can be noted in the orientation and organization of settlement after the Cantera phase. There is less internal diversity in the Late Formative settlement patterns, and one could surmise that there was less specialization in certain types of subsistence activities than occurred earlier. There is no large site completely comparable with Cantera phase Chalcatzingo in either size or ceremonial architecture. On the other hand, we should not be led to believe that Chalcatzingo society suddenly "collapsed" to be followed by a period of cultural decadence or stagnation. The organization of the Late Formative population resembles that of a small regional chiefdom similar to those found in other areas of central Mexico during this period.

Population within the valley shifted toward more generalized exploitation patterns during the Late Formative with greater reliance on agricultural activities in a restricted number of environments. I have suggested a decrease in seasonal collecting in conjunction with this change. It is important to note, however, that this is part of a general adaptive change beginning at the end of the Amate phase and continuing throughout the Formative. During the Amate phase seasonal collecting was presumably still important in supplying a portion of the total subsistence picture; as a result small microband camps clustered in the key resource areas throughout the region. In terms of the Nearest Neighbor analysis this was represented by a greater clustering of small settlements one to another than to all sites both large and small. This relationship, however, changes through time. During the Amate phase the measure of site clustering for all sites in the region (Level I) is 0.646 compared to 0.476 when only the small (Level IV) sites are examined. By the Late Formative this "cluster ratio" dropped to 0.692/0.763 indicating a lesser clustering of small sites than for all of the sites regardless of size (Table 21.10).

Chalcatzingo's decline was fairly rapid, starting during the latter part of the Cantera phase and terminating at the start of the Late Formative. It is unfortunate that we cannot trace the transition in terms of settlement patterns, but at present we lack tight chronological control for this transition phase. The Late Formative was a period of readjustment but not stagnation or decline. The quantity of surface remains at small sites in the valley suggests that overall settlement densities may even have risen. If this was the case (the alternatives to this explanation have already been discussed), there may well have been a situation of overall population increase during this period.

Our general lack of understanding of the sociopolitical processes taking place during the Late Formative makes comparison of the Amatzinac developments with those in other areas of Mesoamerica difficult. In general terms, however, the key factor in central Mexico at this time appears to have been growing regionalization in conjunction with an increase in centralized authority. Complex chiefdom societies became more numerous and characteristic of most areas at this time. Denser populations made the need for resource pooling at the regional level more critical than it had been during previous periods. Architectural constructions with ceremonial functions became much more prevalent, and statuses and regional entities themselves were more sharply distinguished from one another in terms of their internal corporate composition and interaction. Whatever the nature of their internal organization, these entities began to diverge in terms of the quantity of shared attributes of material culture. Distinctly regional ceramic styles began to replace the horizon styles of the Middle Formative. Interregional exchange continued but was more restricted in scope, with a greater percentage of the exchanges occurring between a smaller number of individuals in the upper statuses of each society.

Changing interregional exchange relationships had a pronounced effect on Chalcatzingo's position as a major center in central Mexico. It would appear that the conditions which shaped the nature of Cantera phase society were not sufficient to maintain it throughout the Late Formative. The Amatzinac Valley did not take a step backward in terms of its sociopolitical development as much as it fell back in line with the general level of cultural activity found throughout central Mexico outside of the Mexican Basin. Although the Amatzinac Valley remained in close contact with the Valley of Mexico throughout its later history, it never again played a pivotal role in interregional exchange nor had a center of supraregional importance. The growth of Chalcatzingo is an interesting case because it serves to point out the potency of trade as a stimulus in the early stages of cultural evolution. At the same time its instability in the face of changing interregional relations is enough to clarify that trade in the absence of other conditions is not sufficient, in and of itself, to generate the prolonged and steady development of complex society.

RESUMEN DEL CAPÍTULO 21

Los primeros poblamientos en el valle Amatzinac ocurren durante la fase Amate del Formativo Temprano. La ausencia de pueblos durante el Arcáico puede obedecer a la escasez de plantas silvestres comestibles en la localidad y a la distribución desigual de alimentos de recolección durante el año. Fueron localizados diez sitios de la fase Amate durante el reconocimiento realizado en el valle, todos ellos Residencias Aisladas y Caseríos con la excepción de una Pequeña Población (Chalcatzingo). El bajo nivel de la población local contrasta con las ocupaciones más densas, contemporáneas, en el Valle de México y en el centro de Morelos. La mayoría de los sitios se localizan junto a manantiales perennes y tierra agrícola fértil, lo cual indica la importancia que tenía la agricultura para estos pobladores tempranos. Ocho de los diez sitios se encuentran localizados en la mitad norte del valle, esto es, en la zona más húmeda de Bosque Pithecellobium de tierras más ricas.

Dentro de la jerarquía del sitio, los Caseríos y la Pequeña Población ocurren dentro de la zona intermedia colindando con varias zonas de vegetación, en donde mayores recursos recolectables pueden haber aumentado las actividades agrícolas. Las Residencias Aisladas, por otra parte, se encuentran restringidas a una sola zona de medio ambiente y generalmente distantes tanto del agua como de los asentamientos más grandes. Seguramente se trata de campamentos de microbandas con personas provenientes de las comunidades permanentes y más grandes, las cuales se ocupaban en actividades estacionales dentro de las zonas más especializadas, p.e., de caza o recolección de plantas u otras provisiones.

Durante la fase Barranca la población en el valle sobre pasó al doble. Tres agrupamientos de población surgen en esta fase, un agrupamiento de pequeños Caseríos y Residencias Aisladas al norte, un agrupamiento central de alta densidad de población y diversidad de asentamiento, y un agrupamiento al sur formado de asentamientos dispersos con Pequeñas Poblaciones y Caseríos. Chalcatzingo era la comunidad más grande en el agrupamiento central, y durante ese tiempo una porción grande del sitio fué terraceada. Se estimó que su tamaño era de 13 ha, y su población de 130 a 325. Esto permite la comparación favorable con otros sitios grandes en el Valle de México. Varios sitios más pequeños se agrupan alrededor de Chalcatzingo.

Hay una continuidad fuerte entre los patrones de asentamiento Amate y Barranca, siendo la distancia al agua todavía un factor importante en la ubicación del sitio. Las diferencias encontradas en la fase Barranca incluyen un aumento en el número y tipo de sitios con acceso a zonas de medio ambiente multiple (lo cual incluye las Residencias Aisladas), y una distribución más pareja de la población a través de la region. Algunos de los sitios más pequeños se encuentran obviamente ligados a sitios específicos más grandes.

La fase Cantera representa casi el triple de la población del valle. La división tripartita del valle persiste en esta fase, y Chalcatzingo creció hasta llegar a ser el Centro Regional, con lo cual continuó dominando el centro del valle. Su tamaño aumentó hasta justo por debajo de 0.5 km², con un cálculo de población de 433–1,081. Otra vez, este tamaño es comparable al de los sitios contemporáneos grandes en cualquier parte del centro de México.

Dentro del valle hubo un aumento en la aparición de comunidades de tamaño intermedio, Poblaciones Pequeñas y Grandes, a costa de sitios más pequeños, lo cual indica un aumento en la integración social. Algunas de las poblaciones del agrupamiento central, el área más densamente poblada, ya tenían construcciones cívico-ceremoniales relativamente pequeñas. También hay muestra de montículos de plataforma en el agrupamiento del sur, en tanto que el agrupamiento del norte continúa teniendo sólo sitios pequeños.

Uno de los cambios mayores de ubicación de sitio se debió al aumento en el uso de la agricultura temporal, p.e., se fundaron nuevos sitios más alejados de las áreas con humedad en el subsuelo, o en áreas con topografía levemente rolada, la cual pudiera acumular suficiente corriente superficial durante la temporada de lluvias. El asentamiento en estas áreas de mayor marginalidad, probablemente fue estimulado por el aumento en la población. Las Residencias Aisladas, una vez más, tienden a estar localizadas dentro de zonas ecológicas específicas, y estos pequeños sitios presentan una distribución espacial más uniforme, debido probablemente a la competencia por los recursos.

La interacción social se midió utilizando para ello los factores de distribución de los tipos de cerámica y las herramientas de piedra. En tanto que Chalcatzingo aparentemente ejercía algún control sobre el agrupamiento de población central y las herramientas hechas de obsidiana para todo el valle, al mismo tiempo existía un segundo centro de intercambio localizado en el parte sur del valle, el cual tenía como base la explotación de una fuente local de aprovisionamiento de quarzo.

Comparado con otras áreas del centro de México, el patrón de asentamiento del valle Amatzinac presenta tendencias semejantes de desarrollo. Inmediatamente después de un nivel de población bajo en el Formativo Temprano, hay un incremento demográfico intenso en el Formativo Medio. Chalcatzingo surge como Centro Regional comparable a los de la Cuenca de México y Puebla-Tlaxcala. Lo que distingue al valle del Río Amatzinac de estas otras áreas es el papel central que Chalcatzingo parece haber tenido en la integración regional.

Diferentes cambios ocurren en el patrón de asentamiento del Formativo Tardío, dados posiblemente en conjunción con el ocaso de Chalcatzingo como Centro Regional. El porcentaje de personas que viven en las comunidades de tamaño intermedio aumenta, en tanto que se reduce la población en los Caseríos y las Residencias Aisladas. Existe un índice alto de abandono de sitios entre la fase Cantera y el Formativo Tardío. Con el desmoronamiento del agrupamiento central, aun cuando la población continuó en aumento, ésta se dispersó hacia las partes del valle previamente no ocupadas. El valle perdió la importancia que tenía en el centro de México dado que carecía ya de un Centro Regional de importancia Pan-Mesoamericana.

22. Excavations at Telixtac and Huazulco

TERESITA MAJEWSKI

One of the project's research goals was to excavate smaller Middle Formative sites in the Río Amatzinac Valley to provide comparative data as well as information on intravalley interaction during this period. Time and funds were limited, so the decision was made to test excavate one site in the valley north of Chalcatzingo and another south of Chalcatzingo. We wanted sites at the lower range of the settlement hierarchy to gain a more complete perspective on Chalcatzingo's sociocultural role in the Amatzinac Valley settlement system.

After visiting many prospective locations, Huazulco (RAS-62) in the northern sector and Telixtac (RAS-144) in the southern section were chosen (see Fig. 21.4). These two sites were accessible and had good Middle Formative debris. Part of the Telixtac site is bisected by railroad tracks; thus, in addition to regular permits, permission to work near the right-of-way had to be obtained from railroad officials. Telixtac was test excavated in March 1974 and Huazulco in April 1974.

TELIXTAC

The site RAS-144 (Figs. 21.4, 22.1) is located on part of the *ejido* land belonging to the small village of Telixtac, about 15 km due south of Chalcatzingo in the drier Huizache Grassland zone. In this area Middle Formative settlements are located either along permanent rivers or near springs. Several sites were found along the Río Amatzinac where barranca sidewalls widen and open onto alluvial terraces which could have been utilized for floodwater irrigation.

This portion of the valley is also characterized by shallow-sided impermanent drainages. Telixtac lies at the confluence of four of these small drainages. It is also near a small spring. Surface debris covers over 2 ha between two east-west running drainages (dry at the time of excavations). Ground cover is minimal since the site is used for annual maize cultivation.

Telixtac is a shallow site, with sterile soil and *tepetate* occurring at a depth of about 1–1.5 m. Much of the site has been destroyed by repeated plowing, and cultural debris begins within what is now the plow zone (0–20 cm below surface). To the east, a separate limited Postclassic occupation was noted, consisting of a small circular mound and some scattered ceramic debris. None of this material overlay the Middle Formative occupation.

The only indication of Middle Formative architecture is a low, linear platform mound, approximately 100 × 23 m, which is bisected along its long axis and about half destroyed by a railroad cut. Mound architecture dating to this period is rare in the highlands and occurs only at Chalcatzingo and major sites in the surrounding valley. Thus its presence here indicates that Telixtac was relatively important in the regional hierarchy.

Most excavation units were dug in four areas (I–IV) of maximum sherd concentration, which had been determined by a surface survey of the site. Test Pit 1 was excavated to sample an area of relatively low sherd density.

Area I

Only Area I had surface indications of architecture—the low linear mound. This type of platform mound is unusual due to its length; it is similar at first glance to later period range structures. Two profiles (totaling 6.5 m) were cleaned along the west face of the north-south railroad cut bisecting the mound (Fig. 22.1). Although at least one of the structures found in Area I had associated midden buildup extending onto the mound, the stratigraphy indicates that the mound is not midden but was a purposeful construction. The terrain at the site slopes downward from west to east to a northwest-southeast trending bench (20 m wide) of constant elevation. The linear mound was constructed along this natural bench, extending to the southeast.

Excavations immediately adjacent to the mound revealed evidence of a structure having two building phases. A 24 m^2 area along the west side of the mound was horizontally stripped to 40–50 cm below surface level, uncovering part of the wall lines of a rectangular structure oriented north-south and east-west (Fig. 22.3). The structure originally extended northward; the double foundation wall partially shown in the northern part of Figure 22.3 had been destroyed by subsequent excavation for construction. The indented double wall, measuring approximately 1 m in length (at the center of Fig. 22.3), may have been part of a recessed entrance, opening to the west, on the downslope side of the mound. The structure apparently extended eastward onto the mound.

In some parts of the structure, we uncovered remnants of what may have been a stone underlayer to a floor. This is a common subfloor construction technique at Chalcatzingo, possibly designed to facilitate drainage. The overlying floor had probably been of packed earth. The only artifacts found in situ were concentrations of crushed whole and partial vessels and a mano found on part of the wall foundation.

Clay daub fragments, some of them burned, were recovered in the areas adjacent to the wall lines, indicating that some structure walls had been constructed of wattle and daub. Some of the daub fragments had wattle (*Tithonia tubaeformis*) impressions, while others were flat-sided. While many of the flat-sided pieces from wall surfaces at Chalcatzingo had traces of white pigment (Chapter 6), there is no evidence for this at Telixtac.

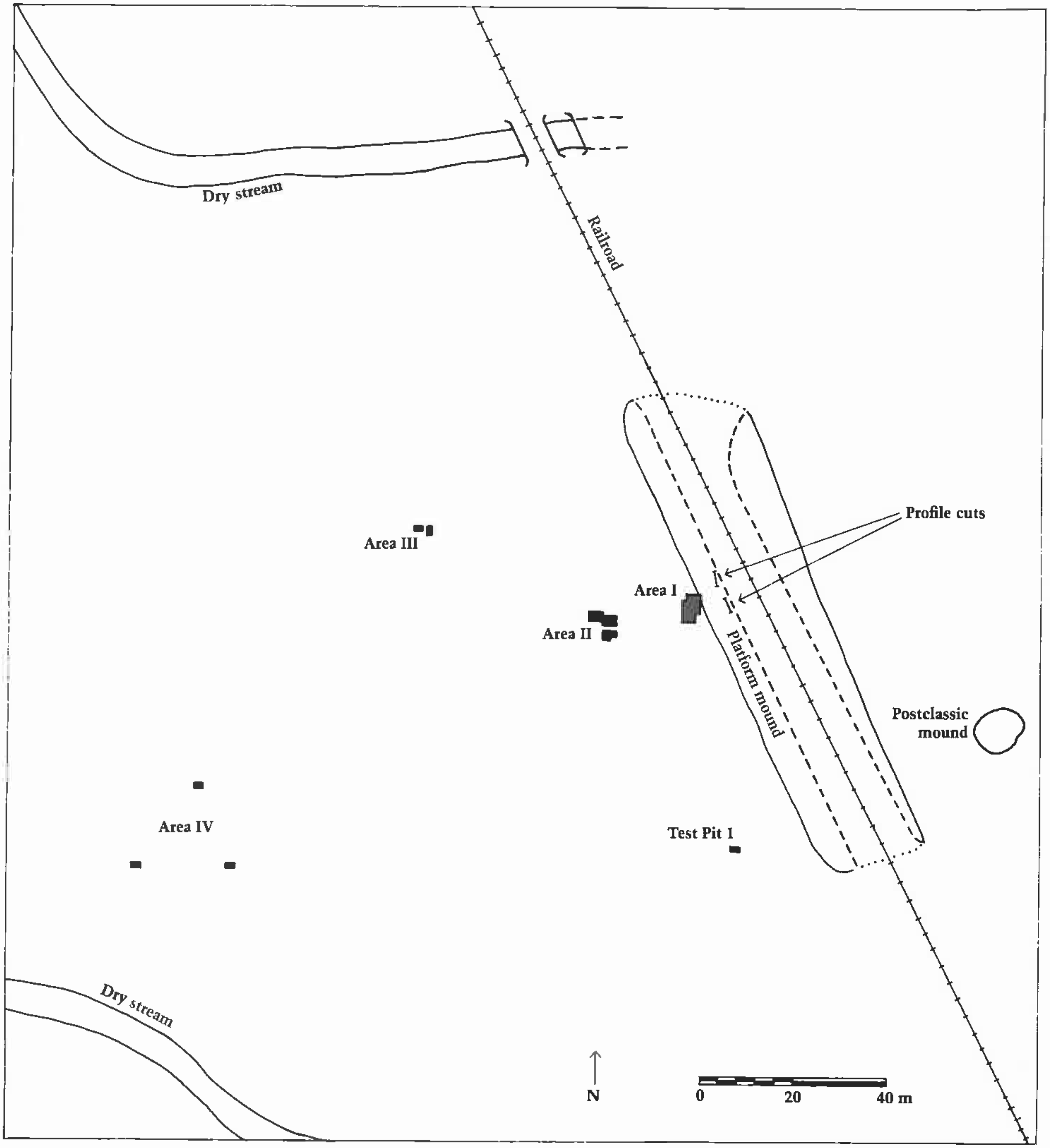

Figure 22.1. Telixtac, showing location of excavation units.

Figure 22.2. Telixtac Area III excavations (*foreground*). The Cerro Gordo and Cerro Chalcatzingo are in the background.

Two trash pits (not illustrated) were associated with this structure. One, on the mound itself, had been dug through part of a wall foundation associated with an earlier construction. It could not be excavated as it was within the railroad right-of-way. For that reason it is not clear whether this pit was inside or outside of the structure. A flexed burial (Burial 3) was found to the north of this trash pit.

The second pit was outside the structure, to the west. Refuse in this pit, which had been excavated into *tepetate*, included ceramics, lithics, ground stone tools, and animal bone. Fragments of human bone occurred in the refuse, and a skull (Burial 2) associated with a partial jade bead and a Carrales Coarse Grey ovate bowl was found at the base of the pit. The pit's basal level has an associated radiocarbon date of 2600 ± 70 BP (720–580 BC; N-1956), well within the Cantera phase limit.

The construction techniques and the presence of subfloor burials, trash pits, and utilitarian artifacts define this structure as a residence, similar to houses at Cantera phase Chalcatzingo. The positioning of this structure adjacent to the long platform mound is quite similar to the relationship between PC Structure 6 and PC Structure 4 (the platform mound) at Chalcatzingo. In neither instance are there data suggesting that these are elite residences, although their association with important public architecture strongly implies that they were special in some regard.

I believe that the linear mound also served a very utilitarian function at Telixtac, probably diverting rainwater and/or barranca overflow away from the living areas.

Area II

What were probably remnants of wall foundations were uncovered in several sections of Area II, but they lay so close to the surface that they had been badly damaged by plowing. The occupation debris in this area is shallow, with sterile soil occurring at approximately 50 cm below surface. Floor debris appears to have accumulated directly on top of the sterile horizon. Part of a straight-sided pit was uncovered in profile, having been cut into the sterile layer.

Ground stone tools were common in Area II, and only Area I had more burned daub fragments. Area II is unusual because all excavated levels contained more than 60 percent eroded sherds. This was not the case in any other area of the site. The only bone material recovered was a human premolar.

Area III

Excavations in Area III were limited to two 1 × 2 m units. Cultural debris was relatively light; only 5 gm of adobe were recovered. Worked animal bone was found as well as several ground stone artifacts, including two mano fragments and a tubular arrow shaft straightener.

One burial (Burial 1) was found in Area III. Unfortunately, this burial was removed by looters before it could be properly excavated. The associated artifacts were eventually recovered, however, and most basic data concerning burial form can be reconstructed. The interment was flexed and appeared to have been a young adult about 15–20 years old, placed in a shallow grave pit. Associated offerings included two whole C5 figurines, a small incised Amatzinac White shallow bowl, an animal effigy pot, and a Pavón Fine Grey pinch-sided ovate bowl. A fourth bowl (Fig. 22.4, upper center) was recovered from looters' backdirt after they vandalized the burial one night, before it was completely excavated. The vessel, probably associated with the burial, is Amatzinac White and has rim form RB-78.

A comparison can be made between this Telixtac burial and the subfloor burials of Chalcatzingo PC Structure 1 (Chapter 8; Appendix C), one of which (Burial

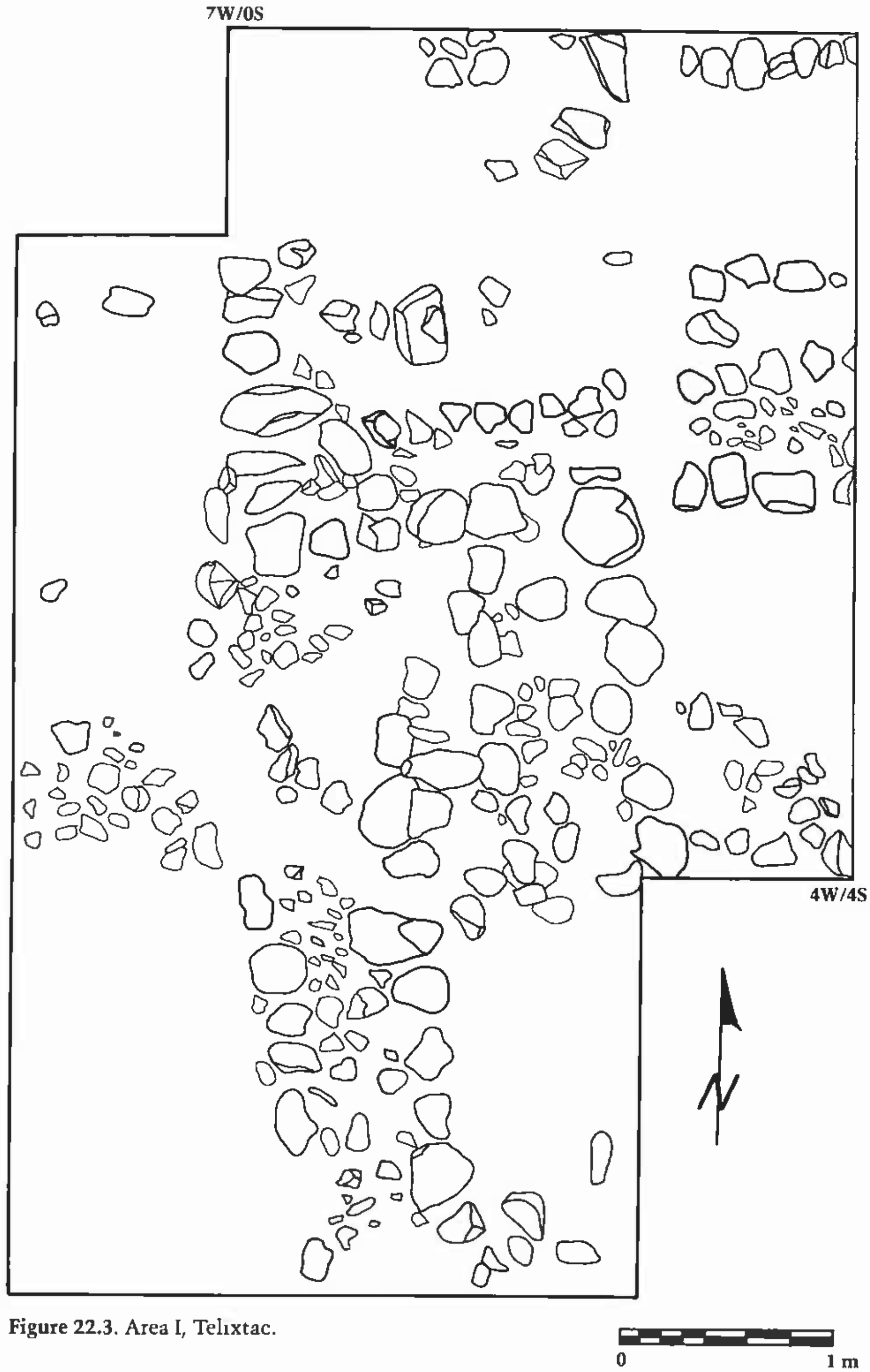

Figure 22.3. Area I, Telixtac.

28, a crypt burial) also had an animal effigy pot. The inclusion of Amatzinac White shallow bowls in burials was also a common practice at Chalcatzingo. Although there is no direct evidence for a structure here, this burial may have been associated with a household cluster.

Area IV and Test Pit 1

These areas are considered together here since they are stratigraphically similar. In Area IV, the area farthest from the platform mound, three 2 × 1 m pits were excavated. Debris here was light, and the remnants of possible wall foundation lines were found in only one unit.

Test Pit 1, which also measured 2 × 1 m, was placed near the mound, about 110 m east of Area IV and 45 m south of Area I. A line of rocks, which may have been part of a structure wall, appeared in this unit, as well as a partial straight-sided pit in profile. Debris in the area of this excavation was moderately heavy, but was concentrated in a small area. Ground stone tools (a whole mano and a partial metate) were recovered from the test pit, but none were found in Area IV. Animal bone was absent in both areas.

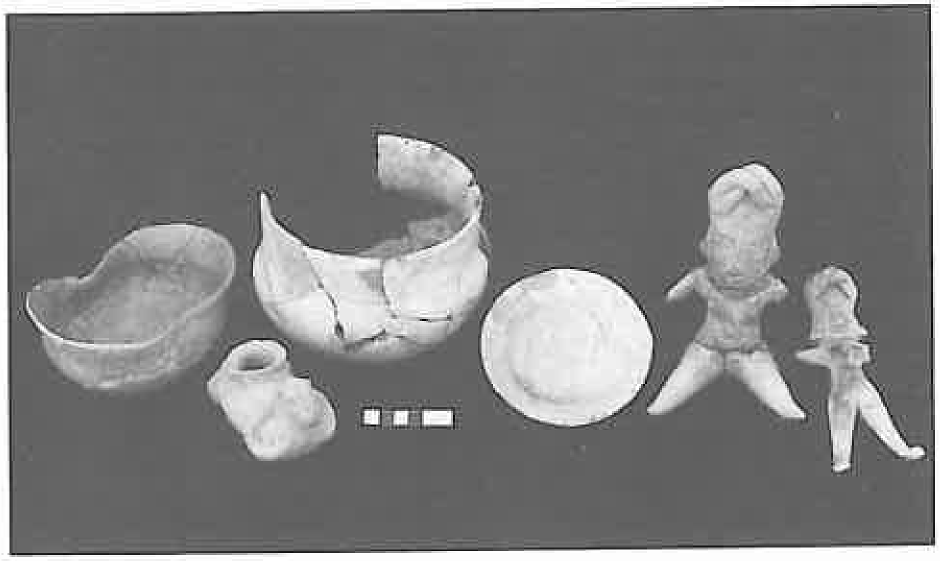

Figure 22.4. Telixtac Burial 1 ceramics.

HUAZULCO

The site of Huazulco (RAS-62) is about 10 km northwest of Chalcatzingo in a flat, moderately wooded area at an elevation of about 1,500 m. It lies about 600 m east of the Río Frío. This entire area of the valley is within the Pithecellobium Woodland environmental zone.

Middle Formative cultural debris was scattered in an area of less than 0.25 ha in the center of a 2 ha cornfield southwest of modern Huazulco. Sherds were concentrated in the southern part of the site, and a 13 m long north-south trench was placed in this area (see Fig. 22.5). Several small additional units were excavated north, east, and west of the trench outside of the ceramic scatter which defined the site, but they revealed no significant cultural remains.

Two habitation floors were found in the southern portion of the main trench. The most recent was at the base of the plow zone, and an earlier construction lay directly above a *tepetate*-like soil, about 1 m down. An incomplete stone foundation wall oriented east-west, forming the southern wall of a structure, was associated with the earlier floor. A disturbed subfloor burial (Burial 1) associated with the uppermost floor only 20 cm below the surface was directly north of this wall. The burial lacked mortuary furniture.

Large amounts of burned earth and pole-impressed daub fragments were recovered throughout the trench, further evidence for a structure, yet no compan-

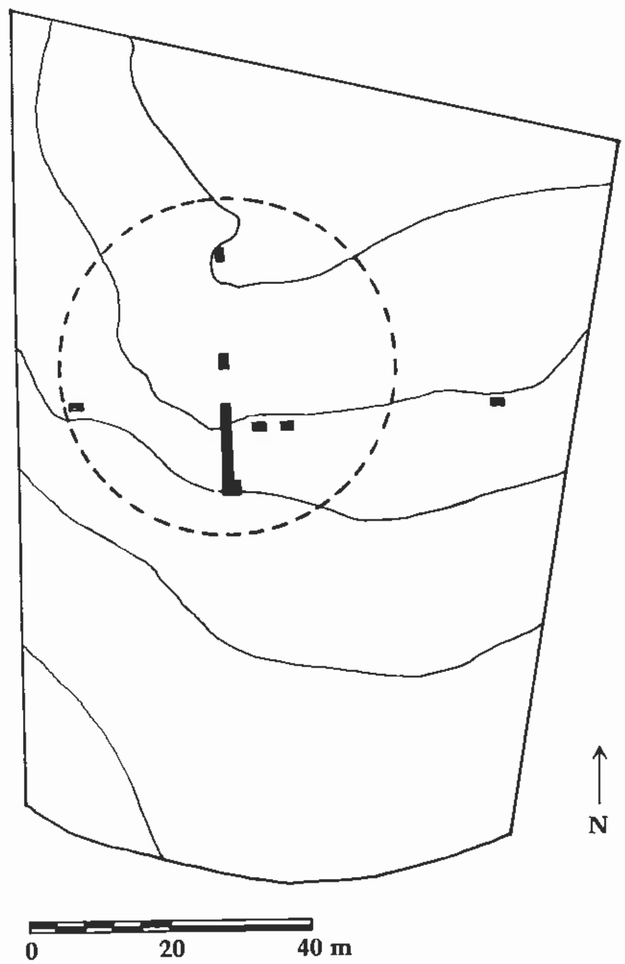

Figure 22.5. Huazulco site area. Solid line is field boundary; dashed line marks the extent of the destroyed mound. Contour interval 50 cm.

ion wall for either floor was found to the north. This could have been due to plowing disturbances. However, such a wall may have been constructed of adobe brick, which probably would not have been preserved (see Chapter 6). One complete brick was found in the northern part of the trench.

Almost 11 kg of adobe debris (some burned and some with flat surfaces) was recovered from one 4 × 1 m area of the trench. This suggests that at the time of destruction of this structure, one wall caved inward (south) toward the probable center of the house. The positioning suggests that the wall may have been located in an unexcavated area at approximately 3S/0E. The combination of daub and adobe brick fragments implies that one or both of the constructions uncovered in the trench may have had both adobe brick and wattle and daub walls such as occur with Cantera phase houses at Chalcatzingo. (Wall types, wall combinations, and house destruction are discussed in Chapter 6.)

Two additional floors occur in the northern part of the main trench. One extended along the base of the plow zone, but its exact dimensions are unknown. A wall of small rocks and burned earth was associated with it. About 50 cm below this floor there appears to have been another floor, with some of the adobe base present in the upward-sloping northern portion. An east-west wall of large boulders was at the southern limit of this floor, continuing east for at least 6 m. Although we cannot date this structure, the boulder wall line is similar to Barranca phase T-9B Structure 1 at Chalcatzingo. Fill over the lower floor was put in before the upper floor was constructed, suggesting an intentional raising and rebuilding of the structure, a practice also known from Chalcatzingo.

The small Middle Formative occupation at Huazulco was almost entirely covered by a Postclassic mound. This low, circular mound, said to have been faced with stone, has been destroyed by recent plowing and leveling activities. Burials are reported to have been removed from the mound, but none of the associated artifacts were available for study. Only about 10 cm of the mound soil still remained, all of it within the plow zone, enabling us to map the structure, which was about 30–40 m in diameter. The mound boundaries have been reconstructed on the contour map of the site (Fig. 22.5).

Most likely the mound represented a raised platform upon which several houses or a house compound would have been constructed. The burials could have been subfloor interments within the structures.

ANALYSIS AND INTERPRETATIONS

Ceramics and Figurines

The main purpose of the Telixtac and Huazulco research was to facilitate cultural comparisons with Chalcatzingo. The ceramic typology and chronology developed for Chalcatzingo were employed in the analysis of ceramics recovered during the excavations (Chapter 13).

Based on the ceramic analysis, the Middle Formative component at Huazulco dates to the Late Barranca and Early Cantera subphases. Unfortunately, there are no radiocarbon dates for Huazulco to verify this placement. Amatzinac White, Peralta Orange, and Tenango Brown types dominate the assemblage. The only evidence that Huazulco is primarily a Cantera phase site is the presence of Xochitengo Polychrome, Amayuca Ruddy, and Atoyac Unslipped Polished I ceramics. Pavón Fine Grey, an "import ware," is notable for its rarity at Huazulco.

Telixtac can be tentatively dated between about 650 and 500 BC. Atoyac Unslipped Polished I, Amayuca Ruddy, and Xochitengo Polychrome sherds, all Cantera phase markers, are present in the ceramic assemblage. Xochitengo Polychromes occur in greater abundance at Telixtac than at Huazulco.

Vessel forms were much more useful as temporal indicators at Telixtac than at Huazulco. Especially common in Area I at Telixtac were outcurving wall bowls (RB-25) with complex interior and exterior rim design and *raspada* incising, diagnostic of the Early and Late Cantera subphases. Also diagnostic are the double-loop handle censer (RB-101), the Amatzinac White shallow bowl, and the animal effigy pot.

It is important to note that Peralta Orange and Pavón Fine Grey ceramics occur at both Telixtac and Huazulco, though Pavón Fine Grey is rare at Huazulco. As mentioned in the ceramic descriptions of these types (Chapter 13), Peralta Orange is a type common at Chalcatzingo and is apparently restricted principally to Amatzinac Valley sites, while Pavón Fine Grey is a non-local, imported type. While Peralta Orange could have been made in ceramic-making villages throughout the valley, Pavón Fine Grey would probably have been diffused through the valley site hierarchy by redistribution. This may help explain why Huazulco, a much smaller site than Telixtac, has so few Pavón Fine Grey sherds. It should also be noted that while the punctate decorations on Peralta Orange at Chalcatzingo are normally triangular, those on Telixtac sherds were made with a circular instrument, indicating that different pottery workshops supplied these two settlements.

Figurines from Telixtac and Huazulco are comparable to those of Chalcatzingo, although the Huazulco sample is quite small. Of the definable figurine types, C8, Ch1-3, and Ch1-5 forms are the most prevalent. As at Chalcatzingo, C8 figurines are usually more carefully made and are sometimes orange-slipped and/or polished.

The two C5 figurines found with Telixtac Burial 1 (Fig. 22.4) are indistinguishable from Chalcatzingo's C5 figurines. However, three other figurines recovered from Area I (Fig. 22.6) are similar to Chalcatzingo's Ch1-5 type, yet differ in eye treatment from those. The eyes of the three Telixtac figurines are created by circular impressions with central punctations. This eye treatment may be a Telixtac variant of the Ch1-5 eye form and, like the Peralta Orange ceramics, suggests that Telixtac had its own workshops producing ceramics similar but not identical to those of Chalcatzingo.

A differential distribution of figurines is apparent at Telixtac. All of the excavated C8 specimens there are from Area I, in the residential structure associated with the platform mound. Also, two unusual C8 figurines closely resembling the head of Monument 10 at Chalcatzingo (Figs. 9.27, 22.7*a–b*, 27.1*j–l*) were recovered from the Area I structure. In the three seasons of excavation at Chalcatzingo, only three others of these figurines were found, and they share identical features with the Telixtac examples.

Internal Site Organization

Based on the surface distribution of artifacts recorded during the reconnaissance of Huazulco and other northern valley sites, Kenneth Hirth (Appendix H) interprets Huazulco as having been an Isolated Residence during the Barranca phase and a Small Hamlet in the Cantera phase. Our excavation data suggest to me that there were from one to several rela-

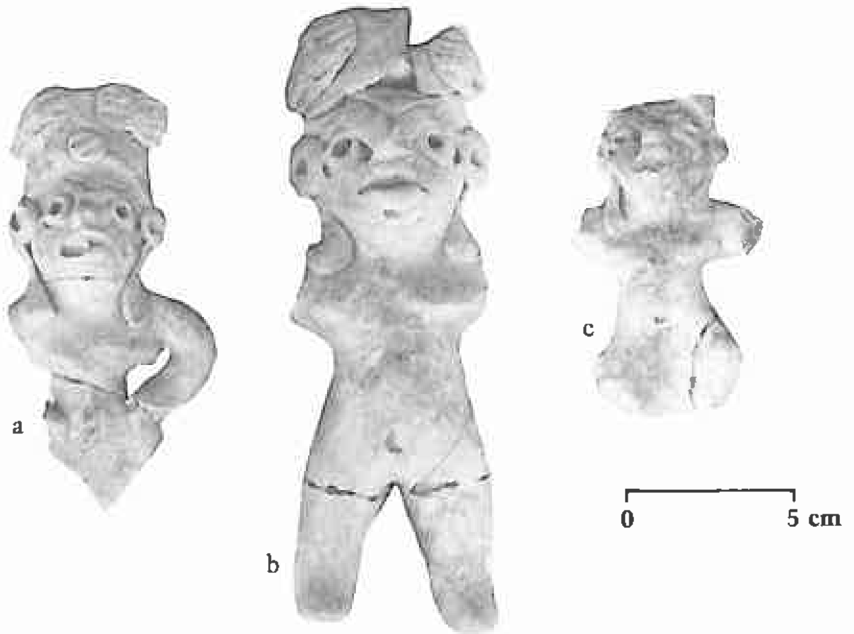

Figure 22.6. Telixtac C5 aberrant figurines.

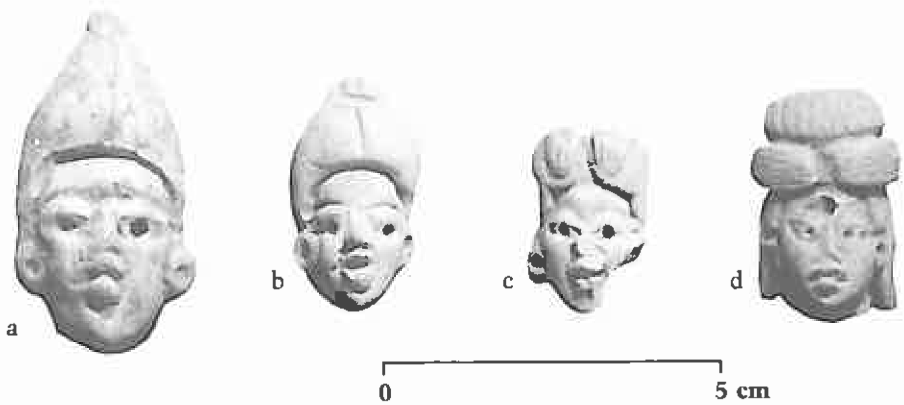

Figure 22.7. Telixtac C8 figurines.

tively contemporaneous household clusters, although superimposed floors were noted. It is unfortunate that house dimensions could not be ascertained to compare to the unusually large residences at Chalcatzingo.

Hirth classifies Telixtac as a Barranca phase Isolated Residence and a Cantera phase Hamlet (Appendix H). However, my surface reconnaissance and excavations revealed no firm evidence for the Barranca phase occupation.

Telixtac had at least five roughly contemporaneous household clusters, with evidence for two sequential constructions in Area I. Wall foundation lines were noted everywhere but Area III, and some had associated refuse pits, ranging in depth from 50 cm to 1 m. The double foundation wall of the Area I structure, although made of smaller stones than similar walls at Chalcatzingo (where stone is far more accessible), suggests that structures may have had adobe plus wattle and daub walls as at Chalcatzingo.

One important similarity between Chalcatzingo and Telixtac is the presence of a Cantera phase structure built beside a linear platform mound (Telixtac Area I and Chalcatzingo PC Structure 6), mentioned above. The Area I excavations at Telixtac also produced a cylindrical jade bead associated with a possible skull burial. These factors, as well as the quality of the artifacts found in Area I (e.g., Xochitengo Polychromes, C8 figurines), indicate that the Area I structure may have been an elite residence. Burial 1, Area III, is also similar to an elite burial at Chalcatzingo (see discussion above).

Perforated sherd discs with modified edges were abundant in Area I at Telixtac. These artifacts may have served as spinning counterweights, which would indicate that the occupants of the Area I structure were involved in the spinning of fiber.

On the other hand, in terms of the analysis of Chalcatzingo's lithics (Chapter 18), the stone tools from Telixtac and Huazulco most closely conform to the Group A pattern (common residences). The lithic artifacts at these sites are high in modified pieces, include few shaped tools, and exhibit a proportionally greater dependence on chert than at Chalcatzingo.

At both Telixtac and Huazulco, lithics needed for household use were probably produced within, or procured by, each living unit. Debitage is almost nonexistent at both sites. It is probable that unworked obsidian arrived first at Chalcatzingo, where it was worked (heavy workshop debris was found on T-37 at Chalcatzingo; see Chapter 19) and then redistributed to outlying areas. The obsidian cores exhibit reuse and exhaustion, strongly suggesting that obsidian was not available in abundance. Chert artifacts made of local materials were always more abundant than those of obsidian, the reverse of the situation at Chalcatzingo (see Chapter 18). Thus, compared to Chalcatzingo, there was a heavier reliance on local as opposed to imported raw materials at these smaller sites.

SUMMARY

The map illustrating the Cantera phase settlement pattern (Fig. 21.4) clearly shows that Huazulco is clustered with ten other small sites in the northern valley. The northern valley appears to represent an early area of colonization during the Formative period. This area came under the control of Chalcatzingo or one of the secondary centers in the central valley region during the Middle Formative.

In contrast, the southern valley exhibits a more dispersed settlement pattern of generally larger sites. Colonization of the southern valley began somewhat later than in the north but developed into at least a two-stage hierarchy of sites, which included secondary centers with platform mounds. The southern valley was integrated through the control of elite living at these secondary centers, which varied in size, e.g., San Ignacio (RAS-78) and Telixtac.

Huazulco and Telixtac, as representatives of smaller sites in the valley, shared a general cultural pattern with Chalcatzingo, one which was different from that of surrounding regions. Two important diagnostics restricted primarily to the valley—Peralta Orange ceramics and C8 figurines—both occur in the rural sites as well as at the main center, Chalcatzingo. At the same time, other objects, such as greenstone pendants and beads, are rare outside of Chalcatzingo.

In terms of more exotic artifact content, Telixtac appears more similar to Chalcatzingo than does Huazulco, although both sites were part of a local network supplementing Chalcatzingo's supply of subsistence goods. The similarities between Chalcatzingo and Telixtac are important, however, since Telixtac was larger than Huazulco and had at least some lower-level elite, while Huazulco was strictly a small rural settlement.

RESUMEN DEL CAPÍTULO 22

Dos sitios de la fase Cantera dentro del valle del Río Amatzinac fueron excavados con objeto de ganar una perspectiva más completa de las interacciones de Chalcatzingo con otras comunidades. Estas son Telixtac, al sur de Chalcatzingo, y Huazulco, un sitio más pequeño hacia el norte.

Telixtac tiene un montículo plataforma largo y en línea, lo cual indica su importancia relativa en la jerarquía regional. Las excavaciones revelaron muestra de una estructura a lo largo del lado poniente del montículo, una residencia semejante en técnica de construcción a los domicilios contemporáneos en Chalcatzingo, y otros cuatro agrupamientos de unidades habitacionales. La ubicación de la casa adyacente al montículo probablemente indica que se trata de una clase de residencia elítica, en base a la analogía que presenta la asociación de PC Str. 6 junto al montículo plataforma (PC Str. 4) en Chalcatzingo. También se descubrieron entierros en el subsuelo y artefactos semejantes a los recobrados en Chalcatzingo.

Huazulco es un sitio mucho más pequeño cuyo componente del Formativo Medio fué cubierto en algún tiempo por un nuevo montículo del Postclásico ahora destruido. Las limitadas excavaciones revelaron muestra de, por lo menos, una estructura con un entierro asociado en el subsuelo, lo cual también pone de manifiesto semejanzas con Chalcatzingo.

Los tipos de cerámica y las formas ubicadas en las fases de Chalcatzingo sirvieron para fechar los dos sitios, con lo que Huazulco fundamentalmente se fechó Barranca Tardío–Cantera Temprano, y Telixtac en el Cantera Tardío. Los dos sitios no tienen la misma distribución de cerámica, p.e., Pavón Gris Fino, una importación quizás controlada por Chalcatzingo, es mucho más raro en Huazulco, probablemente porque tenía menor jerarquía que Telixtac. Las decoraciones a base de puntos de los tepalcates Peralta Naranja de Telixtac se hicieron con un instrumento diferente al que se utilizó en la decoración de sus contrapartes de Chalcatzingo, lo cual indica que se hicieron en otra parte, tal vez en Telixtac mismo. Algunas figurillas de Telixtac también varían de aquellas de Chalcatzingo, aun cuando pueden ser clasificadas dentro del mismo tipo y nuevamente indican la existencia de un taller aparte, dedicado a manufacturar artefactos del estilo Chalcatzingo en Telixtac. Aun cuando los dos sitios obtenían la obsidiana de Chalcatzingo, predominaban los artefactos de cuarzo, lo cual demuestra una mayor dependencia en las materias primas localmente existentes.

En conjunto, los dos sitios participaban del mismo patrón cultural general mostrado por Chalcatzingo. Dos artefactos diagnósticos restringidos al valle, la cerámica Peralta Naranja y las figurillas C8, ocurren en ambos sitios mientras que los artefactos más exóticos, tales como los objetos de piedra verde, se encuentran limitados a Chalcatzingo y quizás a otros sitios grandes poco numerosos.

23. Raw Materials and Sources

DAVID C. GROVE

Archaeologists have recently begun paying greater attention to the raw materials from which artifacts were manufactured. Although "trade artifacts" have long been identified and used for general hypotheses concerning interregional "influences," today artifacts can be scientifically analyzed and sources of their raw materials specifically defined. While these analyses are clearly superior to earlier visual comparisons between artifact composition and source material, scientific characterization is not a Rosetta stone. Characterization provides source data on only a small percentage of the actual (as opposed to the archaeological) cultural inventory. It thus does not serve as a means of documenting entire interaction networks. Nevertheless, it is of substantial value and has contributed greatly to our understanding of some segments of the archaeological record, and has frequently documented that which had previously been conjecture in the realm of trade and exchange.

The Chalcatzingo Project placed special importance upon raw material characterization since both Kenneth Hirth (1978a) and I (Grove 1968c) felt that trade/exchange may have been a significant factor, if not the *raison d'être*, for Chalcatzingo's growth and importance. The results of the characterization studies have been inconclusive in this regard, as perhaps should have been expected. While they demonstrate that Chalcatzingo received raw materials and/or artifacts from other regions, the total data do not elucidate the strength or significance of these inputs, and much remains to be inferred. In fact, the characterization is perhaps most valuable at the local level, where it demonstrates Chalcatzingo's exploitation of resources within the valley.

The exploitation of certain local raw materials which are rare in other regions suggests that Chalcatzingo may have acted as a distributor of these materials to other regions. An intermediary role in the exchange of materials between other regions is also possible. Yet both roles, distributor and intermediary, are difficult to ascertain from the Chalcatzingo data alone, and characterization studies are generally lacking at sites which might have been recipients.

This chapter discusses seven materials found at Chalcatzingo: iron ore, obsidian, greenstone, kaolin, lime, chert, and granodiorite (*cantera*). All of these except kaolin occur in both raw and manufactured states at the site. A generalized map locating the sources of most of these materials in the Río Amatzinac Valley is provided (Fig. 23.1).

IRON ORE

Unworked iron ore fragments as well as worked and polished pieces were recovered at Chalcatzingo from both the surface and excavations. Of the eighty specimens of ore found, only four show any purposeful alteration. In each instance the alteration is present as a relatively roughly ground flat surface. The coarseness of the grinding suggests it was for the purpose of making powder, presumably for use as pigment. The grinding does not seem to be related to the manufacture of polished iron ore artifacts. In addition to the unworked and coarsely ground pieces, thirteen mirrors, including one complete concave mirror found in association with a high-ranking burial (no. 40), were recovered (see below and Chapter 16). Source analyses performed on both the unworked and the polished ore pieces reveal that almost all of the former derive from a local source, while the polished specimens seem to be manufactured only from non-local ores.

Distribution of raw iron ore and polished mirror fragments across the site is non-random. As can be seen in Table 23.1, 58 percent of the raw ore was recovered in the excavations of PC Structures 1 and 2 and T-24. Six raw ore pieces were also recovered from the surface of T-31, suggesting that this unexcavated site area may also have had a significant relationship to iron ore use. Polished mirrors occurred in greatest abundance in the Plaza Central excavations but were also found on T-27, N-5, and S-39, as well as in Cave 1. No raw ore was recovered in these last four excavation areas. Polished iron mirrors usually do not derive from the same contexts or areas which possess the unworked or coarsely ground ore.

Analyses

The most thorough and up-to-date analysis of Mesoamerican iron ore artifacts is currently the work carried out in the Valley of Oaxaca by Jane Pires-Ferreira (1975; 1976b) using Mössbauer spectroscopy (Evans 1975). Through an extensive survey of potential sources in the Valley of Oaxaca and Tehuantepec area, fifty-four sources were sampled, and these provided a base against which to compare raw and worked iron ores being uncovered by the research of Kent Flannery and his associates in the Valley of Oaxaca.

Pires-Ferreira (1975:48–57) has classified and labeled the Oaxacan sources according to their primary composition as follows: Group I, magnetite; Group II, hematite; Group III, ilmenite; and Group IV, mixed magnetite and ilmenite. Groups are frequently subdivided with letter affixes (e.g., I-A, I-B). Some of these groups are relevant to our analyses (below).

The Mössbauer spectroscopy of the Oaxacan samples was conducted by B. J. Evans of the University of Michigan (Evans 1975). For the sake of comparability and consistency in results, Evans consented to run a quantity of the Chalcatzingo samples. Originally fifty-three pieces of iron ore (including four with ground surfaces) and seven mirror fragments were analyzed. Later an additional five samples from a possible source in the Río Amatzinac Valley were analyzed (see below).

The analysis of the Chalcatzingo raw ore samples yielded six distinct clusters. These we have labeled Groups A–F to clearly distinguish them in our discussions from the Oaxacan groups. The comments on the six Chalcatzingo groups are primarily those of Evans (personal communication). On-site distribution of these groups is given in Table 23.1. *Group A.* These are hemomagnetites, in which magnetite is the major phase and hematite is present only in minor amounts (Fig. 23.2). They are not derived from the Oaxacan Group V source and are only grossly similar to artifacts from Oaxacan Group I-A. Thus, they do not appear to be from Oaxacan sources. Of the fifty-three samples analyzed from Chalcatzingo, fourteen (26 percent) are Group A. *Group B.* These are magnetite-hematite ores in which the ratio of magnetite to hematite is approximately 2:1 (Fig. 23.3). They are similar to Oaxacan Group V ores but also different enough to determine that the Chalcatzingo samples are not from Group V sources. Eighteen specimens (34 percent) of the sample analyzed belong to this group. *Group C.* This group has a hematite to magnetite ratio of about 1:4 (Fig. 23.4). While the six samples (11 percent) constituting this group are similar to the Group I-A archaeological samples from San José Mogote, Oaxaca, the Chalcatzingo specimens are not from that Oaxacan source. *Group D.* The solitary specimen from this group is ilmenite (Fig. 23.5) and has a possible match with Pires-Ferreira's Group III-A, a Oaxacan group with no known source (defined solely on the basis of artifacts). Mirrors from La Venta, Arroyo Pesquero, and San Lorenzo likewise match this unknown source (Pires-Ferreira 1975:Table 15). The Chalcatzingo specimen is from T-24, one of the excavated terraces with abundant iron ore fragments. *Group E.* These five specimens (9 percent) contain less than 2 percent iron, although they may be metallic ores. *Group F.* Similar to Oaxacan Group II, these nine (17 percent) hematite specimens (Fig. 23.6) have a qualitatively different character from Oaxacan source ores, and thus a match is doubtful.

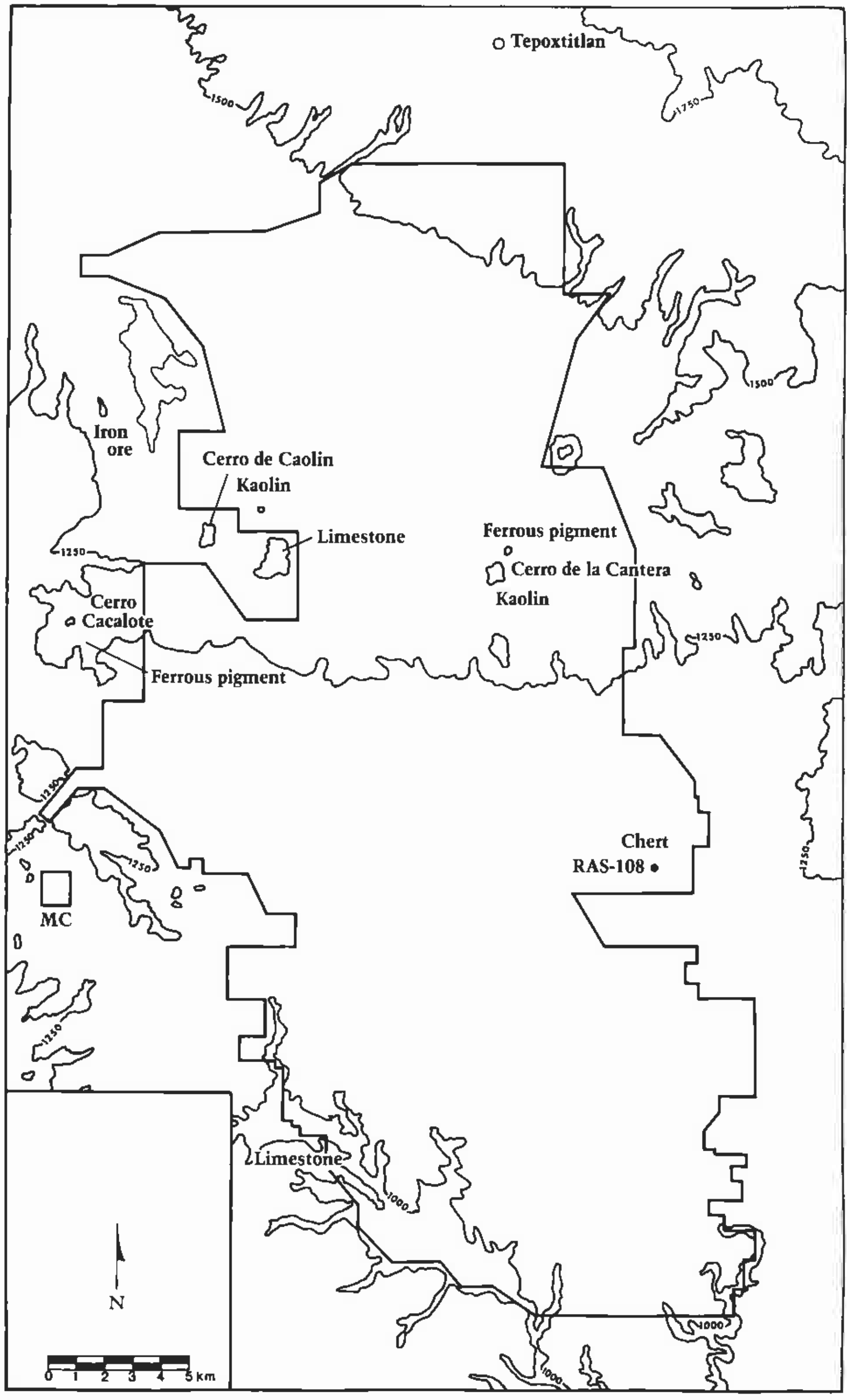

Figure 23.1. Amatzinac Valley, showing locations of mineral resources.

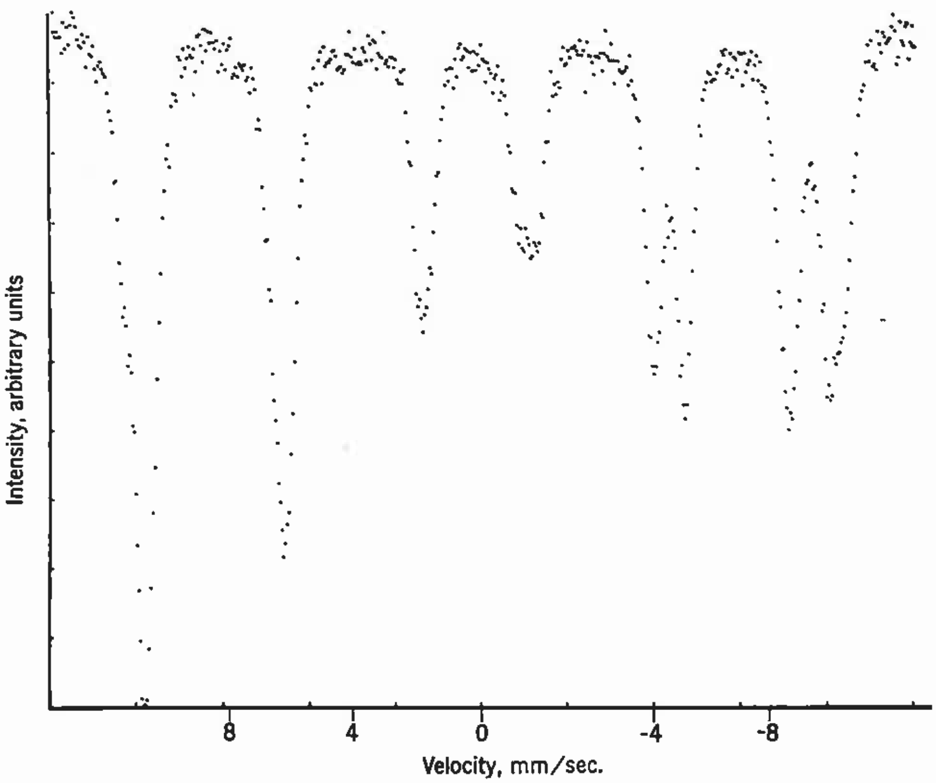

Figure 23.2. Iron ore spectrum, Group A.

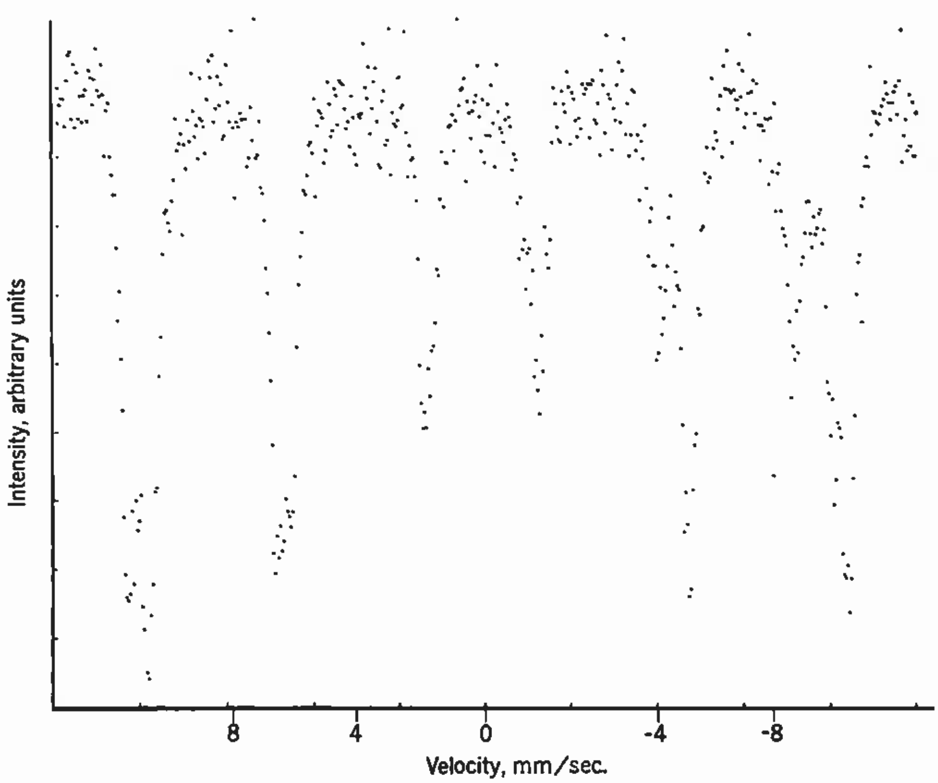

Figure 23.3. Iron ore spectrum, Group B.

Sources

It was not necessary to look outside of the Río Amatzinac Valley area for possible iron ore sources. The valley has long been known as an important source of iron-rich rock. According to Alfonso Luis Velasco (1890:90), the first Spanish iron smelter in Mexico was established at Tepoxtitlan (La Ferrería) near Zacualpan in the northern valley. At least some of the ore for this operation was mined from the hills forming the southwest border of the valley, particularly the Cerro Cacalote. Pit type mines on the Cerro Cacalote were sampled, the material collected consisting of powdered iron oxides rather than solid ore. The bulletin of the Instituto Geológico de México (1923a:216; 1923b:92) also lists hematite and magnetite as occurring near Xalostoc.

Carl Fries (1966) identified a ferrous-rich area near Chalcatzingo. This locale, in the barranca of the Río Amatzinac northwest of Tetla, gives indications of having been lightly mined by the excavation of a shallow cave along a section of the iron-rich sedimentary strata. This "mine," presumed to have been prehispanic due to the presence of Middle Postclassic sherds, would have produced red sediments suitable only for pigment.

At the time of Evans' analysis of the iron ore pieces found on the site, the sources mentioned above either had not been found or had not yielded solid ore samples. Following the analyses, which lacked close similarities to Oaxacan sources, we began a serious attempt to locate the published sources in the western valley. Aside from the pit-like mines on the Cerro Cacalote and the small cave-like feature in the barranca behind Tetla, no other vestiges of prehispanic or colonial mining were found. Ultimately, a hillside between Atotonilco and Xalostoc was surveyed and discovered to have numerous iron ore chunks scattered over the surface. These ore fragments were visually identical to those recovered at Chalcatzingo.

Five samples from this locale were analyzed by Evans. Four were surface specimens taken from widely scattered parts of the hillside (to present a representative sample, if such was possible). The fifth sample came from a modern shallow mine near the top of the hill. Visually this last sample was substantially different from the four surface specimens submitted for testing.

The analysis showed samples 1, 2,

and 3 to be hemomagnetites and good matches to the Chalcatzingo Group A specimens (Fig. 23.7). Sample 4 is magnetite-hematite and matches well with Group B ores (Fig. 23.8). Because minor mining activities have been carried out in the area for a long period of time, it is possible that the surface samples represent spill from loads being carried from other areas of the hill. However, there seems little doubt that this area is the source for both Group A and B specimens, 60 percent of the Chalcatzingo sample analyzed.

Sample 5 is very complex in terms of iron phases present and has no matches with any analyzed archaeological materials.

Mirrors

Seven of the thirteen polished mirrors from Chalcatzingo were analyzed. None are manufactured from Group A or B materials, and all are attributed to imported ores. (See Chapter 16 for provenience of these specimens.) *Mirror M-1.* This complete concave mirror (Fig. 16.22*a*) is unusual, for it consists primarily of high-purity magnetite along with a small amount of some other iron-containing phase which may be an iron sulfide. Evans (personal communication) notes that it is the first time he has seen that kind of spectrum (Fig. 23.9). More unusual is the fact that none of the large mirrors tested for Pires-Ferreira (1975: 48–65) have such a high magnetite content. They are normally ilmenite. There is no match to any known source.

Mirror M-2. This fragment is composed exclusively of ilmenite, and its spectrum is identical to the single ilmenite Group D specimen found on T-24. It is also similar to Oaxaca Group III-A, but the match is not perfect. The presence on T-24 of unworked ilmenite ore and a mirror fragment from the same source suggests that the mirror was not necessarily imported as a finished product but could have been manufactured locally from imported ore. Artifactual evidence of mirror manufacturing (numerous small worked and unworked fragments) such as occurs at San José Mogote, Oaxaca (Flannery et al. 1970), does not occur in excavations or as surface scatter at Chalcatzingo. *Mirrors M-3, M-7, and M-9.* These fragments are made from high-purity hematite ores and are closely similar to our Group F ores. Group F, as stated earlier, is similar but probably not related to Oaxaca

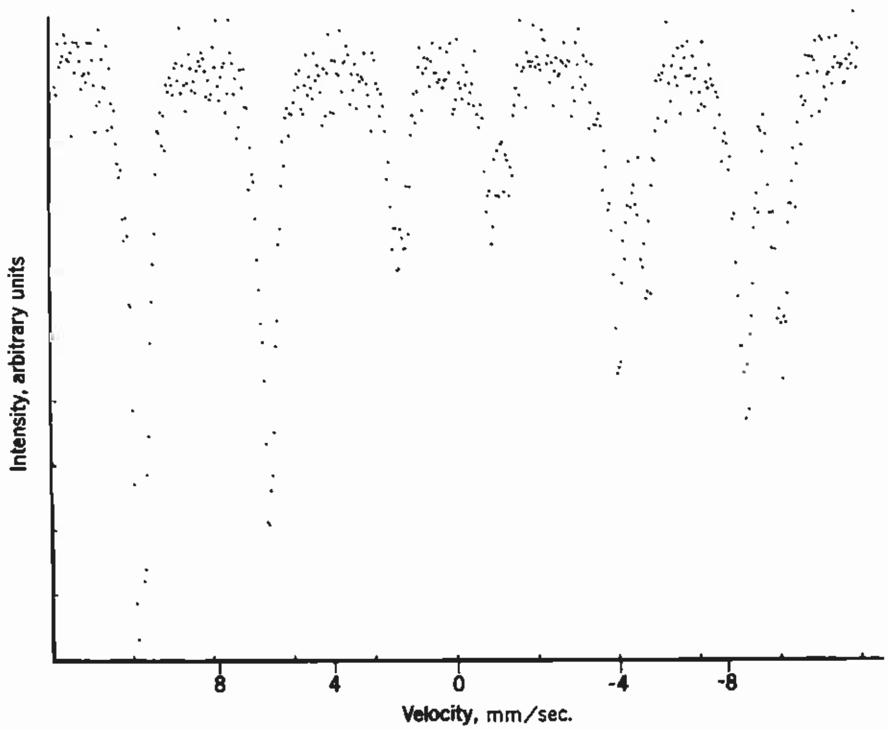

Figure 23.4. Iron ore spectrum, Group C.

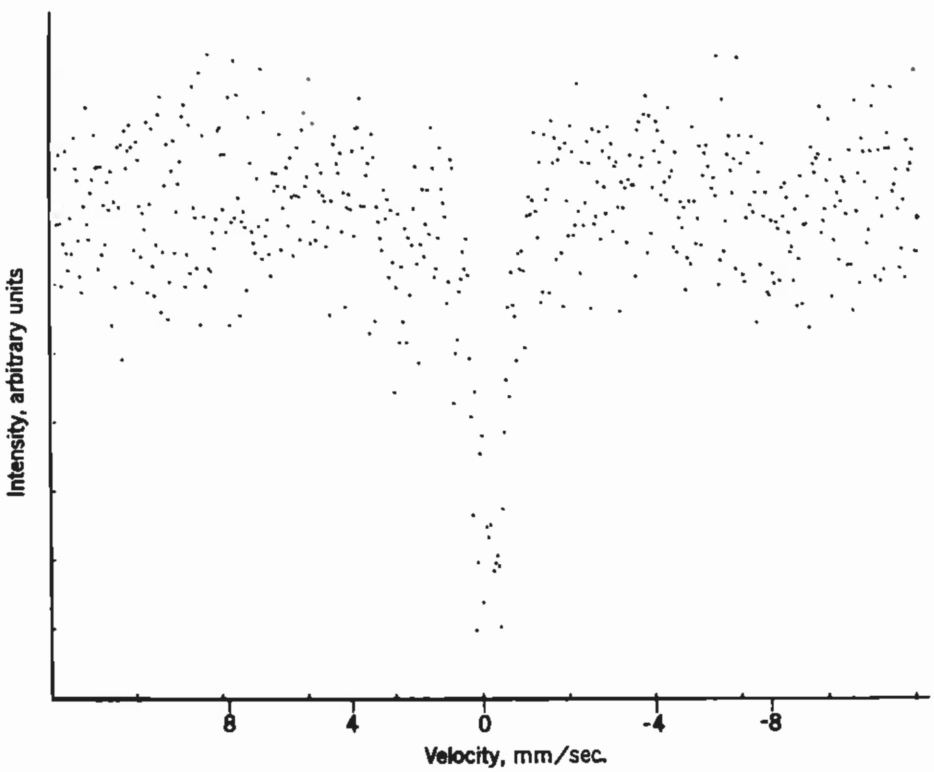

Figure 23.5. Iron ore spectrum, Group D.

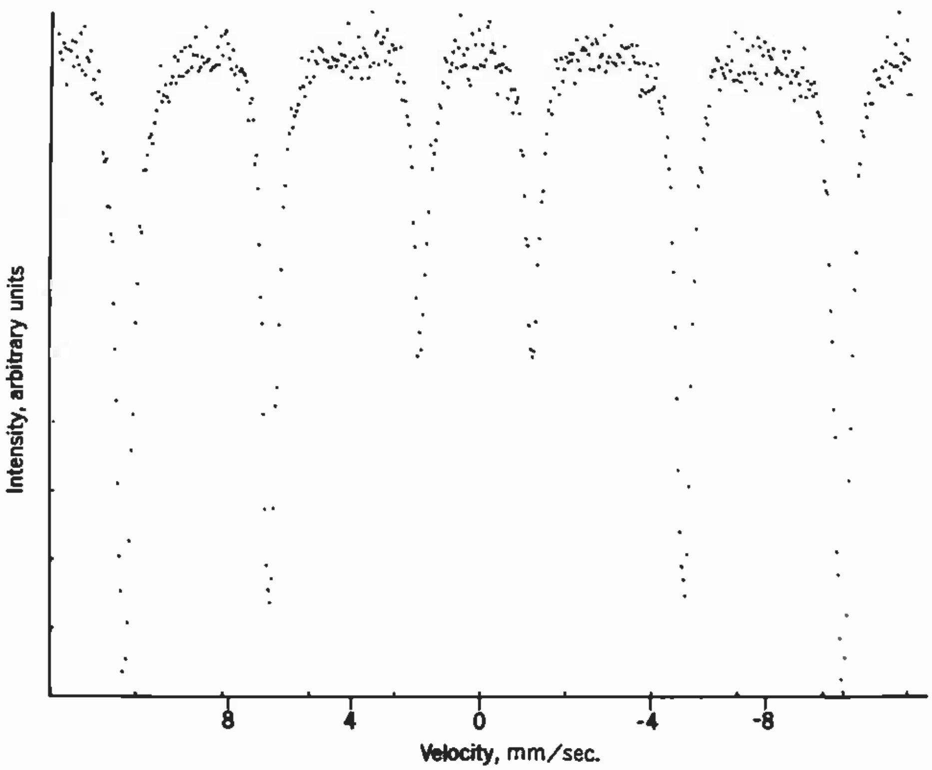

Figure 23.6. Iron ore spectrum, Group F.

Group II. Group F ore specimens have the widest and most varied distribution on the site (Table 23.1). Their source is still undetermined. If the presence of polished and unworked fragments from the same ore source can be taken as evidence of workshop activity (e.g., Mirror M-2), then these data suggest that such activity took place at Chalcatzingo, apparently with non-local iron ores.

However, it is again worth noting that while Group F unworked ore pieces occur at eight different contexts at Chalcatzingo, those same contexts did not yield any polished fragments or other debris which might be expected if individual houses (the context of most specimens) also functioned as mirror workshops. There are other explanations for imported ore fragments in house contexts, including the possible use of the ore for grinding into pigments, or the storage of iron ores in the houses as part of an exchange system participated in by the site's occupants. *Mirrors M-5 and M-8.* These consist exclusively of magnetite, although not as pure as the magnetites found in some Oaxacan mirrors (Evans, personal communication). According to Evans, these two mirror fragments are a "perfect match" to Oaxaca Group I-A, the Loma de la Visnagra source near the north end of the Valley of Oaxaca (Pires-Ferreira 1975:49–54, Table 11). One other Morelos mirror fragment is also known to derive from this source (ibid.:Table 11). It is presumed on the basis of present data that these mirrors were imported into Morelos in an already manufactured form.

Table 23.2 summarizes the identification of ore sources for the analyzed Chalcatzingo mirrors.

OBSIDIAN

Nearly every level of every unit excavated at Chalcatzingo yielded obsidian chips, blades, or small chunks (Chapter 18). Literally thousands of pieces were recovered. In addition, excavations of T-37 uncovered a Cantera phase dump of obsidian debris which yielded over 28,000 pieces (Chapter 19). Because only a limited quantity of the total sample could be source analyzed, a sampling decision had to be made to provide a test sample covering adequate chronological and spatial distributions as well as providing representation of the possible range of sources. My decision was to take, where possible, non-random, selective samples from floor area contexts of most house structures and, where such contexts were not available for certain phases, to take non-random samples from units pertaining to that phase. These non-random samples, which consisted of three to five obsidian pieces from each major unit, were selected visually for what appeared to be different types of obsidian (cloudy, clear, banded, black, etc.).

In addition, a random sample of twenty-five pieces was collected from the T-37 obsidian dump. Further small samples from Late Formative T-27, Telixtac, and Huazulco materials (see Chapter 22), the Tetla Postclassic house (Chapter 25), and comparative Early Formative samples from San Pablo and Nexpa (Grove 1974b) were submitted for analysis. Our analysis comprised a total of ninety pieces of obsidian.

In approaching the trace element characterization of Chalcatzingo's obsidian artifacts, we were aware that a great variety of methods had been utilized in previous analyses of Mesoamerican obsidian, and the results of such studies were therefore not always comparable. To date, three major analytical techniques have been used. The obsidian from San Lorenzo was analyzed with optical spectroscopy (Cobean et al. 1971). Berkeley researchers used both X-ray fluorescence (Jack and Heizer 1968; J. Weaver and Stross 1965) and neutron activation (Stross et al. 1968) in analyzing obsidian from a number of Mesoamerican sites, and Pires-Ferreira (1975; 1976a) likewise used neutron activation for the obsidian recovered by Flannery's Human Ecology Project in the Valley of Oaxaca. Neutron activation appears to be becoming the most popular analytical technique, and this method was chosen for our analysis.

One major problem which had to be faced in planning the Chalcatzingo analysis lay in the number of elements to be selected for the final characterization. While other analyses had tested for up to sixteen chemical elements, only two, three, or four elements were ultimately used for source identification and comparison. The elements most frequently selected were iron (Fe), manganese (Mn), sodium (Na), rubidium (Rb), strontium (Sr), zirconium (Zr), and yttrium (Y). Pires-Ferreira's analysis of Oaxacan obsidian artifacts used only Na and Mn. More commonly, three elements—Rb, Sr, and Zr—were tested and plotted upon a tri-pole graph (e.g., Jack and Heizer 1968; Stross et al. 1968). The use of a limited number of elements obviously lends itself to simple graphs for the identification of clustering.

Another source of variability among obsidian characterization studies lies in the manner in which the quantity of each element in a sample is expressed: percentages (Pires-Ferreira 1975; 1976a), counts per second over background (Stross et al. 1968), or parts per million (Cobean et al. 1971). Compounding this problem is the use of different calibration standards. The result is a series of site-specific analyses which are not readily comparable. Thus, as we approached our analysis of the Chalcatzingo obsidian, there was no standard methodology, reporting procedure, or standardized source data to draw upon. Our solution to this last problem was to conduct our own characterization of source material.

Source materials were made available by Thomas Charlton and Robert Zeitlin (Table 23.3). Although highland Guatemalan sources were included among the samples provided, we restricted our analysis to the central Mexican samples, since previous studies (Cobean et al. 1971; Pires-Ferreira 1975; 1976a) strongly indicated that the expected exploitation pattern would be of only central Mexican sources. The results bear out that assumption. Among the eighteen sources tested were Otumba (the so-called Teotihuacan Valley–Barranca de los Estetes source), Paredon (a source north of Teotihuacan recently rediscovered by Charlton), and Guadalupe Victoria, Puebla. This last source, on the lower slopes of Orizaba Volcano, is known to have been an important contributor of obsidian to the Gulf Coast Olmec center of San Lorenzo (Cobean et al. 1971).

Neutron activation analyses were carried out on the Chalcatzingo samples by Philip Hopke of the Environmental Research Laboratory of the University of Illinois. Thirty different chemical elements were recorded. The analytical methods followed are discussed by Charlton, Grove, and Hopke (1978). Because we did not want to restrict ourselves initially by using only a few elements to compare site samples to source samples, computer programs for discriminate cluster analyses using four different dissimilarity matrices and seven possible clustering criteria were carried out for twenty-seven of the thirty chemical elements. We then eliminated some elements which appeared insignificant, and carried out additional computer runs with eight and later with four elements. We constantly checked the clusters provided by the computer against our own observations of possible patterns. The results were generally consistent and definitely surprising. All of the programs clearly identified a significant portion of the Chalcatzingo samples as coming from the Paredon source.

Although the Chalcatzingo obsidian characterization study was the first to utilize samples from the rediscovered Paredon source, previous studies had not

***Table 23.1.* On-Site Distribution of Iron Ore Groups (Excavation and Surface Specimens Excluding Mirrors)**

	Group						
Provenience	*A*	*B*	*C*	*D*	*E*	*F*	*Unanalyzed*
PC Str. 1	5	7	1			1	6
PC Str. 2	3	5	1		2	1	2
PC Str. 6					1		3
PC other							2
T-4	1					1	3
T-6							1
T-7		1					
T-11		1					
T-15					1	1	
T-19	1						
T-20	1					1	
T-23	1					1	1
T-24	2		2	1	1	1	5
T-25		2	1				2
T-31		1	1			2	2
Cave 4		1					

***Table 23.2.* Iron Ore Mirrors and Sources**

Chalcatzingo Group F	*Oaxaca Group I-A*	*Oaxaca Group III-A Chalcatzingo Group D*	*Source Unknown*	*Unanalyzed*
M-3	M-5	M-2	M-1	M-4
M-7	M-8			M-6
M-9				M-10
				M-11
				M-12
				M-13

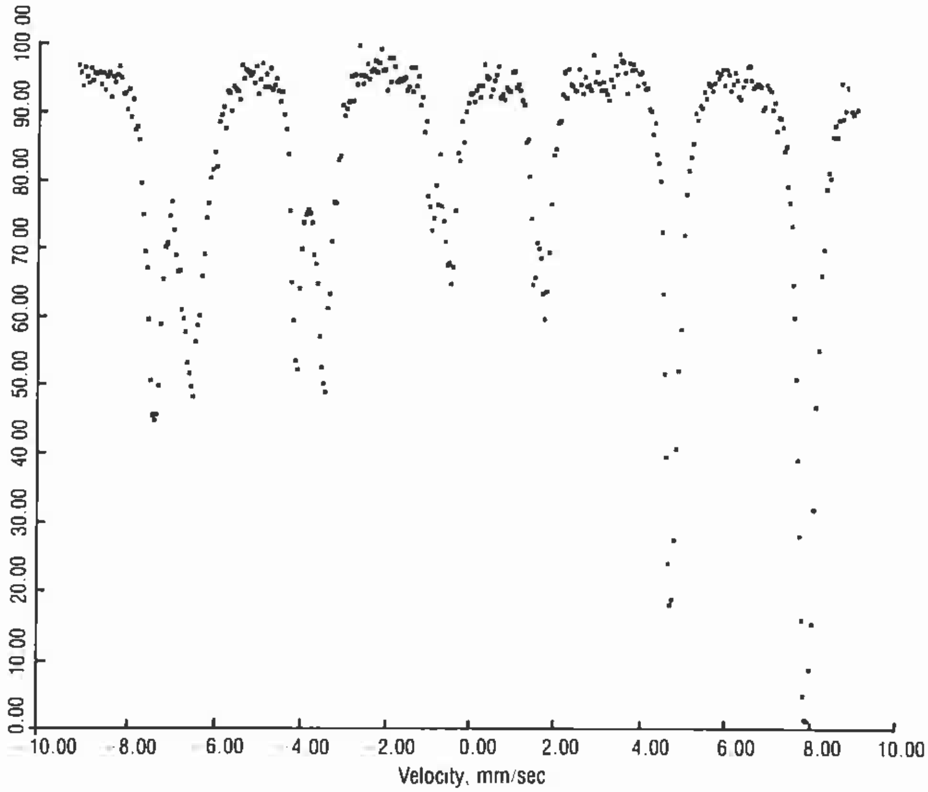

Figure 23.7. Iron ore spectrum, Source Sample 1 (matches Group A).

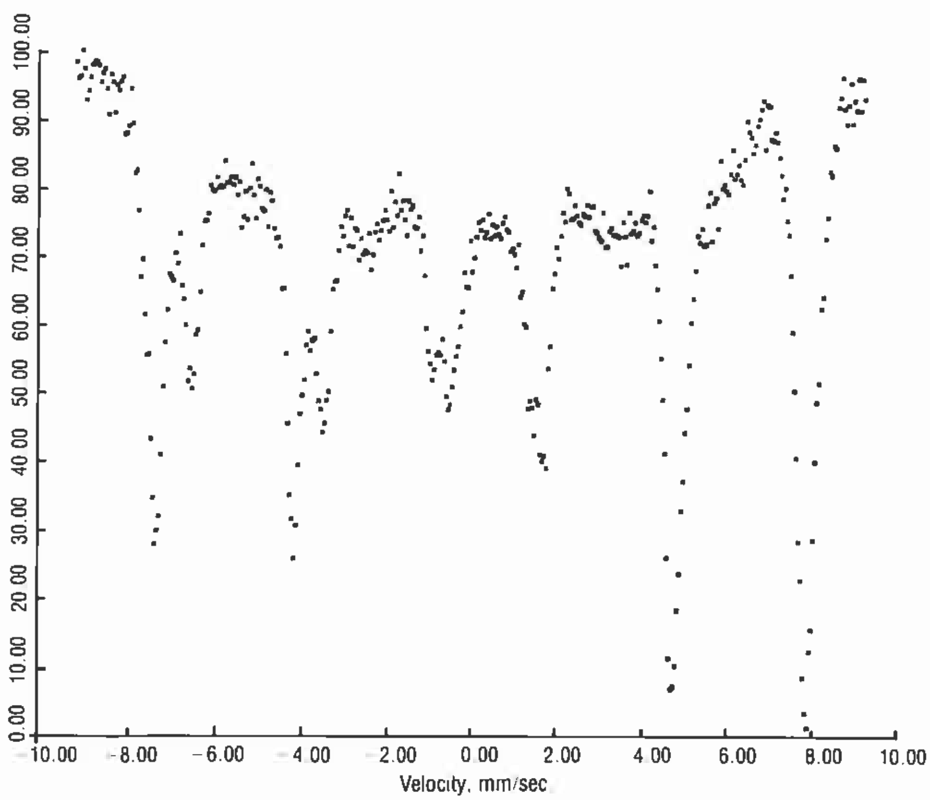

Figure 23.8. Iron ore spectrum, Source Sample 4 (matches Group B).

set apart an "unidentified" source among their samples. Table 23.4 demonstrates that distinguishing between Otumba and Paredon obsidian is virtually impossible with the elements commonly used in obsidian analyses: Mn, Na, Rb, Sr, and Zr. The elements which serve to differentiate these two sources are barium (Ba), lanthanum (La), and arsenic (As). Thus, obsidian from archaeological contexts in Oaxaca and the Gulf Coast previously identified as from the Teotihuacan Valley (Otumba) source probably includes Paredon obsidian as well.

The fact that our analysis was able to separate Otumba and Paredon sources is significant because all of the obsidian tested from the Early and Middle Formative levels at Chalcatzingo originated at these two sources. The Guadalupe Victoria source, so important in the Gulf Coast lowlands, is unrepresented, and logically so. If obsidian exchange is viewed in terms of "cost efficiency" for handling and transportation, then sources nearest to the site should show the greatest amount of exploitation, and at Chalcatzingo this seems very clearly to be the case. In fact, because Otumba is nearer to Chalcatzingo than Paredon, it should be expected that Otumba obsidian would constitute the larger percentage of the sample, and the data show exactly this. Otumba obsidian makes up 68 percent of the random sample from the T-37 Cantera phase obsidian trash dump, while Paredon contributed 32 percent. Only two Pachuca green specimens, a type common during the Classic period, occur in the Cantera phase materials tested.

Amate phase, Barranca phase, Late Formative, and Middle Postclassic samples, as well as those from the valley sites of Huazulco and Telixtac and Nexpa–San Pablo in central Morelos, were selectively chosen. With the exception of the Middle Postclassic specimens, all sample groups contained both Otumba and Paredon obsidian. The Middle Postclassic sample, from the floor of the Tetla house (Chapter 25), contained four Otumba specimens and one piece of Pachuca green obsidian. Because these samples were selective, their percentage distribution is meaningless.

From the data gathered during this analysis it is clear that Formative period Chalcatzingo received obsidian from two sources almost exclusively, Paredon and Otumba. The minimal data from Telixtac, Huazulco, Nexpa, and San Pablo suggest that those sites likewise received obsidian originating from the same two sources. The exclusivity of Otumba and Paredon sources in Morelos during the Formative, together with the proximity of those two sources to each other, suggests that the obsidian was probably pooled prior to its arrival in Morelos. This pooling, I presume, was carried out by a Valley of Mexico community acting as intermediary. If two separate exchange systems, one tied to each source, had been in operation, greater intraregional variation and stronger ties of one site to one source might be expected. Such is not the case.

My undocumented observation is that Chalcatzingo has a greater quantity of surface obsidian debris than have other Middle Formative sites in the Río Amatzinac Valley. This observation, together with the presence of a workshop, suggests that the site was probably a redistribution center for both worked and unworked obsidian in the valley (and perhaps an intermediary in obsidian exchange over greater distances). However, until further work is carried out, this remains simply conjecture.

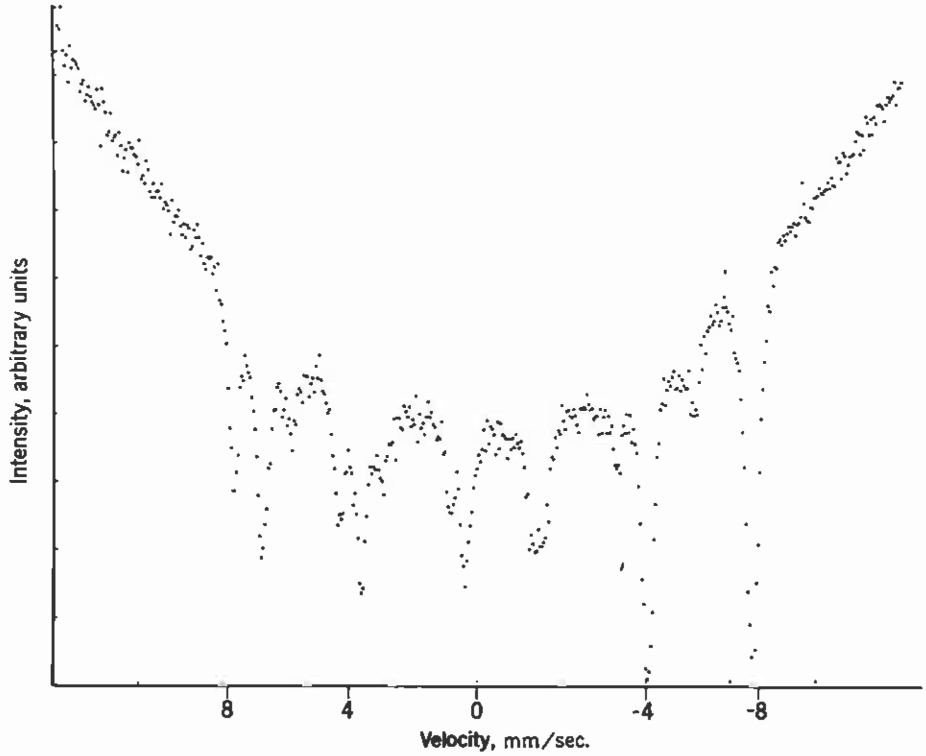

Figure 23.9. Iron ore spectrum, Burial 40 concave mirror.

GREENSTONE

Characterization studies of greenstone (jadeite, serpentine, etc.) are still in their infancy, particularly outside of the southern Maya area. Central Mexican greenstone sources remain essentially at the hypothetical level. Data suggest that jadeite may occur near Acatlan, Puebla (Ortega-Gutiérrez 1974), an area which William Foshag (1957:12) notes may have been a source for the antigorite used in some "Olmec" figurines. The chlorite schists of north-central Guerrero may likewise have yielded jadeite (e.g., Coe 1968a:102–103), but little related exploratory field work has been carried out anywhere in the central highlands.

At this time the only recent characterization study relevant to our materials is that of Phil Weigand, Garman Harbottle, and Edward Sayre (1977) on turquoise exchange between the U.S. Southwest and Mesoamerica during the Classic period. A great number of tiny mosaic fragments, apparently turquoise, were found adjacent to the skull of Chalcatzingo Burial 40. Turquoise is rare in Middle Formative archaeological contexts, and characterizations of the Chalcatzingo mosaic pieces would be of substantial interest. However, we attempted no greenstone characterization since without source data such analyses would be of little value.

The Chalcatzingo greenstone artifacts and raw materials were studied by Charlotte Thomson (Chapter 17, Appendix F). She distinguished five categories of greenstone in our sample: jadeite (several types and thus probably several sources), Chalcatzingo mottled jadeite, serpentine, fuchsite, and other (chrysoprase, chalcedony, etc.). All of these are apparently non-local, since geology appropriate to the presence of greenstone does not occur in this area of eastern Morelos. Her analysis concludes that Chalcatzingo and La Venta received their finer-quality greenstones from the same supplier (and the same sources). Current data do not permit any more elaborate conclusions.

Drill cores and partially worked fragments of greenstone indicate that some lapidary activities were carried out at Chalcatzingo. These activities appear to have been minor, however, and were probably only for consumption at the site and within the Río Amatzinac Valley.

KAOLIN

Circumstantial evidence points to kaolin clay (kaolinite) as probably having been a significant local raw material exploited and perhaps exported by Chalcatzingo. The only source of kaolinite in the Morelos–western Puebla area, according to the Instituto Geológico de México (1923a; 1923b), is in the *municipio* of Jonacatepec, Morelos. Chalcatzingo lies just outside the *municipio*'s northern boundary, and in fact, the southern slopes of the Cerro Chalcatzingo are within the *municipio*. The presence of kaolinite to the south of the site is confirmed by the biological and mineralogical map of Morelos (Mazari 1921).

Informants mention that kaolin clay from this source or sources was exploited until the Zapatista revolution. It was apparently used as a white colorant for sugar produced by the local haciendas. The revolution wiped out the sugar industry in eastern Morelos, and the kaolin demand apparently died with it. We were able to locate only two people who remembered kaolin mining near Jonacatepec. One man, in his nineties, was too infirm to show us the source he remembered and at the same time insisted that

Table 23.3. **Obsidian Source Samples Tested**

Contributor	*Contributor's Sample ID No.*	*Source*	*Description*
T. Charlton	5704	Tulancingo, Hgo.	Green-brown, clear
	5705	Pizarrín	Goldish, clear
	5706	Navajas (Nopalillo)	Fine green, clear
	5707-A	Navajas	Gold bands in black obsidian, inclusion dots
	5708	Otumba (Barranca del Muerto)	Cloudy grey (grey caused by tiny bubbles)
	5709	Otumba (TA-79)	Cloudy grey (grey caused by tiny bubbles)
	5710	Otumba (TA-325)	Clear to cloudy with black bands
	5712-1	Paredón	Clear
	5712-2	Paredón	Clear
	5713	Paredón	Clear
	5714	Paredón	Clear, some dot inclusions
R. Zeitlin	MB-1-1	Penjamo, Gto.	Clear
	MC-1-1	Zinapecuaro, Mich.	Cloudy
	MD-2-1	El Paraiso, Qro.	Clear to streaked
	MD-4A-1	Fuentezuelas, Qro.	Clear light grey
	MD-5-1	Cadereyta, Qro.	Ink black
	ME-1-2	Tulancingo, Hgo.	Grey-green
	ME-2-1	Rancho Tenango, Hgo.	Banded green-brown
	ME-6-1	Teotihuacan	Cloudy, streaked
	ME-7-1	Metzquititlan, Hgo.	Dark streaky grey
	ME-8-1	Cruz de Milagro, Pachuca	Goldish
	ME-10Z-7	Huasca, Hgo.	Very black
	ME-11-1	El Ocote, Hgo.	Clear green
	ME-12-1	Otumba	Cloudy, streaked
	MF-1-1	Guadalupe Victoria, Pue.	Cloudy, black dot inclusions
	MF-3-1	Pico de Orizaba, Ver.	Clear, light streaks
	MF-4-1	Altotongo, Ver.	Very dark brown

Table 23.4. **Neutron Activation Results on Otumba and Paredón Obsidian**

Element	*Otumba Ranges*	*Paredon Ranges*
Na	2.94–3.16	2.92–3.16
Mn	364–386	351–360
Rb	114–133	130–178
Sr	102–211	120–162
Zr	56–105	71–119
Ba	708–909	80–179
Ln	23–30	51–64
As	3–6	11–16

rather than tell us where the "mine" was, he would take us there personally. We made numerous inspections of aerial photographs as well as reconnaissances of the area on foot. We sampled a number of exposures of "*tierra blanca,*" but none proved to be kaolinite.

A second informant, working for the state government in Cuernavaca, told us of kaolin mining in the past near the village of Tlayca to the west, across the valley from Chalcatzingo. A hill immediately south of Tlayca is locally termed the Cerro de Caolin (Fig. 23.1). Unfortunately, at the time we went to Tlayca to take samples from exposures and tunnels on the hill, we were prevented from doing so due to an unfavorable local political situation.

At the moment, the value of locating kaolin sources for any reason other than to verify their presence is questionable. Unlike obsidian and iron ores, which can be characterized by trace minerals, kaolin, once fired, apparently cannot. Thus, present analytical techniques do not permit raw kaolin or kaolin ceramics to be associated with specific kaolin sources or analytically compared.

The question arises as to how important kaolin was in the Middle Formative. Amatzinac White sherds from Chalcatzingo were analyzed by X-ray diffraction at the Illinois Geologic Survey. The featureless readings strongly suggest that the slip is kaolin. It was definitely not a carbonate (lime) slip. We tested over 100 Amatzinac White sherds, taken at random from many site locations, with hydrochloric acid, which would have detected a lime carbonate slip, with negative results. "Whitewashed" daub fragments from a Cantera phase structure were also tested with hydrochloric acid, and again the results were negative. This suggests that the white pigment was probably kaolin.

In sum, the evidence for kaolin exploitation by Middle Formative Chalcatzingo is circumstantial. Kaolin was apparently used as the slip on the ubiquitous Amatzinac White ceramics, which data suggest were locally manufactured. Kaolin was also apparently used as a pigment for "whitewashing" structures. Chalcatzingo lies close to a kaolin source (or sources) known to have been exploited early in the twentieth century. If Formative period Chalcatzingo residents exploited this local kaolin, as they probably did, then they may have also exchanged kaolin to more distant villages lacking this clay. Although the Instituto Geológico de México (1923a; 1923b) data may be out of date, as of 1923 the source near Chalcatzingo was the only kaolin source listed for Morelos and one of only seven listed in all of central Mexico. If most Middle Formative white wares utilized kaolin slip (a hypothesis remaining to be tested), then the demand for kaolin would have been extensive, while the sources may have been few. Kaolin would have thus been an important commodity in the Middle Formative exchange networks.

CHERT

During the surface reconnaissance which covered almost the entire valley (Chapter 21), a small hill in the south-central valley (RAS-108, Appendix H) was found to be composed primarily of red chert. Numerous chert cores were found here, and red chert is found at many other sites in the valley. This suggests that RAS-108 was an important local chert source. Some of the chert artifacts at Chalcatzingo probably derived from this source, although the color variability among the Chalcatzingo sample suggests the possibility that other unidentified sources were being exploited as well (Chapter 18).

More data are needed on the color variability, quantity, and distribution of the RAS-108 chert within the valley and at sites outside of the area as well in order to determine to what extent Chalcatzingo and other communities were exploiting this source and how this chert was transmitted along exchange networks.

LIME

Limestone outcrops occur in the hills on the west and south flanks of the valley (Fig. 23.1). Some of these sources are commercially exploited today. Our evidence for lime use during the Formative period at Chalcatzingo is quite restricted. Excavations on S-39, the southernmost occupation area, uncovered a thin but somewhat extensive deposit of processed lime underlying Cantera phase vessels and burials (Fig. 4.36). Gravel-sized lime pebbles (also processed by firing) were occasionally found during excavations at other site areas (e.g., the Plaza Central cross-trench, T-9B, T-25), but never in associations which would allow the identification of their function.

There are data which lead us to believe that S-39 may have been a ceramic workshop area (Chapter 16). At the same time, we have no data indicating that lime was used in ceramic manufacturing. Our tests on Amatzinac White slip (above) suggest it is kaolin and not lime. Other slips, such as Laca, remain to be tested.

Lime could have been used in the preparation of corn, although the S-39 deposit is the only large lime concentration uncovered. While there are no substantial data to indicate that corn was processed with lime during the Middle Formative, the flat shallow plates with roughened bases (see the RD ceramic forms, Chapter 13 and Appendix D) may be early *comales* (griddles) which would further imply that tortillas made from processed corn were part of the Chalcatzingo diet.

Evidence for Classic period lime use is more extensive since three lime kilns from this period were found during our excavations (Chapter 24). The lime processed at Chalcatzingo was probably utilized in both maize preparation and the making of stucco. Traces of lime plaster occur on T-3 Structure 1, the round pyramid. The Postclassic hillside shrine also shows extensive use of lime plaster.

Figure 23.10. Boulder on hill with large cut.

Figure 23.11. Boulder on hill showing two cuts.

GRANODIORITE

Chalcatzingo's Formative period free-standing monuments are manufactured from the local granodiorite (*cantera*). While large boulders are abundant on this hillslope and could have been worked into almost any form, mining may have taken place at selected areas on the *cerros*. During the project we encountered an area midway up the southern slopes of the Cerro Chalcatzingo with a large partially worked and grooved slab (MCR-12) and other probable slab fragments nearby. More recent investigations of stone exposures above this area indicate that here the rock has natural lamellar fractures which would produce slabs suitable for stelae, etc., with less reworking necessary than would be required with other rocks. Two large, thick, horizontal-lying boulders in the immediate area had been partially cut through (Figs. 23.10, 23.11). These data indicate that quarrying and initial reworking of some *cantera* took place in this locale. Since we have no evidence for Classic or Postclassic use of large worked slabs, we presume this quarry to have been utilized during the Formative period.

Although there has been hacienda period and recent "mining" of *cantera* boulders at the base of the hill for use elsewhere (Chapter 2), there is no evidence that this was an important prehispanic source of monumental-size stone for the rest of the valley. Other sites in the area did not, to our knowledge, utilize stone stelae or monuments, and utilitarian implements would have been more readily fashioned from river stones easily accessible almost anywhere in the valley.

RESUMEN DEL CAPÍTULO 23

En el proyecto tuvo especial importancia la caracterización de las materias primas de los artefactos como medio para ganar información acerca del comercio e intercambio locales y distantes. Se centra la discursión alrededor de siete tipos de materia prima: mineral de hierro, obsidiana, piedra verde, kaolín, cal, quarzo, y cantera. Los resultados de los análisis probaron ser de valor fundamentalmente para entender la explotación de los recursos minerales dentro del Valle del Río Amatzinac.

La espectroscopía Mössbauer reveló que, de los muchos trozos de mineral de hierro encontrados en Chalcatzingo, la mayoría proviene de un área de recursos situada en la sección poniente del valle. Varios fragmentos de espejo pulido, sin embargo, son iguales a los que provienen de los recursos del Valle de Oaxaca, lo que sugiere que éstos hayan sido importados.

La activación de neutrón se utilizó para buscar la caracterización de elementos en los artefactos de obsidiana del sitio. El análisis indica que la obsidiana del Formativo Temprano y Medio proviene de dos recursos, Otumba y Paredón, ambos situados al nororiente del Valle de México. La información sugiere que la obsidiana probablemente fuera "reunida" antes de llegar a Morelos.

Los artefactos de piedra verde no se sujetaron al análisis de caracterización, por no existir suficientes datos de las áreas de recurso. Toda la piedra verde parece ser de importación en Chalcatzingo. Hay alguna muestra de que el trabajo del tipo blando de piedra verde se realizara en Chalcatzingo, probablemente limitado al consumo dentro del área local.

El kaolín era una materia prima importante utilizada para el engobe de la cerámica Amatzinac Blanco de Chalcatzingo y para blanquear algunas casas. Se conoce un recurso de kaolín cerca del sitio, pero el kaolín es una de las pocas materias primas que por naturaleza no pueden ser actualmente caracterizadas con éxito. Sin embargo, la proximidad de Chalcatzingo a esta importante materia prima implica que el sitio pudo haber jugado un papel importante en la distribución de este material durante el período Formativo Medio en las tierras altas del centro de México.

Se encontró una loma de quarzo al sur del valle (sitio RAS-108). Este material parece haber sido explotado localmente y distribuido por medio de una red de intercambio centralizada aquí, al sur del valle y no en Chalcatzingo.

La piedra caliza se encuentra en las lomas a lo largo del poniente y del sur del valle. La cal procesada se encontró en un contexto del Formativo Medio en Chalcatzingo, pero los usos a los cuales haya sido destinada no han sido determinados. La cal pudo usarse en el procesamiento de maíz, pero no parece haber sido usada como pigmento blanco en la manufactura de cerámica.

La cantera de la localidad sirvió como material para los monumentos con soporte propio encontrados en el sitio. Los trozos de roca se obtenían de los macizos que sobresalen en las laderas del sur del Cerro Chalcatzingo, en donde hay muestra de estos talleres todavía a la vista.

24. Classic and Postclassic Chalcatzingo

RAUL MARTÍN ARANA

In addition to Chalcatzingo's major Formative period occupation, there are components from later time periods as well. Román Piña Chan's 1952 research showed that Montículo A (our T-3 Str. 2), one of two mound structures which face a small rectangular plaza, dated to Teotihuacan III–IV (1955: 7–9). Excavations during the three major field seasons of our project uncovered several additional Classic period structures on the main site area. Late Classic and Early–Middle Postclassic structures were also mapped in the Tetla zone of Chalcatzingo, and minor excavations were conducted. Classic and Postclassic artifacts occur as well in caves on the Cerro Delgado. Only one definite Postclassic architectural feature was found in the main site area, the so-called *adoratorio* which is discussed below.

CLASSIC PERIOD

Chalcatzingo was neither large nor apparently important during the Classic period. Several other sites in the valley overshadowed Chalcatzingo in these respects. San Ignacio (RAS-78), in the southern valley, may have been the area's major center. This fact is significant, for until the Classic period the southern valley was relatively unimportant, and the shift in focus to this area points to a major shift in the economy during this time, a shift which terminated with the end of this period (Hirth 1980).

Central and eastern Morelos reflect strong Teotihuacan influences during the Classic period, especially during the Teotihuacan III–IV phase. That such influences are far weaker in western Morelos is undoubtedly at least partially a reflection of central Mexican geography. Central and eastern Morelos are situated adjacent to the Amecameca pass in the Sierra de Ajusco. This pass connects those regions of Morelos with the eastern Valley of Mexico and Teotihuacan. Western Morelos is far more isolated geographically from the Valley of Mexico, and was certainly within the sphere of Xochicalco rather than Teotihuacan.

The small Classic occupation at Chalcatzingo pertains primarily to Teotihuacan III–IV. The largest site near Chalcatzingo at this time was Las Pilas (RAS-14), only a few kilometers to the southwest. This site, situated near a large spring, has recently been excavated and partially reconstructed (Martínez Donjuan 1979). These excavations uncovered a number of large caches of Teotihuacan III–IV ceramics. Several of the mound structures at Las Pilas are characterized by *talud*-cornice architecture, and such architecture also occurs at San Ignacio to the south.

The fall of Teotihuacan affected Classic period settlement throughout central and eastern Morelos. In the Río Amatzinac Valley the settlement pattern shows a shift in population back to the northern valley. The main site area at Chalcatzingo seems to have been abandoned, but occupation may have continued at Tetla. A comprehensive discussion of the valley during the Classic has been written by Kenneth Hirth (1980).

Pyramid Group (T-3)

The major Classic period monumental architecture on the main site area consists of two small pyramid mounds facing a plaza, as well as a small ball court to the north of the plaza. The pyramid-plaza group is situated on Terrace 3, near the northwest end of the site's uppermost and principal terrace, the Plaza Central (T-1). The largest mound, T-3 Structure 1 (Piña Chan's Montículo B; 1955: 8), slightly over 9 m high, faces west onto the plaza. Our 1973 excavations of this structure were intended to define its dimensions and form.

Those excavations indicated that the structure is a circular pyramid (actually more ovoid than round), approximately 35 m in diameter at its base (Fig. 24.1). The pyramid's main staircase, including balustrades, is 8.01 m wide. R. David Drucker (1977) has suggested that Teotihuacan utilized a measurement unit equivalent today to 0.805 m. This mound's stairway width appears to be a basic multiple (10 ×) of that measuring unit.

The round pyramid was built onto the western end of the 70 m long Middle Formative period platform mound, PC Structure 4, which delimits the north side of T-1. The pyramid has an earthen core and an exterior facing of undressed stones, laid with their flattest sides outward. This stone exterior was once plastered, although only traces of the plaster remain today. The pyramid may have originally risen in three stages; however, our excavations and reconstruction were carried out only on the lowest stage. A small area of Classic period stone pavement had been laid onto the upper surface of the platform mound, adjacent to the rear of the pyramid (Figs. 24.2, 24.3).

The plaza area measures approximately 40 × 40 m. Piña Chan (1955: 7) gives the dimensions as 60 × 50 m, but these may relate to the basal measurements of the plaza, which is raised above the terraces to the north (T-15) and west (T-5).

Piña Chan's excavations concentrated on the smaller of the two pyramid structures. The excavated and partially reconstructed structure, Montículo A (our T-3 Str. 2), lies on the plaza's south side. It is a two-stage quadrilateral structure. The lower stage, which measures 24 m per side, had a height of approximately 1.4 m. It may have had *talud-tablero* architecture. The upper stage, 18 m per side, had a height of 1.7 m (Piña Chan 1955: 7). Although Piña Chan's project partially reconstructed this structure, it is today again a featureless mound.

Figure 24.1. T-3 Structure 1 pyramid.

Figure 24.2. Pavement behind T-3 Structure 1.

T-15 Ball Court **(T-15 Str. 2) (Figs. 24.4, 24.5)**

Our initial surveys of Chalcatzingo in 1972 determined that a long low mound occurred on T-15 (Str. 2) slightly north of PC Structure 4, the 70 m long platform mound. It was suspected that this smaller mound might have somehow functioned as part of a ball court structure in conjunction with PC Structure 4, although the T-15 mound is dwarfed by PC Structure 4, which rises nearly 8 m above it. Excavations in 1973 began with a north-south cross-trench across the T-15 mound and onto the northern slopes of PC Structure 4. Additional trenches were placed in the area between the mounds in order to identify "end zones," the playing alley floor, and other features. This work served to delimit the structural features on the north and south portions of the T-15 mound as well as Classic period construction on the north slope of PC Structure 4.

The Classic portions of PC Structure 4 represent additions onto that Middle Formative structure. These constructions changed parts of the north slope of PC Structure 4 into the south range structure of the ball court. This construction terminated in a long east-west wall about halfway up the slope of PC Structure 4 (Fig. 24.6). Unfortunately, heavy erosion on the slopes has destroyed almost all other vestiges of that construction.

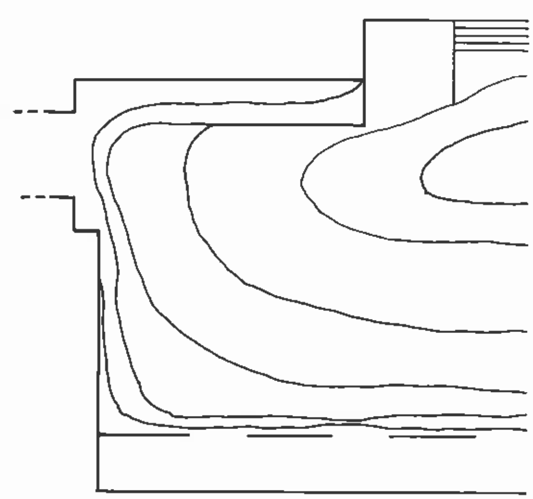

Figure 24.4. Topographic map and profile of T-15 Structure 2 ball court.

Figure 24.3. Close-up of pavement behind T-3 Structure 1.

T-15 Structure 2, the north range of the ball court, is 41.5 m long and is oriented N87½W (true north). Two building episodes were found for this structure. The earlier structure is 11 m wide, while the later addition increased the width to 12.3 m. The sloping playing bench of the second episode may have had an angle of 10° and a width of about 9 m. The slope of the earlier bench cannot be determined.

The first building episode of the north ball court structure used large stones turned flat side outward. There is no plastering apparent on the stones. The outer (second) structure exhibits faced, perfectly laid stones, re-covered with plaster. Plaster was also used on the playing alley floor of the second (later) ball court. The back or north side of T-15 Structure 2 is characterized by a 23.5 m long stairway of three steps bordered on each end by a 2.3 m wide balustrade. The stones that support the exterior ball court walls were carved in a special form. They are well shaped and well faced, and each has a wide raised upper front edge (Fig. 24.7). These stones serve as the front basal stones for the balustrade. Sloping stones rest against them, and the raised front edge provides support for the upper stones and prevents their slippage. This construction form is characteristic of sites of this period in Morelos, the Valley of Mexico, and Teotenango in the State of Mexico. Above the rear stairway,

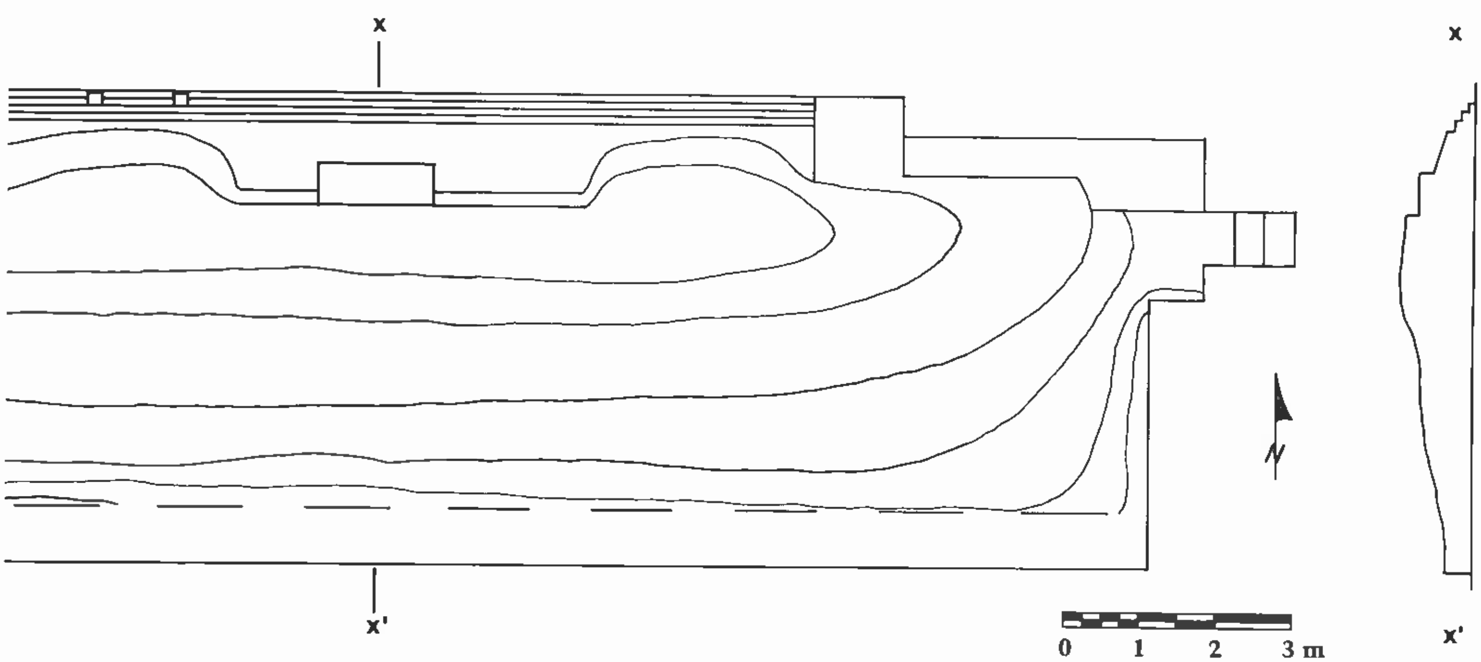

Figure 24.5. Reconstruction of ball court steps. Photo taken several years after reconstruction.

Figure 24.6. Ball court upper wall on slope of PC Structure 4.

and centered at the back of the ball court structure, is a small rectangular altar-like construction 3 m long by 1 m wide and about 30 cm high.

Excavations within the playing alley area disclosed no structural features at either end of the ball court, indicating that the playing alley was open-ended. Its length therefore cannot be determined, but its width for the second building episode was 8 m. A test trench in the center of the playing alley uncovered an offering of five seated clay figurines, 60 cm below the playing alley floor (Fig. 24.8). Four of these figurines were grouped in a circular fashion around the central figure (Fig. 24.8*c*). All of the figures were handmade, decorated with red and blue paint, and relatively elaborate. Each is between 10 and 15 cm high. Also within the center of this circular group was a disc of greenstone, perforated in the center, and a cylindrical object of clay with streaks of paint.

T-15 Platform **(T-15 Str. 4)**

The 1972 and 1973 field research included monthly false-color infrared "aerial" photography of the site to detect unusual moisture and vegetation growth patterns (Chapter 1). These photographs clearly illustrated an unusual moisture pattern on T-15, with some areas drier than others. Upon field inspection, these drier areas were found to be slightly raised and to have surface sherd quantities greater than the surrounding areas. One such raised area occurred 60 m north of the T-15 ball court, adjacent to the terrace's north edge. Excavations were initiated on this slightly elevated portion of the terrace in 1974 and immediately uncovered walls both within and slightly below the plow zone. The wall lines delimited a rectangular structure with an entrance threshold on the west side (Fig. 4.26).

The structure apparently had two building episodes. The earlier is represented by walls delimiting a principal floor area of ca. 5 × 6 m. The exact dimensions are impossible to define because the southern end of this structure has been destroyed by plowing. An enlargement to the floor area approximately 1 m wide later increased the principal floor to 6 × 6 m. The wall alignment of the earlier building stage is N16½E, while the alignment of the second stage is N13½E, only one degree different from the T-4 platform alignment.

Figure 24.7. Shaped stones forming part of exterior ball court walls.

Included in the wall line of the structure's threshold are nicely faced stones with a wide raised edge, identical to those found on the balustrades of the T-15 ball court. From their position it seems unlikely that these stones served the same "support" function here that they did on the ball court. Grove (personal communication) is of the opinion that the persons originally constructing this platform structure removed these stones from the ball court structure. This suggests that the ball court was no longer functional at the time of this construction. Since we have no dates for either of these structures, this remains conjecture.

Although they are within the plow zone, some of the floor area and exterior wall lines have sections of plaster remaining. The exterior wall stones of this structure are small in comparison to those of other Classic structures on the site. It is my impression, although the structure is quite destroyed (particularly on the east and south sides), that it originally had a height of about 50 cm from the base of the threshold to the floor. No postholes were discovered on the floor level. Because looters' pits and plowing have destroyed many sections of this "platform," all traces of any upper building on it may have likewise been destroyed. We can therefore only speak of this as a platform-like structure. Associated artifacts clearly indicate that it is Late Classic in date.

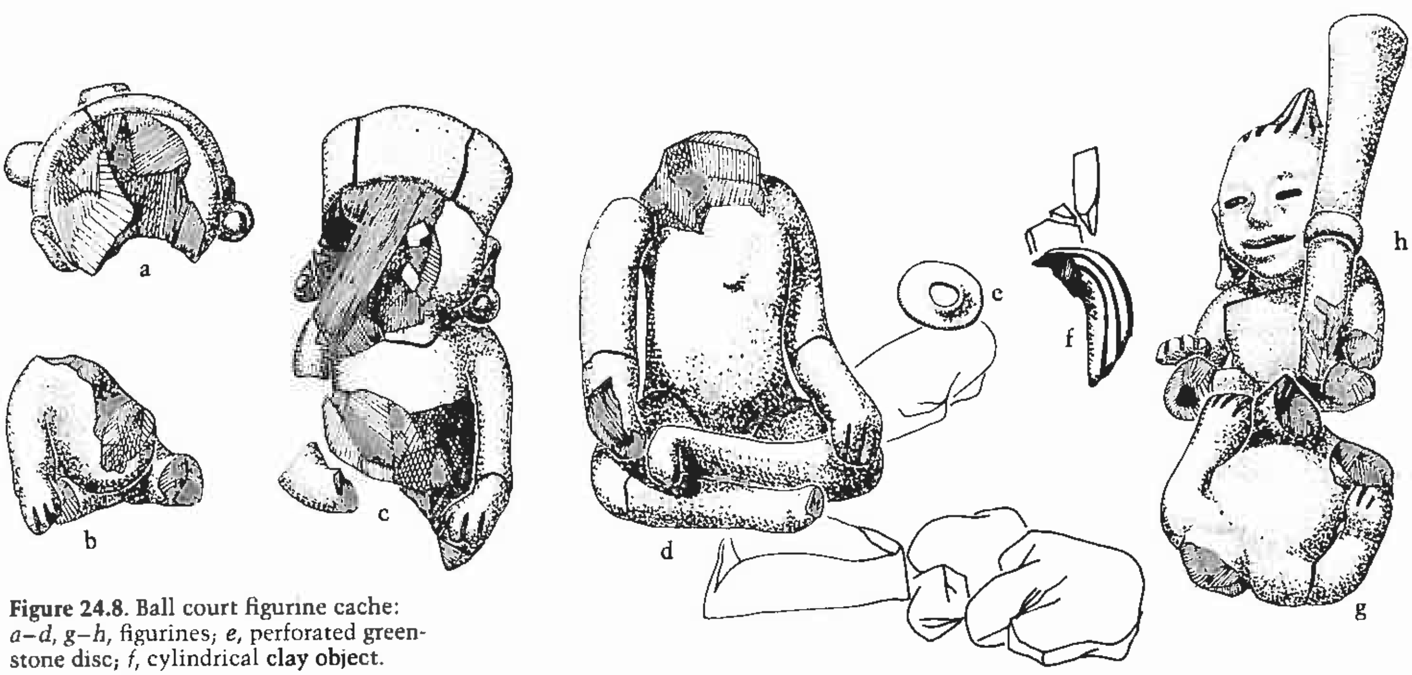

Figure 24.8. Ball court figurine cache: *a–d, g–h,* figurines; *e,* perforated greenstone disc; *f,* cylindrical clay object.

***T-4 Platform* (T-4 Str. 3)**

Our 1982 excavations on T-4 uncovered, amid a confusion of Middle Formative wall lines, a low Classic period platform structure (T-4 Str. 3; Fig. 4.15). The structure, which is quadrilateral, measures 4.8 m in width and has "back wall" lines at 3, 3.8, and 4.8 m from the front of the structure. The walls of the structure are highly destroyed and in their present condition are not straight. Therefore, the exact dimensions and orientation of this platform structure are generally difficult to ascertain. The front of the structure and the balustrade have an apparent orientation of N12½E (true).

The platform rises only about 20 cm, and the walls are delimited by faced stone. The front of the structure has a 2.2 m wide balustrade, although on a structure this low, the balustrade appears to have been of a "formal," obligatory architectural nature, rather than functional feature. The stones along the front of this platform are slightly sloped (Fig. 24.9), a characteristic typical of many Classic period constructions at Chalcatzingo. It is apparent that this platform was constructed not by building upward, but by excavating the surrounding soil from around the areas desired for the platform, leaving the platform rising from this excavated area.

Figure 24.9. Slightly sloping front wall of T-4 platform (T-4 Structure 3).

The Classic period excavations which created this raised platform went through the floor of a Middle Formative structure, and thus the upper surface of the platform is also the floor surface of that Middle Formative (house?) structure. It is probable that some of the damage to the T-4 Middle Formative architectural features uncovered by the project's excavations is due to Classic period construction and destruction and the Classic period use of Middle Formative wall stones.

It is perhaps significant that the large rock which we designate as MCR-19 (Figs. 11.18, 11.19) with a quadrangular design of pit marks and grooves, lies only a few meters west of the raised platform. Naked-eye sightings taken along the alignments of the pit marks cross both the large round Classic pyramid (T-3 Str. 1) and the T-4 Classic platform (Grove, personal communication). The alignment of the MCR-19 quadrangle is likewise within 1° of that of the platform. Because the platform had been reburied prior to the discovery of MCR-19, exact sightings between the quadrangle and the platform's features could not be made, although a meaningful association between the stone and the structure is presumed.

***Lime Kilns* (T-4 Str. 4, T-23 Feas. 4 and 7)**

Three Classic period lime kilns were uncovered during the excavation of Middle Formative structures. The largest kiln is located on T-4 (Fea. 4). Two smaller kilns were found on T-23 (Feas. 4 and 7). All three kilns are subterranean and intrusive into Middle Formative structures. All are described and discussed in detail by Teresita Majewski (1976b), who also draws comparisons with ethnographic examples in Mesoamerica. Only a few basic details of the kilns are presented here.

The T-4 kiln (Figs. 24.10, 24.11) was almost round, with a diameter varying between 2.8 and 3.1 m and an approximate depth from lip to base of 2.3 m. The walls of the kilns slant inward at an angle of approximately 75°, thus creating an inner basal diameter of approximately 1.8 m. The kiln walls are constructed of large, relatively flat stones, flat side facing inward. They have been set in a mud mortar.

The upper 1 m of this feature contained fill which was largely loamy soil, sand lenses, and one concentration of calcitic rock. Near the bottom of the feature were layers of calcitic rock sandwiched between layers of charred earth, charcoal, and ash. When the feature was completely cleared, fire blackening of the lower sides was evident.

Over five hundred cobble-sized stones were removed from the lower levels of the feature. Of these three hundred were tested with hydrochloric acid, and 82 percent tested calcitic. Many could be seen to be in various stages of calcinization from limestone to lime. These data indicate that the function of this feature was indeed that of lime burning.

Ceramic material within the kiln was relatively sparse, but the fill did include both Middle Formative and Classic period debris. In one of the lowest levels, a Teotihuacan IV mold-made figurine head was found together with Teotihuacan IV sherds. A radiocarbon sample from the lowest charcoal layer in the kilns (N-1694) yielded a date of AD 690 ± 80 (Table 5.1).

The 1974 excavations of Middle Formative structures on T-23 uncovered two small intrusive Classic period lime kilns. One (Fea. 4) has a diameter of about 2 m, the other (Fea. 7) of 1.2 m. Both kilns have lip-to-base depth of about 1 m. Neither kiln was excavated due to time limitations.

It is probable that the western end of T-23 where the two kilns occur, as well as the area immediately to the north (between T-31, and T-33 and T-35) was an area of Classic period lime production. Limestone rocks, some partially calcined, occur on the surface of this area. Limestone is not indigenous to this hill or this section of the valley, but outcrops do occur in the southwest portion of the valley (Fig. 23.1).

T-17 Platform and T-7 Wall Lines

Northwest of the T-3 Classic pyramid-plaza group, at the western end of T-15, there is an approximately 2 m rise onto T-17. Excavations on the western end of T-17 uncovered, at a depth of 35 cm below the surface, the top of a 70 cm tall, well-built sloping wall running north-south (declination N6½E). This wall, when taken with the raised configuration of this entire terrace, suggests that most of T-17 itself is a raised, stone-faced Classic period platform. This platform covers an area of roughly 35 × 70 m. It is possible that a small mound structure might be present on the northwest end of this platform (see topography, Fig. 4.2), although we did not test for such a structure. This large raised platform appears to form the western end of the Classic period ceremonial complex.

On T-7, directly south from T-17, a number of large boulders protrude from the ground surface. These boulders occur in two straight lines with alignments of roughly N83½E and N86½E. One stone in this group, excavated by a villager one weekend in 1974, was discovered to have the faint, weathered remains of a bas-relief carving, and is apparently a Middle Formative stela (Mon. 24), which had been buried upside-down as part of the wall line. This suggests that the wall is post–Middle Formative. The fact that the boulder line has a general right-angle alignment to the T-17 platform wall, as well as its proximity to the T-17 platform, suggests that the boulder line dates to the Classic period.

T-20 Structures 2 and 3

Surface reconnaissance showed a concentration of Middle Formative white ware sherds in the area of a marked slope change on T-20, a hillside terrace. Excavations in this area uncovered within the plow zone the partially destroyed remnants of Classic period walls and floors which are part of structures overlying Middle Formative deposits (Fig. 4.28). Looting and erosion are responsible for bringing substructure Middle

Figure 24.10. Classic lime kiln (T-4 Structure 4) at beginning of excavation.

Figure 24.11. Classic lime kiln (T-4 Structure 4) after excavation.

Formative sherds onto the surface of this area, as well as for the general destruction of the Classic period structures.

Only the south side of Structure 2 was well preserved (Fig. 24.12). The exterior walls are of large unfaced, naturally smooth stones, placed flattest side outward. Rounded river cobbles are also included in the exterior wall line. No evidence of plastering occurs on the walls or floor area.

One wall section of Structure 3 (Fig. 24.12) was built of flat stones set at a slope of about 60°. Similar sloping *talud* sections are found on the T-4 Classic platform's front face, and also occur on a far larger scale on the T-17 platform walls. Such a sloping *talud* suggests that the southern wall of this structure was the front wall.

Nine Classic period burials were uncovered during the T-20 excavations, seven of which were within the probable subfloor area of the structures. The subfloor burials usually occurred in groups of two to four individuals (adults, children, or both; see Appendix C, Burials 67–72, 74–76). The presence of these burials suggests that these structures were residential rather than ceremonial constructions. Two Middle Formative burials and destroyed wall lines were also recovered in the excavation of this area, indicating that a Middle Formative structure once existed here as well.

***T-27 Structure 2* (Fig. 4.34)**

Excavations at the north end of the thumb-like terrace of T-27 uncovered walls within the plow zone. These appear to be part of a Late Classic (Teotihuacan IV) structure. Time did not permit the clearing of the entire structure, but several features are worth noting. The walls are all composed of large unfaced stones. There are no sloping walls such as were found with the T-4 platform or the T-20 structure, and the construction is far more massive than that of other Late Classic structures found on the site.

Three burials were recovered during the excavations (nos. 121, 125, 135). Burial 135, highly fragmentary, was found within a small rectangular stone crypt located in a wall line on the southeast side of the excavation. Associated with this interment was a cache of thirteen Teotihuacan IV vessels (Fea. 1), seven of which were Thin Orange ring-base bowls (Fig. 24.13).

T-9A

T-9A excavations disclosed the remains of a very destroyed Middle Formative structure. However, the area apparently was also utilized during the Late Classic, since excavations also revealed one Late Classic vessel, and two of the four radiocarbon dates run for T-9A pertain to the Classic period (N-1414:AD 510 ± 80, N-1415:AD 560 ± 80; Table 5.1). It is possible that Classic period inhabitants of this terrace reutilized existing wall foundations from the Middle Formative structure. Heavy erosion and modern plowing, both responsible for destroying most of the Cantera phase structure, undoubtedly removed almost all traces of the overlying Classic remains.

CT-2

On the slope below and east of Relief Group I-A (Mon. 1, "El Rey") and immediately to the west of the El Rey Drainage is a small stone platform excavated in 1973. When excavations began, the feature looked like a random pile of small rounded river cobbles. However, clearing excavations showed it to be a platform structure approximately 3 × 3 m², with a small extension to the east giving the entire structure an L-shape. Although the majority of the stones comprising the structure are rounded river cobbles, several lines of larger, flatter stones delimited its outer walls. The small platform, on its highest (north, downhill) side, is only about 45 cm tall. An inverted metate near the front center may have served as a "stair" onto the platform. Classic sherd fragments serve to date this platform.

Figure 24.12. Classic period walls on T-20: Structures 1 (*background*), 2 (*center*), and 3 (*right foreground*).

Classic Period Burials

Classic period burials occasionally occur intruded into Middle Formative structures (see Chapter 8 for discussion). They are usually individual occurrences (e.g., T-4, T-24, T-25), and are catalogued in Appendix C.

Classic Pictographs

A large number of rock paintings occur at Chalcatzingo, and they are discussed in detail in Chapter 12. Because most consist of very simple motifs, they are difficult to date through stylistic similarities to other Mesoamerican art. However, the paintings found in Cerro Delgado Cave 19 (Fig. 12.45) are more complex and exhibit strong similarities to the art of Teotihuacan, while sharing attributes with Chalcatzingo's cruder paintings as well. This suggests that the majority of the paintings may date to the Classic period.

Figure 24.13. T-27 Structure 2, Feature 1 vessel cache.

Figure 24.14. Postclassic shrine (*adoratorio*) on hillside below Monument 2 (reconstructed).

Tetla

One other Late Classic occupation zone occurs at Chalcatzingo: the Tetla zone, located on the northeastern side of the Cerro Delgado. Our knowledge of the Classic period here comes through surface collections and a few stratigraphic pits. Because many of Tetla's mounds appear to be Middle Postclassic (although some may overlie earlier Classic constructions), the description of Tetla is given in the next section of this chapter.

POSTCLASSIC PERIOD

Postclassic structures and artifacts were found on two areas of Chalcatzingo: the main site zone and the Tetla zone behind the Cerro Delgado.

Wall lines and plaster fragments were discovered while clearing brush on the hillslope below Monument 2 during the first year of the project (Grove and Angulo 1973:25–26). Subsequent excavations uncovered a series of wide stairways and platforms, all with traces of plastered surfaces. These extend for about 30 m up the hillside, attain a maximum width of over 10 m, and end at the base of the boulder cluster containing Monument 2 (Fig. 24.14). This Postclassic structure, which the project reconstructed, we term the *adoratorio* (shrine). This structure is unique in the region, and its location strongly implies that it was directed toward the veneration of Middle Formative Monument 2. Grove (1972b:36) has noted that this (or the Cerro Jantetelco) might be the Teocuicani shrine mentioned by the sixteenth-century chronicler Fray Diego Durán.

Ceramics recovered during the excavations of the *adoratorio* include large brazier fragments with pendant clay ears of corn, figurine fragments, and Tlalhuica Polychrome sherds (Fig. 24.15). The sequence of Postclassic ceramics is still in question in this area; the structure may be Middle or Late Postclassic in date. Similarities between the *adoratorio* sherds and those from the house excavated on terrace Tetla-11 (Chapter 25) argue for a Middle Postclassic date.

The evidence of Postclassic "occupation" on the main site area consists mainly of a few Mazapan figurine fragments recovered from a trash pit in T-27 Structure 2 (Fea. 1; Fig. 4.34). There is, however, good evidence for a significant Postclassic occupation at Tetla. The Tetla zone lies between the barranca of the Río Amatzinac (which runs east and then

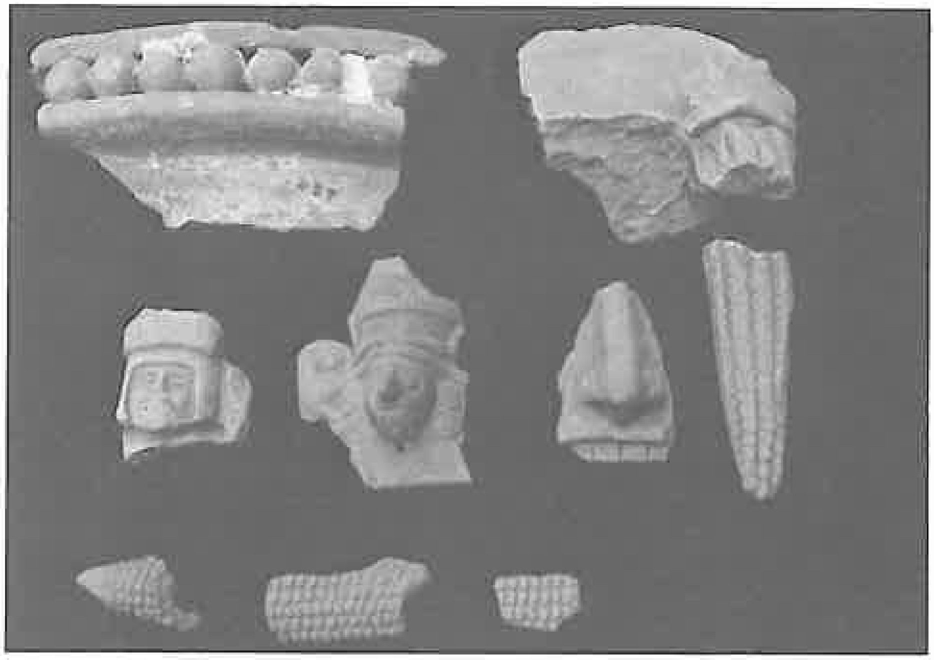

Figure 24.15. Postclassic vessel sherds and figurine heads from excavation of shrine.

south to delimit two sides of the zone) and the eastern (rear) face of the Cerro Delgado (Fig. 24.16). Surrounded by the deep barranca and the cliffs of the *cerro*, Tetla has relatively restricted access and is in a naturally defensible position. This may or may not have been a significant locational factor for the Late Classic–Middle Postclassic occupation here.

Tetla has approximately 14 ha of flat terrain between the barranca and the steep hillslopes which define the zone's western and southern limits. A large portion of this L-shaped flat expanse, which extends along the northeast and east of the Cerro Delgado, may represent Formative, Late Classic, and Early–Middle Postclassic modifications of the original ground surface. A deep stratigraphic test pit on the terrace Tetla-11 revealed nearly 3 m of mixed fill which included Late Classic sherds and thus can be tentatively dated to that period.

This flatland area contains the largest mound structures at Tetla and includes the three "occupation zones" defined by the project's regional settlement survey (Appendix J: RAS-1A, -1B, -1C). At the northeast end of the area is a low, artificially leveled hill surmounted by two large mounds (Str. A-1, A-2) and at least one plaza area (Figs. 24.17, 24.18). Debris from a looter's pit on the east side of one mound included a tubular clay drainpipe (Fig. 24.19) similar to those from Tula, Hidalgo, described by Dan M. Healan (1974). South of the hill are a variety of small mound groups as well as a large raised platform (Str. B) made up of a rock and earth core and supporting a mound (Figs. 24.17, 24.18).

To the west of the main hilltop structures is a second grouping of mounds, including a definite ball court (Fig. 24.7). This ball court (Str. C), on Tetla Terrace 1, consists of two parallel mounds about 30 m in length and 1.5 m in height, separated by a playing alley ca. 6 m wide. The approximate orientation of the ball court is N64½W. An old colonial period road running from Chalcatzingo to Tenango cuts through Tetla and may have destroyed the eastern end of the ball court.

To the east of the ball court is a large, unusual horseshoe-shaped mound (Str. D) about 2 m tall, with the mouth opening to the west. The path from the mouth to the interior of the structure drops another 2 m, making the interior area ca. 4 m lower than the top of the surrounding stone walls. This inner area measures approximately 10 m east-west × 6 m north-south. One characteristic of this odd-shaped mound, seen in the quantity and type of vegetation growing there today, is the greater moisture within the inner area. This suggests that the structure may surround an old spring or well. Small springs do occur along the base of the *cerros*, and a spring or well would have been a possibility here.

It should be noted that water for Tetla was probably taken from the barranca, and one of the few access trails to the barranca begins just north of this structure. In the barranca, at the end of this trail, is a bedrock mortar group adjacent to the river (MCR-21; Fig. 24.20). During times of heavy rain when river water is extremely muddy, or in periods of dryness when the river is a mere trickle, or possibly during periods when the site was being defended, an on-site water source would have proven to be of value. Obviously the true function of the U-shaped mound remains to be tested by future research.

Excavations in 1974 revealed a Middle Postclassic house structure on Tetla Terrace 11, to the north of the horseshoe-shaped mound. This house is described in Chapter 25.

To the north of Tetla's flatlands are the steep eastern and northeastern slopes of the Cerro Delgado. Here are long, thin terraces which create a total of about 4.5 ha of additional land for cultivation. These terraces are still maintained and farmed today. Small mounds occur on several of the terraces, and surface debris includes great quantities of Late Classic and Early–Middle Postclassic undeco-

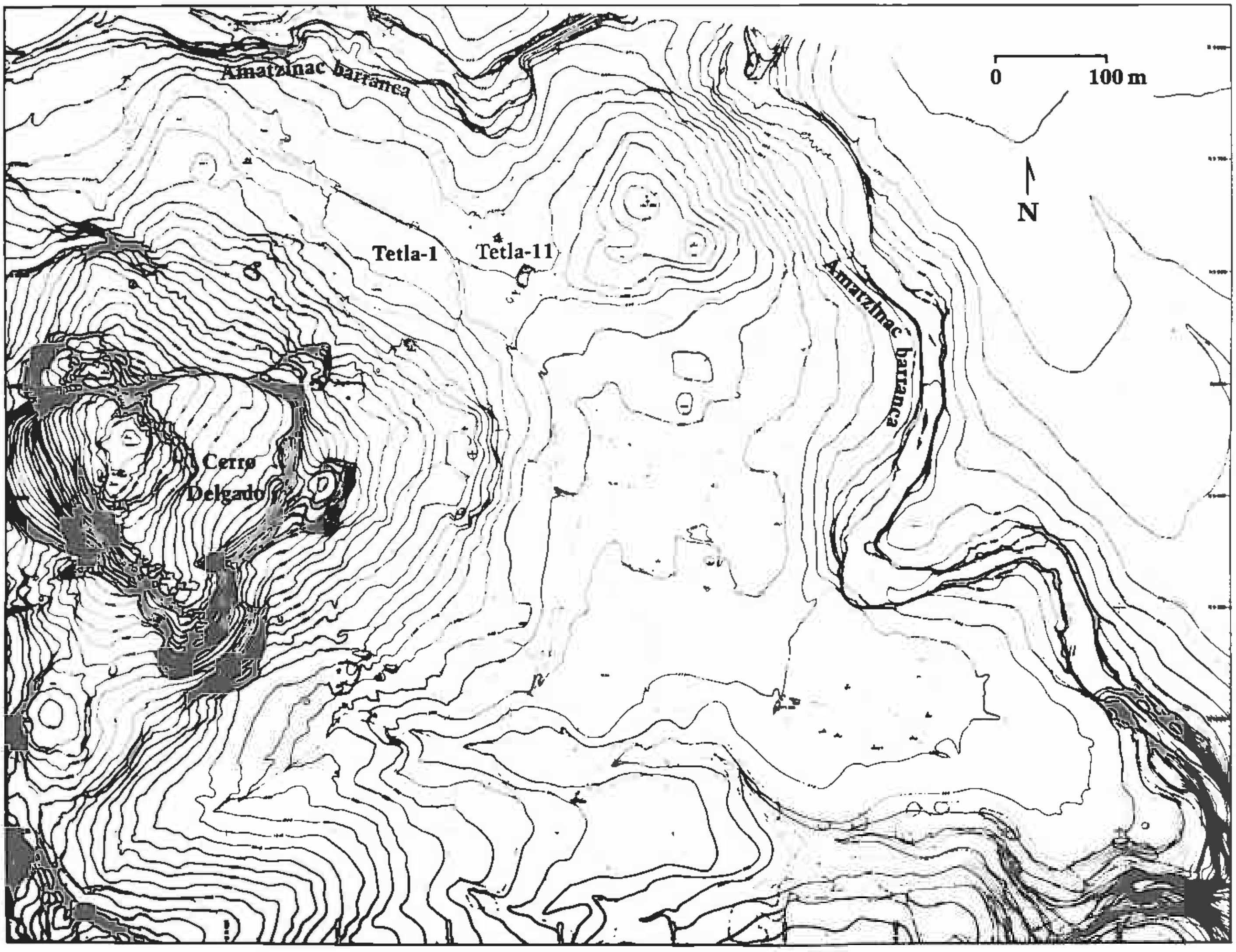

Figure 24.16. Tetla site area.

Figure 24.17. Northeast section of Tetla, showing **ball court** (*center foreground*) and pyramid-plaza complex atop hill (*right background*).

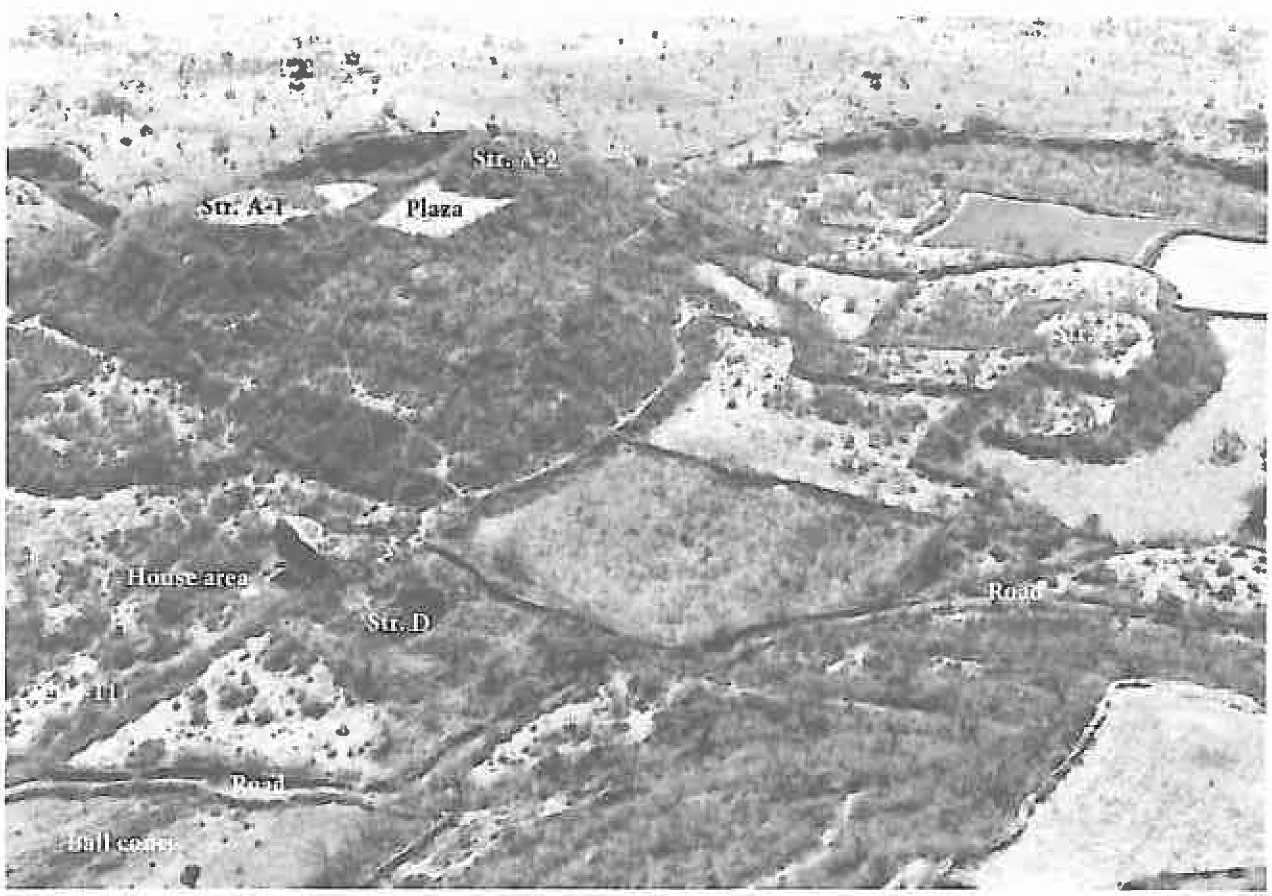

Figure 24.18. Eastern section of Tetla.

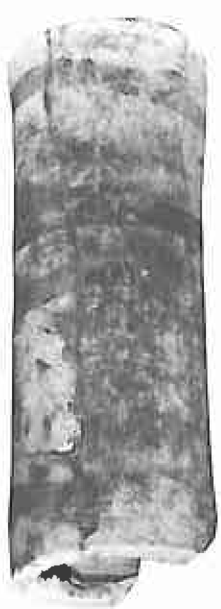

Figure 24.19. Postclassic tubular pipe (stripes are clear tape holding object together). Length: 34 cm.

rated utilitarian ceramics as well as obsidian and other stone artifacts. The surface assemblage implies that at least one function of these terraces was habitation. Many small and naturally flat sections of the hillslopes have concentrations of ceramics and stone artifacts as well, indicating that these too served as habitation areas.

The southern border of the Tetla zone is formed by a long ridge which extends eastward from the back of the Cerro Chalcatzingo to the river barranca. Grove's reconnaissance of this ridge in 1967 (Grove 1968b: 277) and subsequent surface surveys during this project located a number of small terraced areas with occupation refuse on the ridge's north (Tetla) side.

Above Tetla, at the junction between the cliffs of the Cerro Delgado and the steep talus slopes, are several caves (nos. 1, 2, 16; Fig. 12.37). Today these are sometimes used for storing bundles of grass to be used as cattle fodder. Informants have told us that the caves were also used as a refuge by Zapatista revolutionaries, and excavations in Cave 1 yielded a one-*centavo* coin with an 1890 date, while Cave 16 contains the remains of a stone wall and a small trench, possibly for defensive purposes. The caves also contain Formative, Classic, and Postclassic period artifacts. Floral remains recovered from Cave 2 are listed in Appendix A.

The top of the Cerro Delgado is partly comprised of an eastward-sloping plateau (Fig. 12.37). Access to the plateau is possible only from Tetla, and vestiges of highly eroded pecked footholes still exist on one cliff slope. One village family still climbs the cliffs sometimes to plant tomatoes on the ca. 1.5 ha of usable land on the plateau. Several small caves are found in the cliffs at the uphill portion of the plateau (see also Chapter 12). The plateau's surface is littered with ceramic debris identical to that on Tetla's flatlands. A small mound built atop an artificial platform occurs at the highest point on the Cerro Delgado.

COMMENTS

It is worth noting that there are a wide variety of ceremonial and habitation zones at Tetla. While Tetla's earliest settlements appear to be Middle and Late Formative, its heaviest occupation seems to have taken place during the Early–Middle Postclassic. The variety of habitation areas at Tetla suggests that the site could yield interesting data on social stratification patterns. The one house excavated (Chapter 25) was located within the Middle Postclassic ceremonial zone. It was a large, well-made house with plaster floors. However, the hillside slopes also contain habitation debris, but either on small terraces or natural flat areas on the hillsides, neither of which is large enough to sustain a dwelling the size of the excavated structure. Plaster fragments are also missing from these latter locales.

Taken as a whole, these data suggest three types of residential structures, possibly related to levels of the society: (1) large houses; (2) houses on small artificial hillside terraces; and (3) houses on natural flat areas of the hillside slopes. A possible fourth type could be related to cave habitations, although it is not clear at this time whether cave utilization was for habitation, specialized activities, or ritual use.

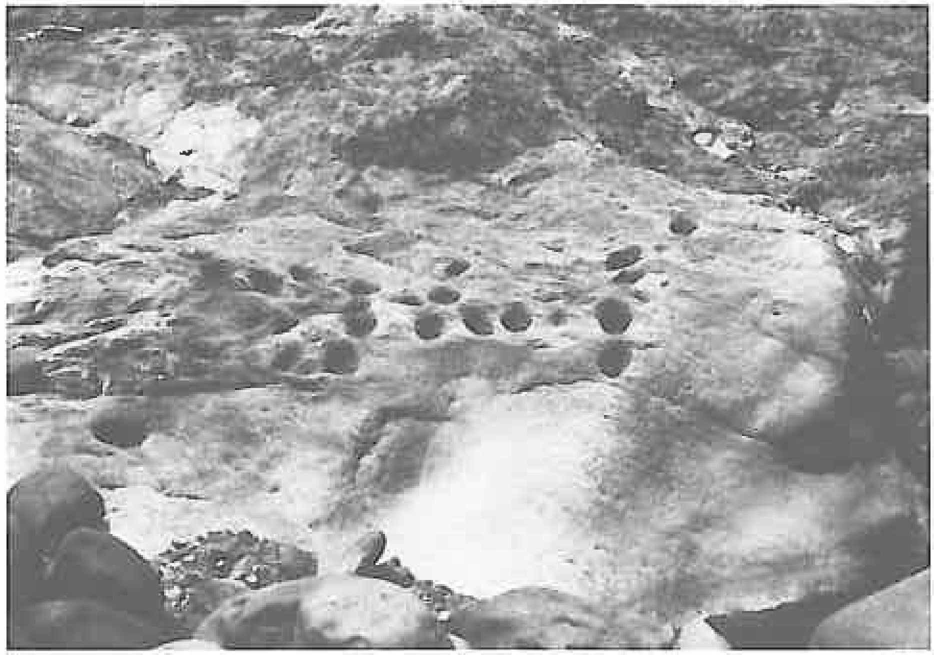

Figure 24.20. Mortar holes (MCR-21) in barranca below Tetla.

RESUMEN DEL CAPÍTULO 24

El pequeño poblamiento del Clásico en Chalcatzingo pertenece fundamentalmente al período Teotihuacan III–IV. La arquitectura monumental importante del sitio para este período consiste de dos pequeños montículos piramidales que miran hacia la plaza (T-3) y una cancha de pelota al norte de esta plaza en T-15. El montículo más grande, T-3 Str. 1, es una pirámide redonda. Las otras construcciones del período Clásico en la zona principal del sitio incluyen varias plataformas, tres hornos de cal, y posibles estructuras de casas con entierros asociados. Algunas de las pictografías más elaboradas del sitio pueden fecharse al período Clásico, sobre la base de que presentan semejanza de estilo comparadas con los murales teotihuacanos. Tetla también tuvo un poblamiento pequeño del Clásico, pero su componente más importante está fechado en el Postclásico Medio. La única estructura del Postclásico, encontrada en la zona principal del sitio, es el complejo escalera-plataforma que conduce hacia arriba al santuario dedicado al bajorrelieve del Formativo Medio, Monumento 2. El fechamiento de esta estructura usando la cerámica asociada permanece incierto, aun cuando es probable que sea Postclásico Medio. La arquitectura del Postclásico en Tetla incluye un número de estructuras, entre las que se encuentran un complejo montículo-plaza en la cima de una pequeña loma artificialmente elevada, y una cancha de pelota. A semejanza de la zona principal del sitio, existen aquí terrazas artificiales, las que probablemente ubicaban algunas de las estructuras de las casas, así como las tierras de cultivo. Además, algunas de las cuevas del Cerro Delgado tuvieron ocupación durante el Postclásico Medio.

25. The Excavation of a Postclassic House at Tetla

LYNETTE NORR

The Tetla zone of Chalcatzingo lies on the north and east sides of the Cerro Delgado (Chapters 2 and 24). Reconnaissance during the 1972 and 1973 field seasons together with data gathered in 1967 (Grove 1968b:277) indicated the presence of Postclassic occupation and ceremonial structures there. One major question prior to excavations at Tetla in 1974 was whether Tetla represents the Late Postclassic period village site of Chalcatzingo, as stated in village tradition (Morayta 1980:36). Results of our research show Tetla to have been occupied primarily during the Middle Postclassic (Second Intermediate: Phase Three [AD 1150–1350]; Sanders, Parsons, and Santley 1979), with Epiclassic and possibly some Early Postclassic occupation, but no Late Postclassic. Middle and Late Formative materials were also recovered during the excavations and in surface collections.

This chapter concentrates on terrace Tetla-11, where the 1974 excavations uncovered a four-room habitation structure. The spatial distribution of artifacts within the structure is described, activity areas are identified, and the probable uses of each room are discussed. A description of the artifacts can be found in Appendix I. The chapter concludes with a discussion of the implications of these data in terms of this period of central Mexican culture history.

THE EXCAVATIONS

The Tetla-11 terrace lies north of the Cerro Delgado and west of the major Postclassic mound structures of the site (Figs. 24.16–24.18). At the time of the excavations the land had been unplowed for many years and functioned mainly as pasture. Much of the area was covered by short grass and *huizache*. The excavation area was laid out at the eastern end of the terrace at the base of an 8 m tall boulder which dominates the field. The units were established with a grid orientation of N54½W.

Upon beginning the excavations it quickly became apparent that a well-preserved structure floor lay less than 30 cm below the surface. Over 57 m^2 of area was opened, exposing a four-room structure (Fig. 25.1). All artifacts directly on the floor were mapped in place.

On the southwest side of the structure is what may be a courtyard or patio area. This area is littered with many small stones mixed with adobe and burned hard-packed earth. No walls such as are typical of house courtyards today were found enclosing the area.

THE STRUCTURE

The structure appears to have been a house, constructed in two stages. The eastern three rooms, B, C, and D (see Figs. 25.2, 25.3), constitute Construction Stage 1. An interior double wall and the specific artifact remains found on the floor of the larger western room, A, suggest that Room A was a later addition, Construction Stage 2. This addition created a narrow hallway entrance at the southwest corner of Room B. What was probably the main entrance to the house is in the southern wall of Room C, and is marked by three dressed threshold stones. Access to the western room, A, was limited to an outside doorway in the northern wall.

A stucco floor was present in all rooms and in the entrance, although not always in a perfect state of preservation. Two shallow earthen steps at the southern entrance to Room B also showed evidence of a stucco surface. Where no stucco was preserved, the floor was of smoothed, hard-packed dirt. A cross-section of the stucco floor in Room B showed that it had been resurfaced at least three times, with each resurfacing having added 5–6 cm to the floor. At least the earliest of these floors had been painted red. Below the floors was a prepared house platform of dirt fill mixed with small flat stones and ceramic debris. Approximately 30 cm below the house floor and 1 m west of the wall foundation of Room A was a parallel wall which probably functioned as a secondary foundation or retaining wall for the house platform.

All wall foundations were constructed of cobbles varying in diameter from 5 to 30 cm and larger dressed stones up to 1 m in length. Excavations outside the house along the west and north walls showed that the wall foundation continued some 15–20 cm below the house floor. Adobe and stucco-faced adobe bricks from the collapsed walls were found throughout the excavation area. This basic form of stone and adobe residential architecture is also present at about the same time at Tula (Healan 1974:47–50), and is documented by Bernardino de Sahagún (Soustelle 1972:131) for sixteenth-century Aztec residences. The people of Chalcatzingo still use a similar house wall construction today.

There were no indications as to how the structure may have been roofed. The large boulder which overhangs a portion of Rooms B, C, and D was probably integrated into the roof construction.

ACTIVITY AREAS AND ROOM USE

A plan view of the house floor, with associated features, artifacts, and debris, is shown in Figure 25.2. A study of the horizontal distribution of artifacts and debris from the floor defined units of activity. Artifacts of relative abundance and random distribution throughout the house and courtyard were considered to be of little importance in determining activity areas or room use and are discussed later as to their significance as temporal markers or, as in the case of the

Figure 25.1. Foundation walls of Postclassic house, Tetla.

spindle whorls, their function as related to form. The distribution of unique or special-function artifacts was noted in order to determine the significance of their location within a particular room, given the possibility that certain rooms may have been used primarily by males or by females. Activity areas and inferred male or female work areas are shown in Figure 25.3.

Generalized food preparation activities occurred within both Rooms A and B. These activity areas surround hearths located against the west wall of each room. Near the hearths are numerous sherds of cooking pots, large jars with lime-encrusted interiors, *fondo sellado* ("stamped bottom") bowls, and ceramic *molcajetes*. Two large manos, a ceramic spoon with orange pigment, and a dense concentration of small (1–2 cm) unretouched chert flakes were also found on the Room A floor. The generalized food preparation area of Room A covers an area approximately twice that of the similar area in Room B. The associated debris of Room A is also much greater in quantity and less fragmentary than that of Room B, suggesting that Room A was the primary area of food preparation.

The courtyard area southwest of the house may have been utilized for maize grinding. Two manos and two metate fragments were found here, as well as *comal* sherds (which were rare within the house). This suggests that the grinding of the *nixtamal* (lime-processed corn kernels) and the toasting of the tortillas took place in the courtyard, while the actual soaking of the kernels in lime water took place indoors in the general food preparation areas.

Directly north of Room A, from the doorway to the limits of the area excavated, was a garbage/midden area covering more than 5 m^2 to a depth of about 45 cm below the house floor. This area was not a garbage pit, but simply accumulated material presumably swept or thrown out of the room, including ceramic and lithic debris mixed with animal bone, spindle whorls, and bone awl fragments.

Four figurine fragments occur within the food preparation area in Room A (two are shown in Fig. 25.4*a–b*) and three within the garbage/midden area. This location may indicate that they relate ideologically to the occupants' subsistence and well-being. Another artifact of probable ideological significance is a grey-black obsidian trilobal eccentric found in the south section of the room. Most of the sixty-three trilobal eccentrics reported from Tula by Terrance Stocker and Michael Spence (1974: 88) also came from residential structures. Figurine fragments in Room B (Fig. 25.4*c–d*) are also clustered near the hearth and thus possibly associated with food preparation.

A second activity, related to sewing, perforating leather, or perhaps weaving, can be postulated for Room A. Four bone awls were found in the north half of the room, and a fifth one was found in the doorway. No other artifacts or debris were associated which might indicate their specific use.

Nearly 50 percent of the area of Room A was used for generalized food preparation and for sewing or weaving, tasks suggesting that the room was used mostly by women. The limited access to Room A through the single, northern doorway may have been a means of separating "women's chores" from other household activities. The fact that Room A may be a later addition to the house is in complete accordance with ethnographic data presented by Jacques Soustelle (1972: 131–132) for Tenochtitlan. There, the number of rooms in a house increased with the family's wealth, and when possible one or more rooms were reserved for the women. While Room B may have originally been for women's activities (e.g., cooking), the addition of Room A may have created a shift in activities, and Room B may have taken on a more generalized living function.

Two distinct activity areas can be defined within Room C. Obsidian debitage including flakes, blades, and a core was found in the southwest area of the room, and the only clustering of projectile points within the house occurred in the center of the room. These artifacts suggest a male usage of the room, with some lithic manufacturing or retouching activity.

The room's second activity area is not necessarily male oriented. What is suggested here to be a small stucco domestic shrine is located against the room's east wall. This portion of the wall foundation is formed by dressed and fitted stones, and the stuccoed floor is raised ca. 10 cm above the floor of the rest of the house, forming a niche-like area under the overhang of the large boulder.

Two unique artifacts come from this area. A green obsidian crescent eccentric was found in the subfloor fill in this portion of the room. Obsidian crescents are also found in residential contexts near temples at Tula (Stocker and Spence 1974: 88). A small shoe-pot with a fire-clouded toe (Fig. 25.5) had been buried nearby and covered with the stucco flooring. The shoe-pot is too small to be of domestic utility and was probably used ritually

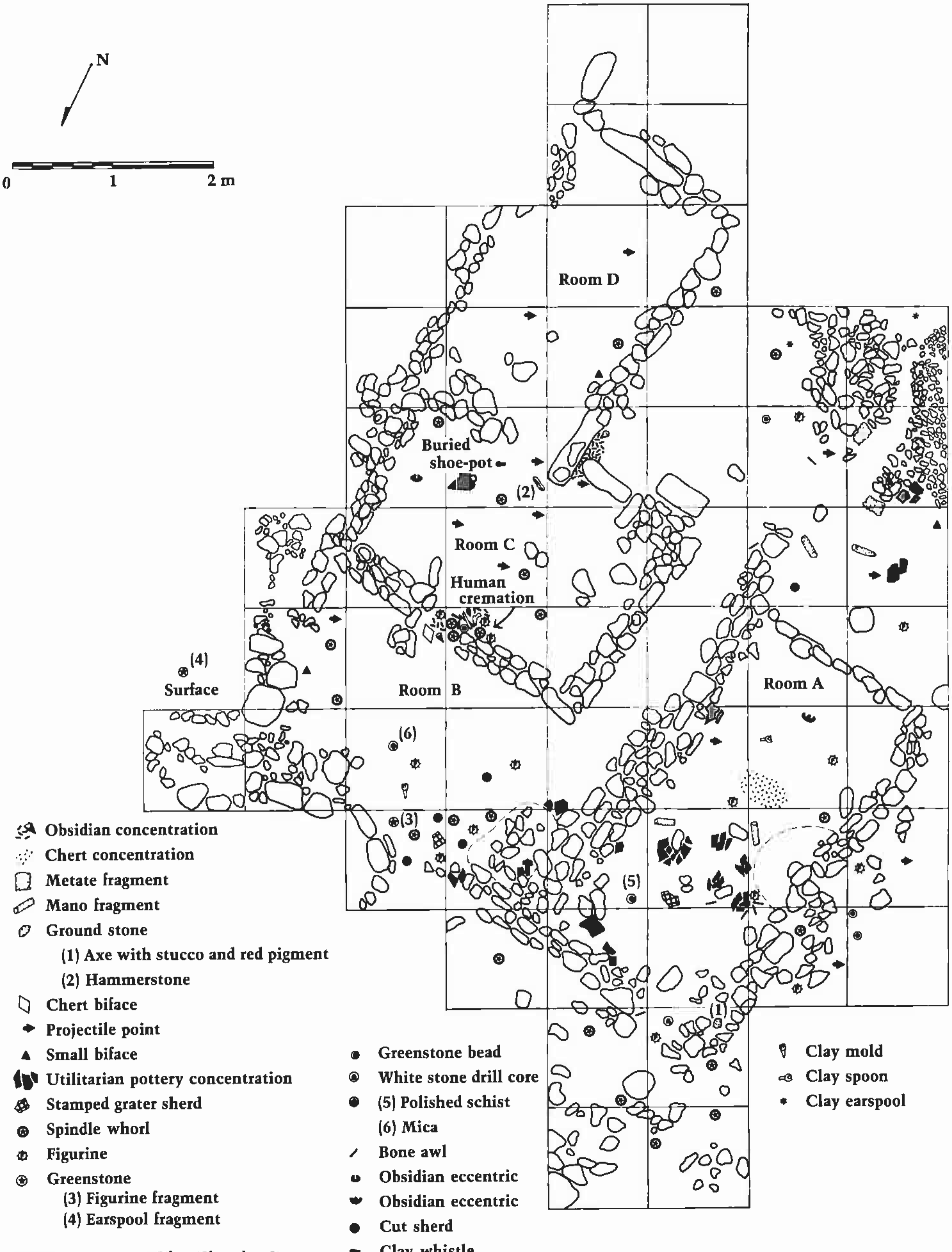

Figure 25.2. House with artifact distributions indicated.

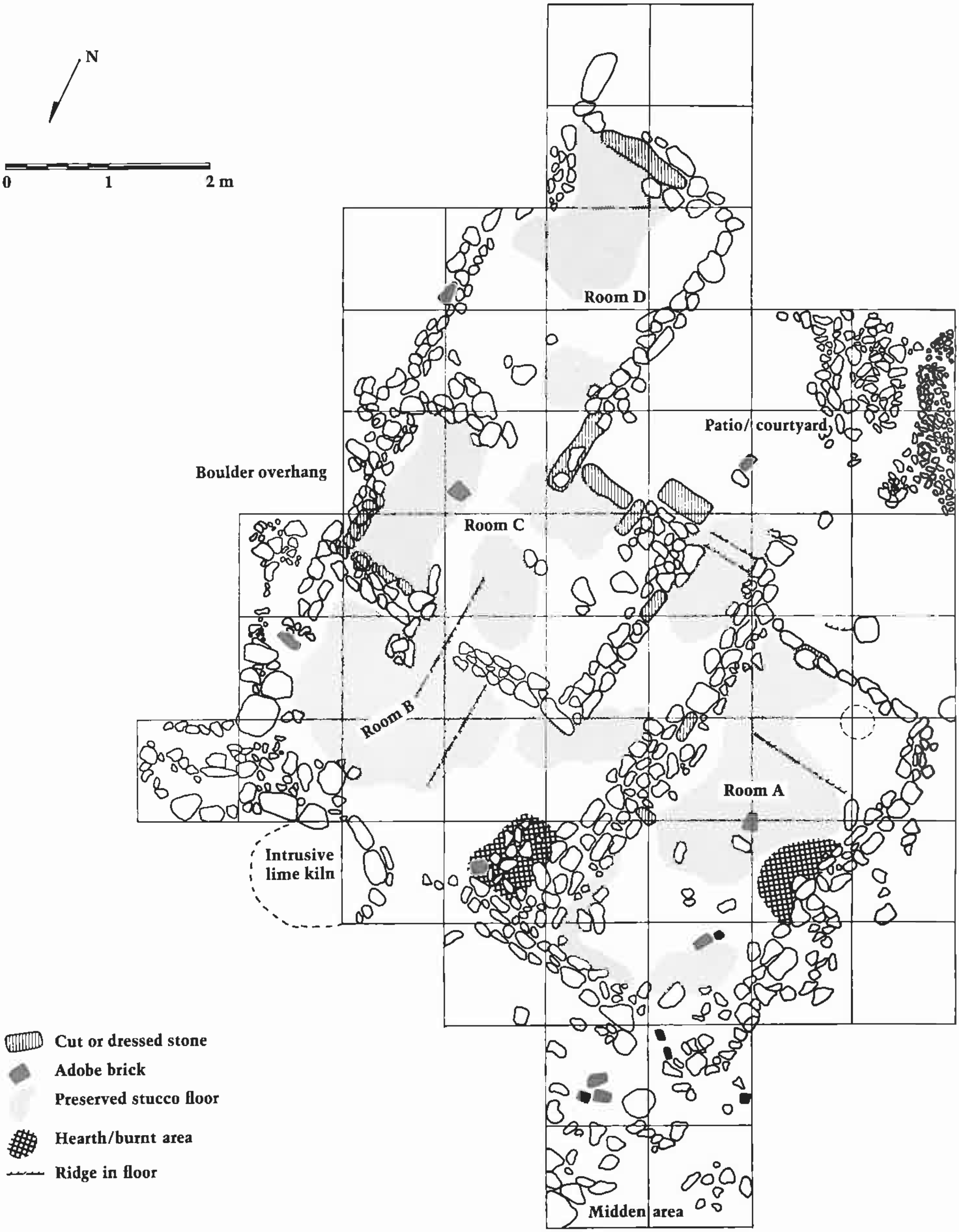

Figure 25.3. House with activity areas indicated.

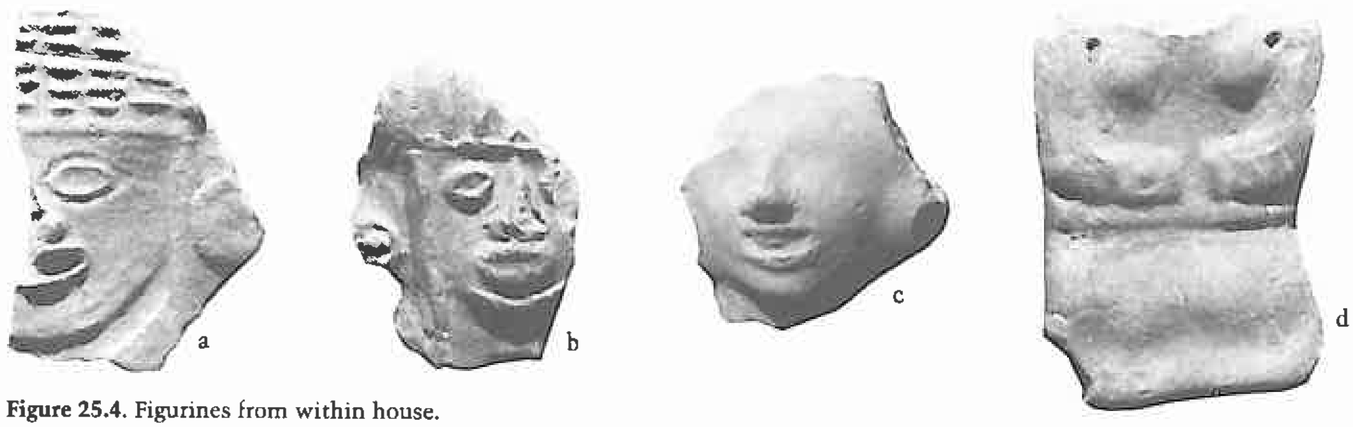

Figure 25.4. Figurines from within house.

in association with the shrine area.

Representative of a single event rather than an area of habitual activity is the subfloor human cremation burial in the Room B-C doorway (Burial 160). The burned bones were accompanied by a variety of burial offerings, including a Graphite-Black on Red ware vessel fragment, a carefully made bifacial, bipointed, mottled pink and white chert knife, two obsidian cores and a small cache of blades, three figurine fragments (one of which is a Middle Formative C8 type), a pale green jadeite bead, three spindle whorls (Fig. 25.6), and a bone awl like those found in Room A.

Figure 25.5. Shoe-pot. Length: 16 cm.

Room D is the least specific of the house's four rooms in terms of identifiable activity areas. The debris from the room's fill consists mostly of sherds and lithic material. Two partial vessels, a White-Slipped Orange ware polychrome vessel (Fig. I.10*a*; cf. Noguera's polychrome *firme*; 1954:122–136) and a Black on Red vessel (Fig. I.5*b*), both with raised interior bases, were found in this room. Because of the general absence of specific artifacts, it is possible that this room functioned primarily as a sleeping area.

It is interesting to note that the Tetla-11 residential structure shares many similarities with a Late Postclassic (Late Horizon) small village residential structure from the Teotihuacan valley (Sanders, Parsons, and Santley 1979:Fig. 5.16a). These similarities include general building form, orientation, southern hallway entrance, and west wall hearth placement. This suggests that a regional cultural norm may have existed for rural residential constructions.

SPINDLE WHORLS AND SPINNING AS A HOUSEHOLD ACTIVITY

The excavations recovered twenty-four spindle whorls, apparently randomly distributed throughout the house, courtyard, and midden areas. An additional forty-four whorls were recovered from surface contexts at Tetla, from the Cerro Delgado cave excavations (of probable Middle Postclassic context), and from Classic and Postclassic levels on the main site zone. All sixty-eight whorls were measured and classified as Type A (small) or Type B (large), and further differentiated by surface treatment (incised, moldmade, or undecorated). This information, as well as data on provenience and illustrations of the whorls, can be found in Appendix I.

Mary Parsons' analysis of whorls from the Teotihuacan Valley and the Texcoco region of the Basin of Mexico defines three whorl types based upon clustering in the attributes of maximum whorl diameter, hole diameter, weight, and decoration. Her results suggest that small whorls were used to spin a fine fiber such as cotton, and larger whorls a heavier fiber, probably maguey (M. Parsons 1972). The analysis of the Tetla whorls utilized maximum whorl and hole diameters, weight, and height to define the two Chalcatzingo whorl types, A and B. The Chalcatzingo whorl types are not identical to those found in the Texcoco region and the Teotihuacan Valley, so letter designations for our types have been chosen in order to avoid confusion with Parsons' Types I, II, and III, and to emphasize their difference, which is probably both temporal and regional rather than functional. Histograms of measurements of the four attributes on all sixty-eight whorls (Fig. 25.7) show that the greatest difference between the two whorl types is weight, followed by whorl diameter. Whorl height was found to be of little importance in distinguishing the two types, except that an increase in height (or diameter) will obviously increase the weight.

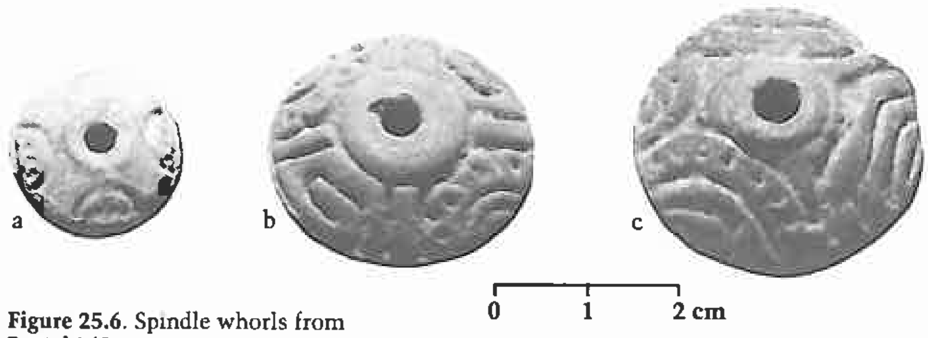

Figure 25.6. Spindle whorls from Burial 160.

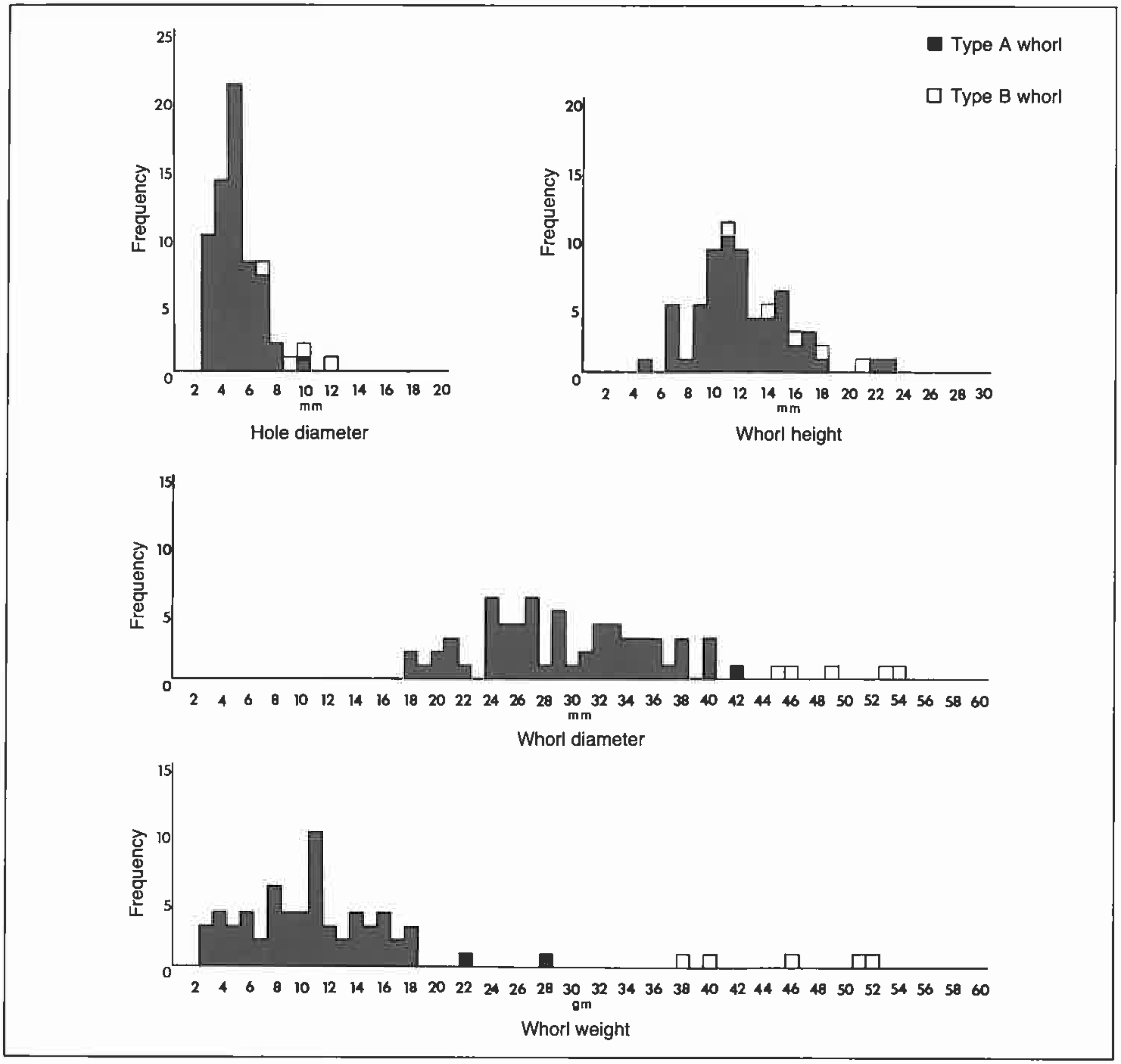

Figure 25.7. Histograms of measurements of Type A and Type B spindle whorls.

The clear bimodal separation between our Type A and Type B whorls seems to support Mary Parsons' analysis and conclusion that two sizes of whorls were used to spin two kinds or sizes of fiber. Fig. 25.8 shows that variation exists within Type A, for most mold-made whorls are larger than undecorated or incised examples. This could indicate that different weights of the same fiber, presumably cotton, necessitated a slightly different-sized whorl, and that spinning tool kits had various sized whorls to accommodate thread weight.

Mary Parsons worked primarily with whorls from Late Aztec contexts. She was therefore uncertain whether the presumed cotton whorls (her Type III, our Type A) had been present in similar quantities earlier, or whether perhaps the large number of these whorls might relate to increased cotton procurement through trade or tribute during the Late Aztec period. Our data do not clarify that question, but do demonstrate that during the Early Aztec period (Middle Postclassic), small whorls predominate and thus cotton was apparently the primary fiber spun at Tetla-Chalcatzingo. The Cave 2 finds (Appendix A) include a quantity of raw cotton as well as some cotton thread.

Type B whorls, used for a heavier fiber such as maguey, are relatively uncommon in the Chalcatzingo sample. This seems to imply that everyone within our sample universe had easier access to cotton, and that maguey thread was rarely spun. This is in agreement with the project's data on crops grown in the Río Amatzinac Valley today and at the time of the conquest. Maguey is rare in the area, but cotton may have been an important crop in the southern valley. Maguey spinning may have become widely used in central Mexico only after the Triple Alliance restricted the wearing of cotton garments to the nobility. At the same time they demanded heavy tributes in cotton garments from provinces in Morelos.

The Tetla spindle whorls came primarily from within one residential structure. Our excavation data thus cannot tell us whether twenty-four whorls is an unusually high number for a residence. If in the future other residences are excavated at Tetla, their spindle whorl yield will be of interest. An unequal distribution of whorls between domestic structures across the site would suggest some specialization within the site.

BOTANICAL REMAINS

Thirty-one carbonized corncob fragments were recovered from the hearth area in Room B. The sample is homogeneous, consisting of ears with a slight taper, little or no twist, hollow cobs, and eight rows. The cupules are broad (5–7 mm) with relatively long, hard glumes. No cobs had attached kernels, nor were there any loose kernels in the sample. The largest cob is 33 mm long and 10 mm in diameter (David Bugé, personal communication).

It is difficult to be certain without evidence from the kernels, but the type of corn represented in the Tetla samples seems closely related to the eight-rowed corn of west Mexico, Harinoso de Ocho. The width of the cupule, the thickness of the cob, and the consistent occurrence of eight rows fit almost nothing else. The modern variety of corn grown at Chalcatzingo is Pepitilla (see Chapter 26), which is distinguished by a high row number (average 15.5) and long, narrow-beaked kernels (Wellhausen et al. 1952). The Tetla samples likewise do not compare with the corn recovered from Chalcatzingo Cave 2 (apparently Middle Postclassic). The majority of Cave 2 corn is classifiable as Nal-Tel–Chapalote, which has eleven or twelve rows and small kernels.

The Tetla samples also differ from the modern corn of Tepoztlan (E. Anderson 1951) in displaying significant influence from west Mexico. Edgar Anderson (ibid.: 449) noted that Morelos lies at the border of the west Mexican and central Mexican regions and was surprised to find so little influence from west Mexico in the corn today. It seems, however, that Chalcatzingo shows three separate influences in its corn: an early Nal-Tel–Chapalote, probably imported from the Gulf Coast, an eight-rowed corn from west Mexico, and the modern Pepitilla which is found throughout the Balsas region. The last seems to be a very recent introduction, given the lack of archaeological evidence for its early arrival.

CERAMICS AND DATING

The Tetla ceramic typology, based primarily upon surface treatment, decoration, and paste texture, is presented in Appendix I. Six decorated ceramic wares were defined, and when appropriate, a ware was subdivided into descriptive decorative types. Four undecorated wares and an "eroded" category were also defined.

The comparison of Tetla ceramics to other Postclassic ceramic assemblages met with initial problems in 1974 when the analysis was begun. Little is known and almost nothing is published on Postclassic Morelos ceramics, and data are even scarcer for eastern Morelos. Thus, the use of ceramics alone as a means of dating the occupation at Tetla rested on shaky ground.

The two decorated ceramics which were most abundant at Tetla, painted and incised Polished Red ware and Black-on-Orange ware, were the most useful in establishing a ceramic phasing for the Tetla occupation. The Tetla Black-on-Orange ceramics (Figs. I.1–I.3) are very similar to Culhuacan Negro sobre Naranjado or Aztec I (Griffin and Espejo 1947; 1950; Séjourné 1970), and the Polished Red wares (Figs. I.4–I.8) are most similar to those found in association with the same Black-on-Orange ceramics at several locations in the southeast portion of the Basin of Mexico (Jeffrey Parsons, personal communication; Blanton and Parsons 1971: 298–299; O'Neill 1962: 121–141).

There are also a number of Postclassic ceramic types which are common in the central highlands of Mexico but conspicuously absent at Tetla. These include Red-on-Buff Mazapan varieties and Black-on-Orange types II, III, and IV. The Black on Orange ceramic types were once thought to be temporally sequential, mutually exclusive, and a part of the Postclassic ceramic assemblage perhaps as early as the Early Postclassic Mazapan ceramics (Franco 1949: 185; Griffin and Espejo 1950: 13; Séjourné 1970: 63). New Basin of Mexico data (Jeffrey Parsons, personal communication; Sanders, Parsons, and Santley 1979; Charlton 1979), supported also by the Tetla analysis, indicate that Mazapan ceramics are earlier than the Black on Orange ceramics, Black on Orange types I and II are contemporaneous but regionally separate, and Aztec III ceramics continue into colonial times.

Thus, while the Tetla ceramics are contemporaneous with Aztec I–II (Second Intermediate: Phase Three) in the Basin of Mexico, they postdate the AD 950–1150 Mazapan ceramics and predate the Late Horizon Aztec III–IV ceramics. This dating is confirmed by two radiocarbon assays from the Tetla house. A charcoal sample from Room B (ISGS 508) produced a date of 720 ± 75 BP (AD 1230 ± 75), while a lime kiln feature

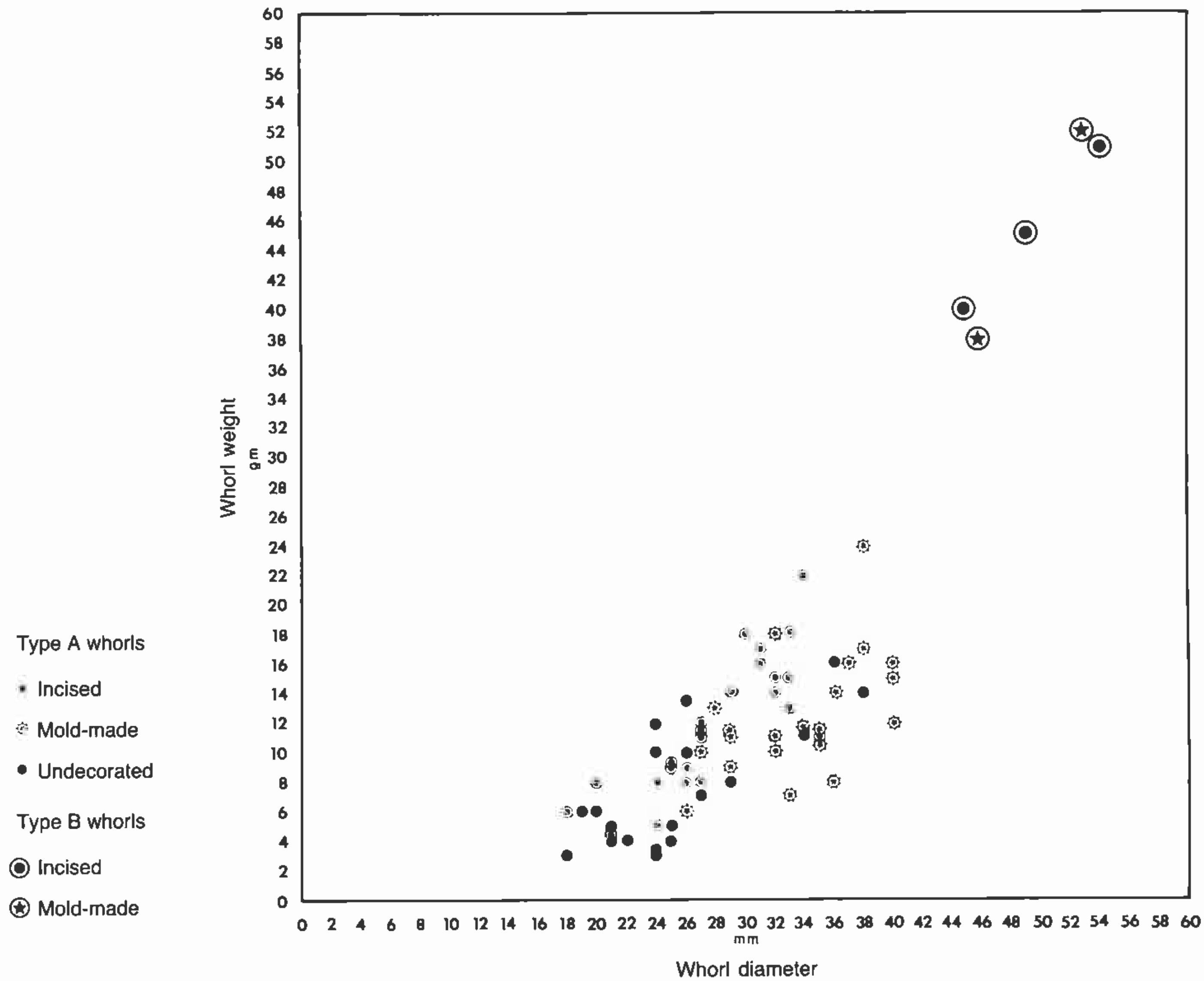

Figure 25.8. Type A and Type B spindle whorls distinguished by weight and whorl diameter.

intrusive into Room B (ISGS 509) dated 610 ± 75 BP (AD 1340 ± 75).

A REGIONAL PERSPECTIVE ON THE MIDDLE POSTCLASSIC AT TETLA

Data obtained during the surface surveys of Tetla and the analysis of ceramics underlying the Middle Postclassic Tetla-11 house platform indicate that there was also a relatively extensive Late Classic occupation at Tetla. During the Early Postclassic, however, despite various references to Toltec expansion into Morelos (e.g., Hirth 1977; Muller 1949) or to strong ties between eastern Morelos and Tula (Hirth 1977), there is very little evidence at Tetla either for a significantly large local population or for Toltec influence. The near absence of an Early Postclassic component suggests either a partial abandonment of Tetla at that time or a local Late Classic to Middle Postclassic transition lacking "diagnostic" Toltec and Mazapan materials.

During the Middle Postclassic, settlement in the Basin of Mexico was heavily weighted toward the southern part of the basin. Surveys there identified six or seven large nucleated sites, including Culhuacan, Xochimilco, Cuitlahuac, Mixquic, Chalco, Xico, and Amecameca in the mountains to the southeast. There is a clear economic and/or sociopolitical separation in the Basin of Mexico between southeast and northwest areas.

The most obvious material difference is in the decorated ceramics, where the contemporaneous Aztec I and Aztec II Black-on-Orange ceramics have independent distributions. A strong economic and/or sociopolitical link is most probable between the Chalco-Xochimilco region in the south and the Puebla-Cholula area, while the northern Basin of Mexico seems to be more closely linked to the collapsed Tula sphere (Sanders, Parsons, and Santley 1979:149–153).

As should be expected on the basis of geographical proximity, ceramic similarities link Tetla most closely to the southeastern Basin of Mexico and the Puebla-Cholula area. Nearly 95 percent of the Tetla decorated ceramics are like the predominant decorated wares in the southeastern basin of Mexico at Culhuacan (Griffin and Espejo 1947; 1950; Séjourné 1970), Chalco-Xochimilco (O'Neill 1962; J. Parsons et al. 1981), and Texcoco (J. Parsons 1971). Although the decorated wares occur in different frequencies at various sites, they generally include Aztec I (and some Aztec II) Black-on-Orange, several types of Polished Red ware, ceramics similar to some of the Tetla Orange ware polychromes (e.g., Chalco polychromes), and the Red on Burnished Buff (and zoned incised type) ware. The similarities to the Puebla-Cholula area's ceramics (Noguera 1954; Muller 1978) and those of the Tehuacan Valley (MacNeish, Peterson, and Flannery 1970) are more often in vessel and appendage form than in surface decoration.

Five percent of Tetla's decorated sherds, the Black on White ware and some of the Orange ware polychromes, are found more frequently in western Morelos and northern Guerrero (Paul Schmidt 1977; M. Smith 1981; Jorge Angulo, personal communication).

During the Middle Postclassic, eastern Morelos was apparently not densely populated and lacked a nucleated center the size of those in the southeast Basin of Mexico. The Río Amatzinac Valley was on the southern periphery of a large interaction sphere encompassing rapidly growing nucleated centers in the Basin of Mexico and the Puebla-Cholula region to the east. The strongest sociopolitical and/or economic ties were in those directions.

It was suggested above that one commodity which the Río Amatzinac Valley had to offer in tribute and exchange (within that interaction sphere) was cotton (M. Parsons 1972:65; Hirth 1977:44). Imports into the valley certainly included lithic raw materials (obsidian, metamorphic stone, etc.) and possibly some ceramics as well. While Tetla's undecorated utilitarian ceramics were probably locally made, some of the decorated ceramics (less than 4 percent of the ceramic assemblage), figurines, and spindle whorls could have been imported (ceramic whorl molds do indicate some local manufacture as well). A petrographic analysis of clay minerals and temper from the Tetla ceramic sample is now in progress and may help differentiate local from imported artifacts.

RESUMEN DEL CAPÍTULO 25

Las excavaciones realizadas durante 1974 en la zona de Tetla en Chalcatzingo fueron enfocadas a la estructura residencial localizada al poniente de los montículos principales del Postclásico. La casa de cuatro cuartos fué construida en dos etapas, siguiendo el modelo de construcción de piedra y adobe típico de las habitaciones del Postclásico del centro de México. Los artefactos fueron localizados "in situ" dentro del plano levantado de los pisos de la casa, y sus distribuciones fueron usadas para definir las unidades de actividad. Las actividades de preparación general de alimentos estaban confinadas a dos de los cuartos, así como a un área de patio al suroriente de la casa. Las labores de perforación o costura, deducidas por la presencia de leznas de hueso, parecen haber tenido lugar en uno de los cuartos, en donde también se trabajó la obsidiana. En base a la analogía etnográfica, se puede postular que algunos cuartos de la casa se reservaron para las actividades femeninas, y otros cuartos para las masculinas.

Un artefacto importante, que en la distribución del interior de la casa aparentemente resulta ser al azar, es el malacate, de los cuales veinticuatro se encontraron en la casa, en el patio, y en las áreas de basura. Éstos y otros malacates de Tetla se clasificaron como Tipo A (pequeña) y B (grande), siendo los dos tipos claramente identificables por su peso. En base a la analogía con los malacates de la Cuenca de México, se sugiere que los malacates Tipo A hayan sido usadas para una fibra fina, posiblemente algodón, y el Tipo B para una fibra más pesada tal como la de maguey. La superioridad numérica de los malacates Tipo A en Tetla encaja bien con la información etnográfica acerca de la importancia del cultivo de algodón en Morelos durante el Postclásico.

Los olotes de maíz que se recobraron de uno de los hogares en la casa aparentemente representan una variedad de maíz intimamente relacionada con el ocho-líneas Harinoso de Ocho del poniente de México. Este maíz es diferente del Pepitilla de hoy día en Chalcatzingo y aún del Nal-Tel–Chapalote que fué el maíz que se recobró de los componentes del Postclásico Medio en la Cueva 2 en el Cerro Delgado.

Se definieron seis acabados decorados y cuatro sin decorar para la cerámica de Tetla. Éstos son Negro sobre Naranja, Rojo Pulido, Policromos Naranja con Baño Blanco, Negro sobre Blanco, Rojo sobre Amarillo Quemado, Café con Vetas Bañado Naranja, Café o Naranja Bañado Utilitario, Quemado sin Baño, Tetla Burdo, y Mica Templado Burdo. En base a las semejanzas de cerámica, Tetla parece haber estado ligado intimamente a los sitios del suroriente de la Cuenca de México y el area de Puebla-Cholula. Los dos acabados más abundantes eran el Rojo Pulido, pintado y con incisiones, y el Negro sobre Naranja (el cual es muy semejante al Azteca I), y resultaron ser estos dos acabados muy útiles para establecer las fases de la cerámica.

Los diagnósticos de cerámica Mazapan Postclásico Temprano y los tipos posteriores, Negro sobre Naranja II, III, y IV se encuentran ausentes en Tetla, cuyo poblamiento se coloca en el rango de 1150–1350 DC *(Intermedio Segundo: Fase Tres), ésta es una fecha que confirman dos ensayos de radiocarbono en materiales provenientes de la casa. Por ello, el sitio aparentemente carece de poblamientos del Postclásico Temprano y Tardío, pese a las referencias sobre expansiones "Tolteca" hacia esta área y los mapas de conquista de este período, así como a las narraciones sobre la existencia de una población del Postclásico Tardío conocida como Chalcatzingo.*