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 build-up" 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.

***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

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-

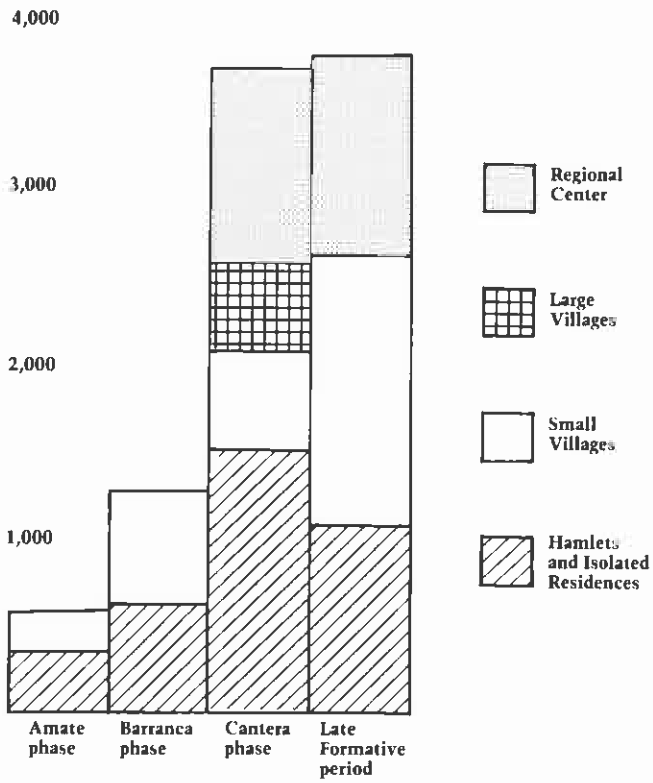

Figure 21.1. Proportions of total population by site hierarchy.

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*	*CONOC*
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)
CONOC			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.

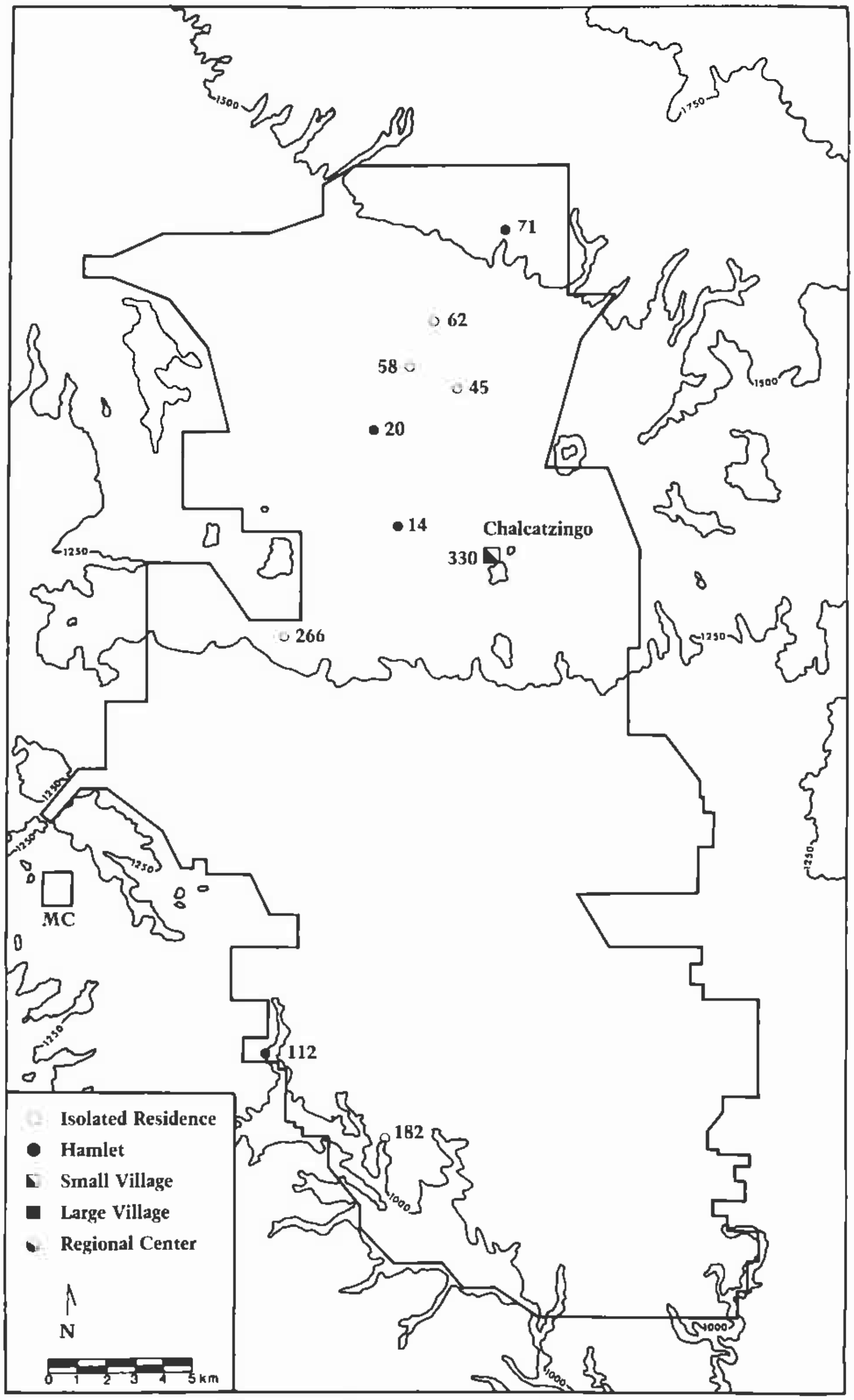

Figure 21.2. Amate phase settlements in the survey area.

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-

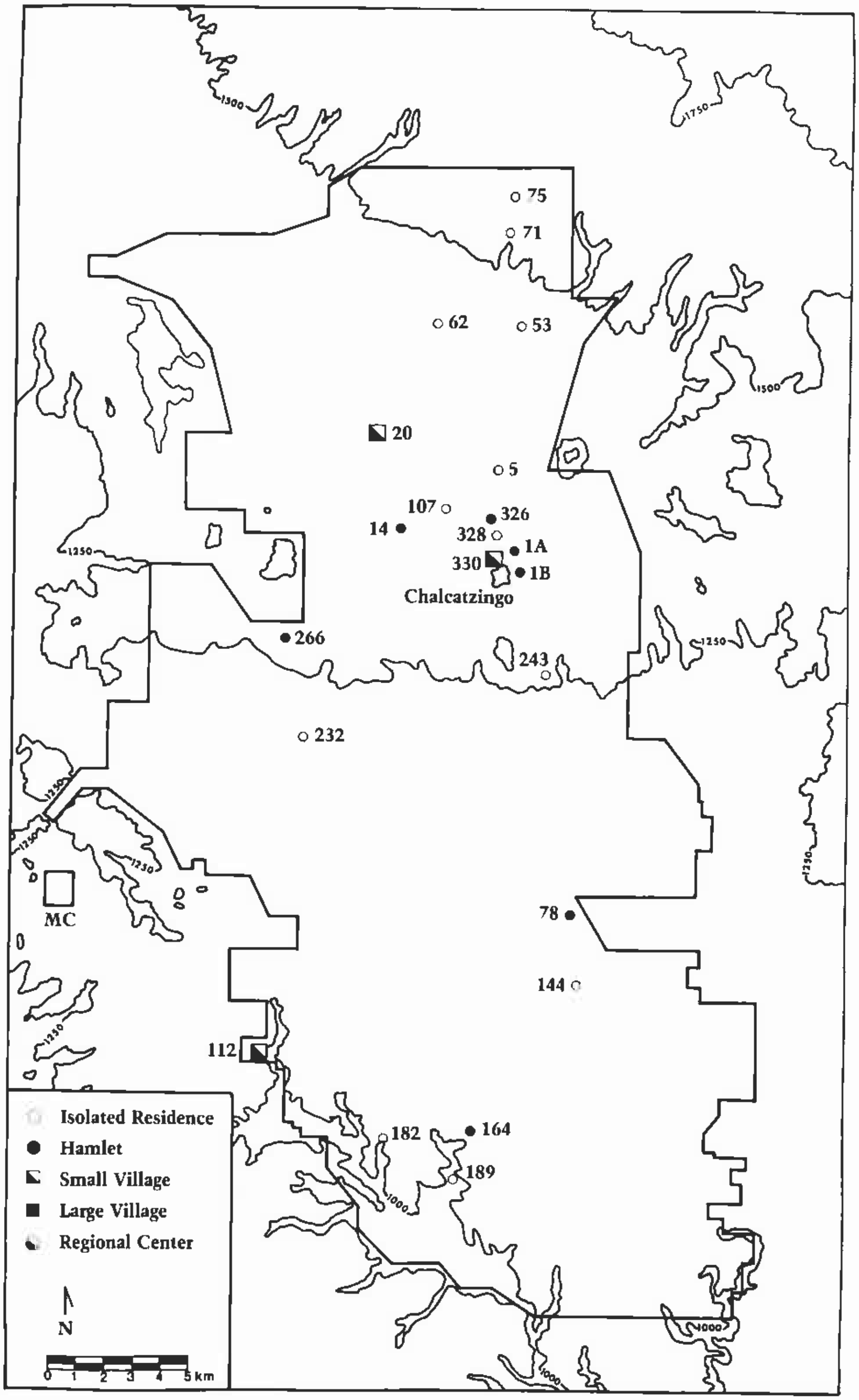

Figure 21.3. Barranca phase settlements in the survey area.

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

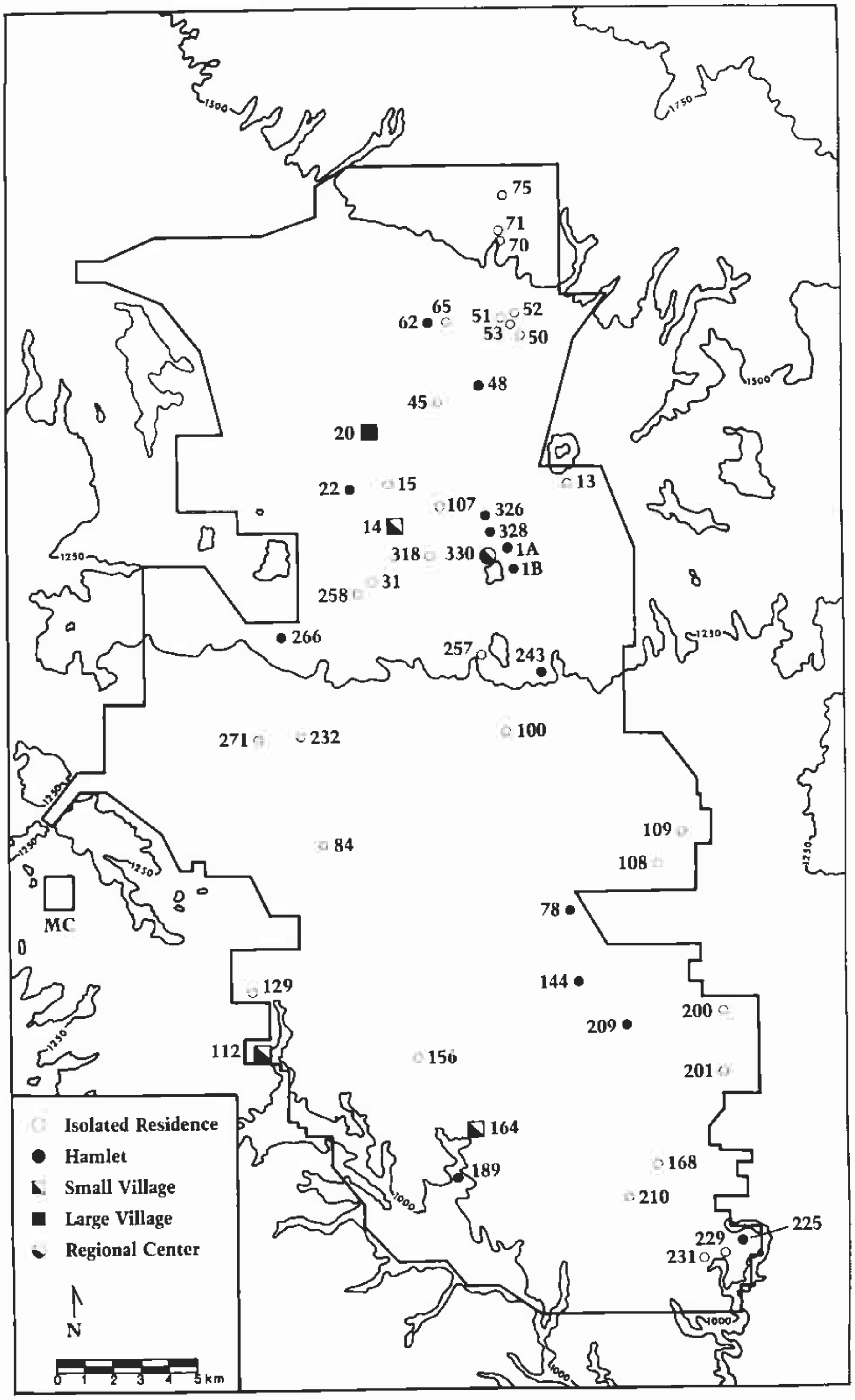

Figure 21.4. Cantera phase settlements in the survey area.

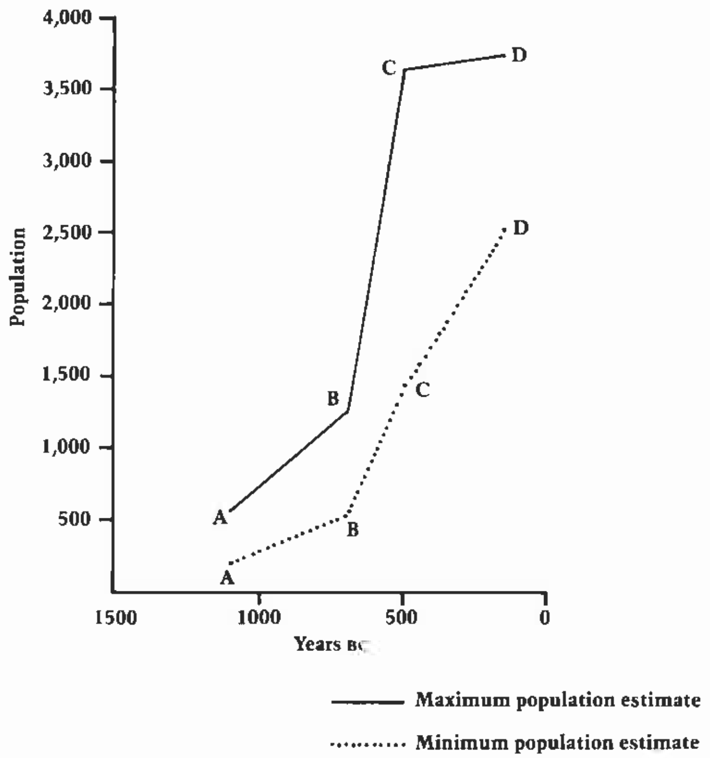

Figure 21.5. Change in regional population through time: *A*, Amate phase estimate; *B*, Barranca phase estimate; *C*, Cantera phase estimate; *O*, Late Formative estimate.

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

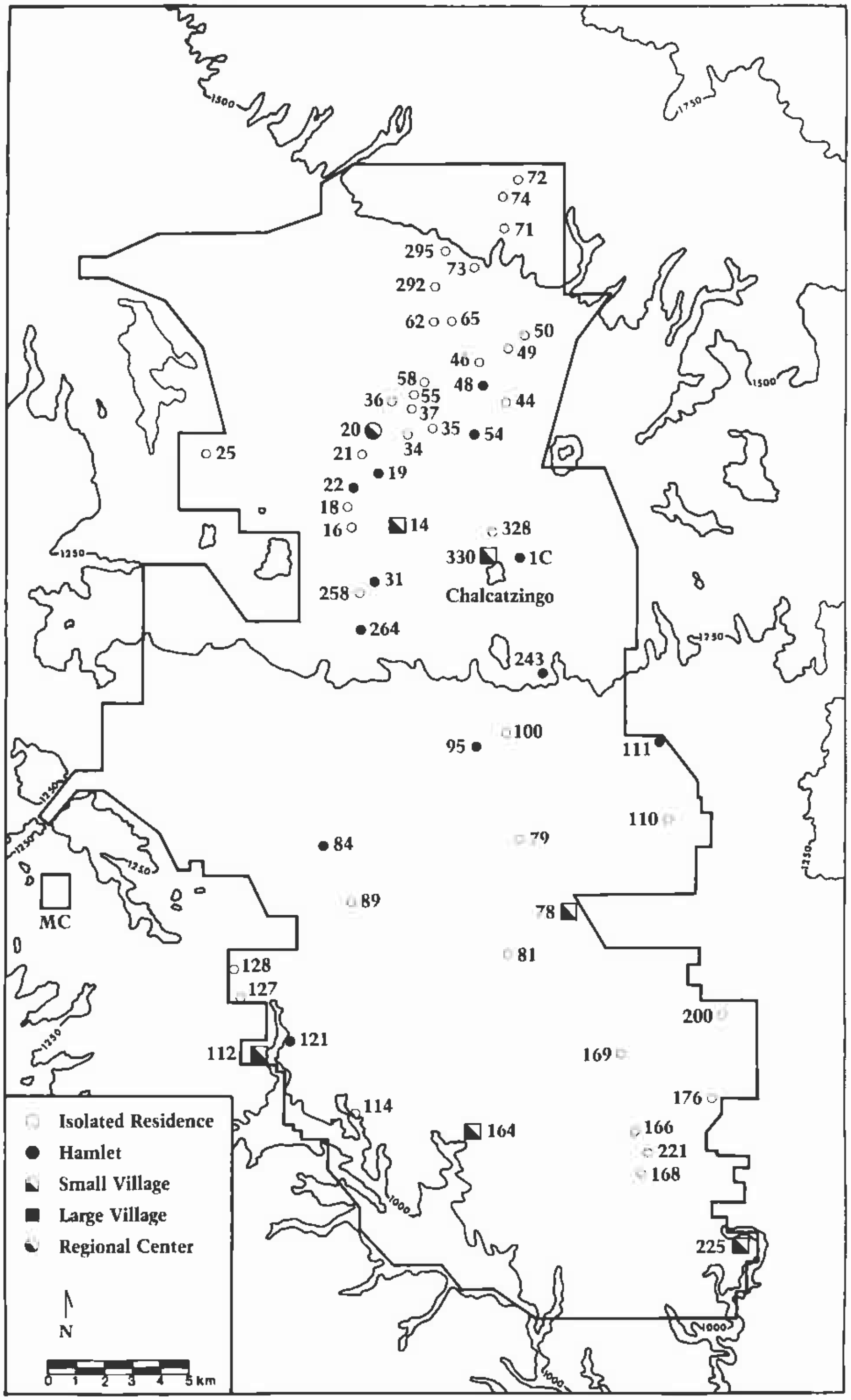

Figure 21.6. Late Formative settlements in the survey area.

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.

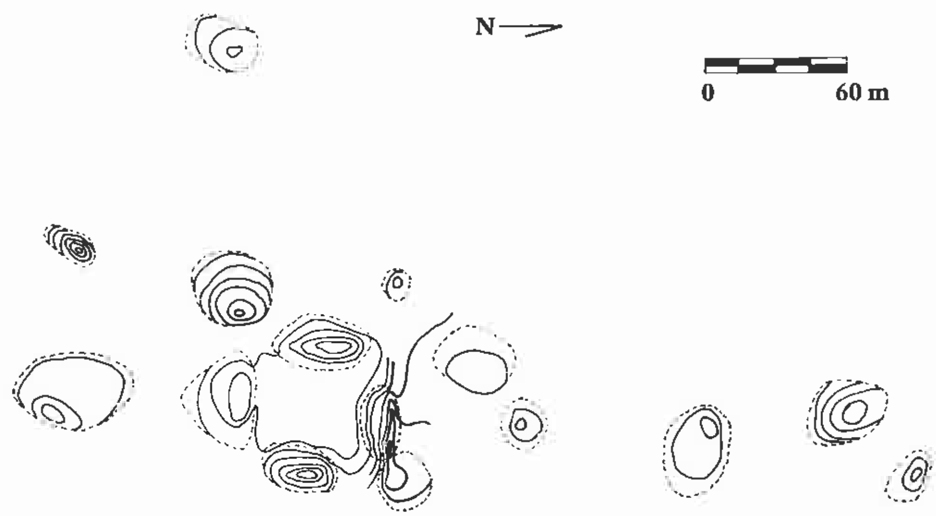

Figure 21.7. Campana de Oro (RAS-20). Contour interval 0.5 m.

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 Tardió. 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.