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## THE AZTEC MARKETING SYSTEM AND SETTLEMENT PATTERN IN THE VALLEY OF MEXICO: A CENTRAL PLACE ANALYSIS

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*Documentary data reveal the Aztec marketing system in the Valley of Mexico to have been a highly developed and complex institution. Examination of this information shows that the Aztec regional economy fits the requirements of classical central place theory as developed by Christaller. A central place analysis of Aztec settlement locations is presented, and it is concluded that commercial factors were of primary importance in shaping the settlement pattern in the Valley of Mexico. This does not rule out political, ecological, and other factors, whose roles in the settlement system are discussed. The implications of these results in terms of the Aztec economy and its development over time are briefly considered, and comparative data are mentioned.*

This paper is an attempt to determine the effects of the Aztec marketing system on the location of settlements in the Valley of Mexico just prior to the Spanish conquest of 1519. Several authorities have suggested that marketplace trade was an important determinant of the Aztec settlement pattern (Parsons 1971:228ff.; Sanders 1965:85), but the nature of this relationship has not been systematically investigated. In this paper I will first show that what is known ethnohistorically of Aztec markets indicates that they were integrated into a typical regional peasant marketing system, comparable to those documented by anthropologists working in China and many areas of Latin America. Central place theory, which deals with the influence of commercial factors on the placement of market centers in such systems, is thus applicable to the Aztec case. I hope to show that, although for a number of reasons the results are not unequivocal, there is a very strong indication that commercial factors go a long way toward explaining the distribution of Aztec settlements in the Valley of Mexico.

### THE AZTEC PEASANT MARKETING SYSTEM

The early Spanish chroniclers tell us that in late pre-Hispanic times, peasant markets were located in cities and towns throughout the Aztec empire in central Mexico. A wide range of goods (and services) was offered; Fray Toribio de Motolinía wrote that "at these markets, called *tianquiztli* by the Indians, they sell whatever is found in this land, from gold and silver to reeds and firewood" (1951:266), and Fray Bernardino de Sahagún lists more than 120 different goods for sale in the main market of Tlatelolco (1964: book 8, 67-69). The importance of the Valley of Mexico market system, especially the Tlatelolco market, in supplying the Aztecs' island capital of Tenochtitlan with food is indicated by the fact that one of Cortés' first actions after conquering the city was to get the markets "organized as before" (Cortés 1971:321) in order to ensure the provisioning of the city. In a recent article, Parsons (1976a) estimated that the 150,000-200,000

inhabitants of the capital city obtained approximately 40% of their food through the market system (the rest coming from taxes, rent, and tribute).

The Spanish conquistadores were completely awed by the great size and orderliness of the Tlatelolco market. Cortés wrote that 60,000 buyers and sellers congregated daily in the marketplace (1971:104), and there are a number of accounts describing the capital market and its operation in some detail (e.g., Sahagún 1950–1969; Torquemada 1969:554ff.; Zorita 1963:157ff.). When we turn to the other cities and the countryside in the Valley of Mexico, on the other hand, there are very few actual descriptions of the markets. It is highly probable that most of the cities and towns had regular markets (see below), but the Spanish did not see fit to describe them. Torquemada gives one of the reasons for this when he states in his chapter on markets:

In order not to lengthen this chapter with innumerable matters, I will reduce all [the markets] to those of the city of Mexico [Tenochtitlan]; because you will see that through these it is possible to understand the markets of all the other parts of the land (1969:555, author's translation).

Gibson (1964:335, 352–356) has shown that the Indian market system was one of the least interfered-with native institutions during the century following the conquest. Spanish authorities generally left the Valley of Mexico markets alone to operate in the traditional manner, so long as Mexico City was supplied with food. Thus, given the reduction in Indian population after the conquest, it is reasonable to assume that towns listed as having markets in the middle and late sixteenth century also had markets before the arrival of the Spanish. The *Relaciones Geográficas* of 1579–1581 (PNE 1905–1906, vol. 6:62ff.) mention weekly markets in the towns of Coatepec, Chimalhuacan, Chicoloapan, Ocopetlayuca or Tuchimilco, and Tepeapulco. Torquemada (1969:555ff.) mentions markets at Xochimilco, Texcoco (see also Cortés 1971:96), and Otumba, while Durán (1967, I:180) discusses the Acolman market. In addition, Gibson (1964:355–356ff.) mentions early post-Conquest markets at Ecatepec, Coyoacan (see also Berdan 1975:201, 371–383), and Huitzilopochco.

Although we have few surviving descriptions of these Aztec markets outside of Tenochtitlan, the information above, along with statements by Torquemada (1969:554ff.) and Clavigero (1945:281) about the prevalence of markets, indicates that peasant markets were widespread in the Valley of Mexico in late Aztec times. This market system fits the general pattern of complex regional peasant marketing systems that anthropologists have studied from the perspective of central place theory. The essential features of such regional marketing systems (which C. Smith 1977:122ff. and 1976:320, 353ff. calls “complex interlocking systems”) will now be described, using the work of G. William Skinner (1964) and Carol A. Smith (1974) as a model, and it will be shown that the Aztec case fits the model.

Regional peasant marketing systems are found in *agrarian states* (C. Smith 1974:167; 1976). These are socially stratified preindustrial societies in which the bulk of the population is involved in food production. This is clearly the case for the Aztecs; the food-producing peasantry (*macehualtin*) lived in towns and villages throughout the Valley of Mexico, while the smaller non-food-producing sector (composed of craftspersons and the nobility) lived in the major cities surrounding the central lake system.

Regional peasant marketing systems have *itinerant merchants* traveling from market to market buying and selling various goods (Skinner 1964:10–16; C. Smith 1974:181–184). Except in the largest centers, the demand for goods at most peasant marketplaces is not sufficient for merchants to be able to support themselves full-time; so they travel between markets to tap the demand of a larger area. Motolinía says that among the Aztecs, “The merchants and traders have regular journeys, and walk from market to market as in Spain [merchants travel] from market to market” (1903:33, author's translation). Durán (1971:138), Clavigero (1945:280), and Torquemada (1969:559) also mention these itinerant merchants, who appear to have been regional merchants or middlemen, independent of the guilds of *pochteca* or long-distance traders. This view, strengthened by references in the *Relaciones Geográficas* (PNE 1905–1906: 77–78, 85, 172, 249–250) to merchants in central Mexican markets who do not seem to have been *pochteca*, is taken by Berdan (1975:167–169) and Corona Sánchez (1976:97). However, the sources are not unequivocal;

Castillo F. (1972:95) denies the existence of non-*pochteca* professional merchants, and Jeffrey Parsons (personal communication) thinks that the above quotation may refer not to intra-valley trade but to long-distance exchange. In any event, there is documentary evidence of merchants (whether *pochteca* or not) selling in marketplaces in the portion of the valley under consideration (PNE 1905-1906: 77-78, 85, 172; see also Corona S. 1976:97), and there is a great likelihood that at least some of these merchants were typical itinerant merchants of the type described by C. Smith (1974) and Skinner (1964).

Tied in with the institution of itinerant traders is the occurrence of *market periodicity* (Skinner 1964:10-16; C. Smith 1974:184-186). There is usually a regular weekly market schedule based on the indigenous calendar, adjacent centers holding their markets on different days. This benefits the producers and itinerant merchants, who can be in each of several markets on their "market days," as well as the peasants, who do not need to go to market every day. Larger markets (or higher order central places) usually meet more frequently than smaller markets (lower order central places). This pattern describes the Aztec data closely. The standard market week was five days; most markets met at this interval, though smaller rural markets met every 20 days, and the largest urban markets convened daily (Sahagún 1957, book 4:138; Durán 1967, I:178; Torquemada 1969:555, 559; Motolinía 1903: 331). Clavigero (1945:281) states that "nearby places held markets on different days so as not to damage or impair one another." Durán also noted this staggering of adjacent markets so that they would fall on different days of the week (1967, I:178).

Another characteristic of regional marketing systems is the presence of *community specialization* (Wolf 1966:40ff.; Cook and Diskin 1976). The areal economic integration provided by the system of markets allows and encourages communities to specialize in the production of agricultural and craft goods. These specializations are both ecologically based and nonecological. In the Valley of Mexico, archaeological data (site locations and artifact inventories) point strongly to such ecologically oriented community specializations as maguey and nopal production in the upper piedmont zone (Parsons 1971:221) and the exploitation of lacustrine food sources (Parsons 1971:216, 225) as well as salt production (Parsons 1971:226; Blanton 1972:176) along the shores of Lake Texcoco. These findings are supported by early colonial documentary sources. (cf. Corona S. 1976:98). In addition, the chroniclers tell us of certain marketplace specialties—dogs at Acolman (Durán 1967, I:180-181) and birds at Otumba and Tepeapulco (Motolinía 1903:334)—which probably signify production specialization at the community level.

The final characteristic of regional peasant marketing systems to consider is that market day is a *major regular social event* (Skinner 1964:32-43; C. Smith 1974:187-191). First, market day represents the prime opportunity for peasants to attend to religious, political, and legal duties in the market town; second, market day is a recreational event where people socialize with friends, meet potential spouses, and so forth. There are ample data on religious, political, and legal activities in Aztec markets (see Kurtz 1974:696-699), and as for the enjoyable recreational side of marketing, we have the following quotation from Fray Diego Durán:

The markets were so inviting, pleasurable, appealing, and gratifying to these people that great crowds attended, and still attend, them, especially during the big feasts, as is well known to all. I suspect that if I said to a market woman accustomed to going from market to market: "Look, today is market day in such and such a town. What would you rather do, go from here right to Heaven or to that market?" I believe this would be her answer: "Allow me to go to that market first, and then I will go to Heaven" (1971:274-275).

The information presented above indicates that the Valley of Mexico under the Aztecs exhibited not only peasant marketplaces but an integrated regional marketing system (see C. Smith 1974:193 on the distinction between marketing and marketing systems). This system is in many respects fully comparable to those complex market systems that have been analyzed by anthropologists and geographers in terms of central place theory. For this and other reasons (discussed below), we are therefore justified in using the methodology of central place analysis to study the Aztec market system. A more thorough comparative treatment of the various features of the market system, using extensive ethnographic and historical parallels, is provided in M. Smith (1978).

## CENTRAL PLACE THEORY

The work of Skinner (1964, 1977), C. Smith (1974, 1976, 1977), and Crissman (1972, 1973, 1976) has demonstrated that classical central place theory (CPT), first developed by Christaller (1966), is a powerful tool in the anthropological study of peasant marketing systems in agrarian states. First, being a deductive model, it goes beyond the simple *description* of market center location and actually *explains* why the centers are located where they are (M. Smith 1977); second, central place analysis and concepts derived from the theory lead to a fuller understanding of peasant economic and social systems in general, as the anthropologists cited above have amply shown (a dissenting view is expressed by Crumley 1976, however).

The basic methodology of central place analysis consists of comparing a deductive model of settlement with real-world patterns to evaluate the degree of fit. No empirical settlement pattern will ever match the predicted central place model exactly, but the general deductive formulation can be weakened (i.e., made more specific) by the inclusion of data on the actual settlements. The resulting hybrid model, which is still a *deductive* (and hence explanatory) model, is then compared with the real-world settlement pattern (see Crissman 1976 for a discussion of this methodology). If the settlement pattern largely conforms to the predicted model, we can presume that the behavioral assumptions of that model are indeed operating in the real world (Christaller 1966; Crissman 1976; M. Smith 1977). These behavioral assumptions of central place theory concern marketing behavior; briefly, it is assumed that (1) purchasing power will be distributed evenly across the landscape; (2) consumers will maximize their time/cost benefits and patronize the closest market center; and (3) merchants or markets will locate so as to maximize their profits (see Christaller 1966: parts I and II; Marshall 1969:12-20; C. Smith 1974:171; Crissman 1976:202-208; Johnson 1977:479ff.). Thus if the Aztec settlement locations (which were also market locations, as was shown above) conform to the predicted central place model, there is evidence that the marketing system and peasant marketing behavior were of primary importance in producing the settlement pattern. The problem of evaluating the "degree of fit" of the central place model to empirical data has not been adequately dealt with in the literature. Distances between central places can be distorted while the central place structure remains intact (Marshall 1969:33ff.); so the primary criterion for central place applications is *adjacency* rather than distance *per se* (Crissman 1976:214); as far as I know, no quantitative measure has been devised that takes this into account. Again, the reader is referred to Crissman (1976) on the specific methodology involved.

There are two major problems in the application of classical central place theory to the data of prehistory. First, as the behavioral assumptions indicate, CPT applies only to market economies. While some anthropologists have attempted to justify the use of CPT on nonmarket economies (e.g., Johnson 1975:286-294; Callen 1976), their efforts are unconvincing. The social, political, and economic systems of societies with integrated peasant markets are quite different in many respects from societies that lack such markets. As Steponaitis (1978) has shown, certain of these structural differences make it highly unlikely that the basic assumptions of CPT would hold for societies without markets (see also C. Smith 1974:171; Johnson 1977:494ff.). To complicate matters, Renfrew (1975:10ff.) and others have pointed out that it is probably not possible to differentiate a market system from a more formal redistributive system using archaeological data. Thus if we do not know whether a given prehistoric society had a marketing system, we cannot know whether CPT is applicable or not. This of course does not rule out the use of other formal methods of locational analysis in the anthropological and archaeological study of societies lacking peasant markets (see, for example, Hodder and Orton 1976; Johnson 1977; Steponaitis 1978).

The second basic difficulty in applying CPT to prehistoric societies is that a fundamental aspect of central place methodology is the construction of a hierarchy of market centers, based on the number and types of goods and services offered (Marshall 1969:50ff.; Crissman 1972, 1973, 1976; Johnson 1977:495); this is almost impossible to do using archaeological data alone. The mere identification of hexagonal distributions without reference to central place hierarchies (e.g., Callen 1976; Hammond 1974) is not very informative; it simply points to a regular or equidistant

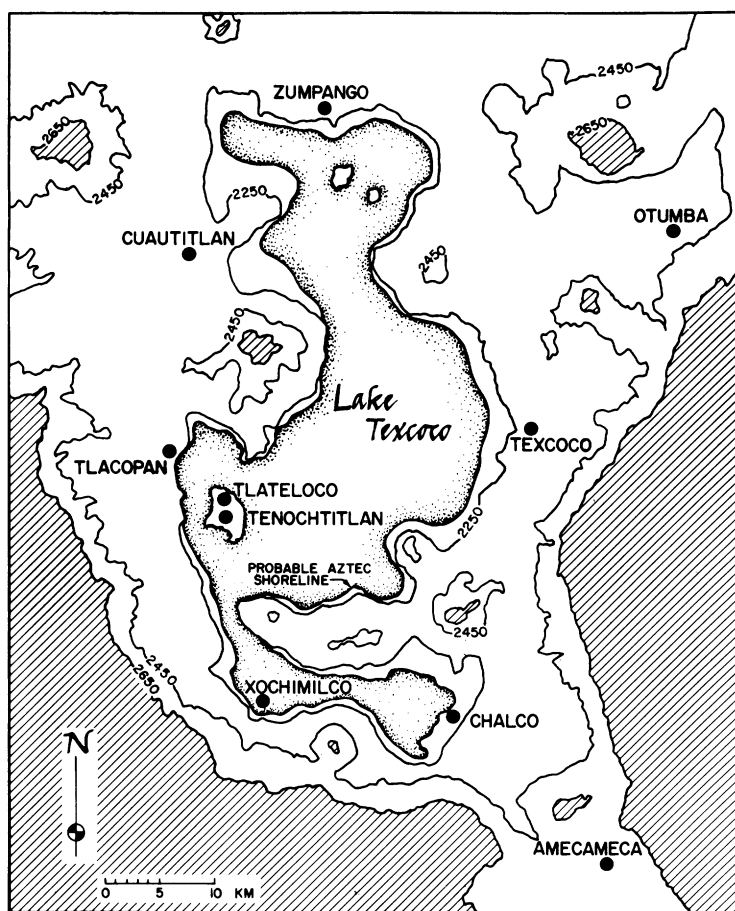


Figure 1. Overview of the Valley of Mexico in 1519. Shaded areas represent mountainous zones (over 2,650 m in elevation) with little settlement.

spacing of settlements. Central place theory, based on hierarchies, is far more powerful and useful than this. Flannery (1977:661) briefly discusses this issue in reference to Hammond's (1974) work. The picture is not as dark as it may sound for archaeology, however; Hodder and Orton (1976:60ff.) have shown how concepts and methods derived from classical CPT can be of great use to archaeologists, even when a complete central place analysis is not possible.

As the first section of this paper has shown, the first problem does not apply to the Aztec case: the ethnohistorical sources clearly document the existence of a complex regional marketing system in the Valley of Mexico. The second problem, however, must be regarded as a somewhat more serious difficulty. While the early Spanish observers gave us lists of goods and services offered at the largest of the Aztec markets, such information does not exist for the smaller markets, and thus a hierarchy based solely upon goods and services cannot be constructed. However, although population size is not always an exact indicator of central place hierarchy level, a high positive correlation has been observed between market-town population and the number of central functions offered (Marshall 1969:51; Haggett 1966:115ff.; Crissman 1972:231ff.). For this reason, population size can, with caution, be used to construct the central place hierarchy (cf. Johnson 1977:495). This will be done here in a modified form, using both archaeological and documentary estimates of Aztec settlement size; what information we do have on the commercial functions of various settlements will also be taken into account.

### A CENTRAL PLACE ANALYSIS OF THE AZTEC SETTLEMENT PATTERN

Figure 1 gives an overview of the Valley of Mexico as it probably looked on the eve of the Spanish Conquest. The dominant topographic features are the mountains surrounding the valley and the lake system in the center. These, of course, influenced settlement location and trade patterns: all large settlements are found in the lakeshore plain and the lower piedmont zones between the lake and the mountains. Trade across the mountains on a local level was probably minimal, while we know that trade throughout the lake system by canoe was extensive (Torquemada 1969:556; Gibson 1964:361ff.). It initially seemed desirable to apply the central place model to the entire Valley of Mexico, but after several unsuccessful attempts, the domain was limited to the eastern and southern portion of the valley, shown in Figure 2. As will become clear, the central place model fits this region well; reasons why the northern Valley of Mexico did not conform to the predictions of CPT will be discussed at the end of this section.

The locations of the sites in Figure 2 are based on the surface survey results of Sanders (1965), Parsons (1971), and Blanton (1972) and on compilations of documentary data by Gibson (1964: maps 2 and 3) and Gonzalez A. (1968). The symbols for the settlements indicate their placement in the central place hierarchy (Table 1). As Johnson (1977:497ff.) has pointed out, the fact that Aztec

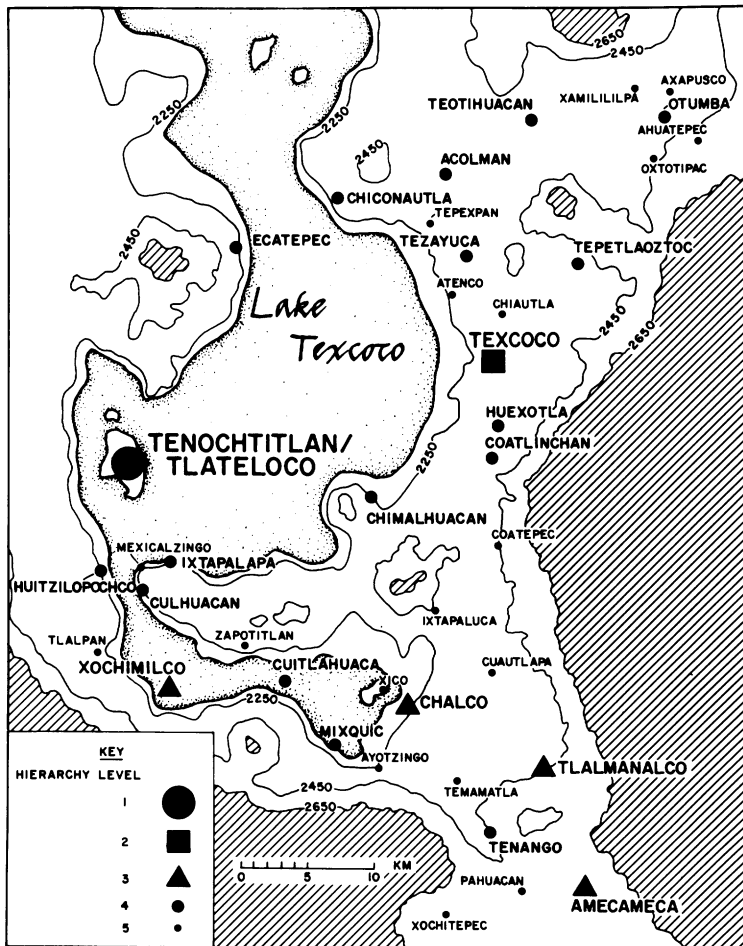


Figure 2. Settlements used in the central place analysis. The different symbols indicate the central place hierarchy levels of the settlements, taken from Table 1. Shaded areas are over 2,650 m in elevation.

Table 1. Central Place Hierarchy.

Level 1			
Tenochtitlan/Tlatelolco <sup>a</sup>			
Level 2			
Texcoco *(3)			
Level 3			
Amecameca		Tlalmanalco	*(4)
Chalco	*(2)	Xochimilco	
Level 4			
Acolman	*(5)	Huitzilopochco	
Chiconautla	*(3)	Ixtapalapa	
Chimalhuacan		Mixquic	
Coatlinchan/Huexotla <sup>a</sup>	*(5)	Otumba	*(2)
Cuitlahuaca	*(5)	Tenango	
Culhuacan	*(5)	Teotihuacan	
Ecatepec		Tepetlaoztoc	
		Tezayuca	
Level 5			
Ahuatepec		Oxtotipac	
Atenco		Pahuacan	
Axapusco		Temamatla	
Ayotzingo		Tepexpan	
Chiautla		Tlalpan	
Coatepec	*(4)	Xamililipa	
Cuautlapa		Xico	
Ixtapaluca		Xochitepec	
Mexicalzingo		Zapotitlan	

Note: An asterisk means that the position of the settlement in the central place structure (Figure 4) is of a different level from its initial hierarchy level as given in this table; the level of its spatial position is indicated in parentheses. For example, Texcoco is a second-level center located in a third-level spatial position (see Figures 3 and 4).

<sup>a</sup> The pairs Tenochtitlan/Tlatelolco and Coatlinchan/Huexotla are considered twin cities on the basis of their close proximity; the pairs are treated as single central places.

city sizes conformed to a more-or-less rank-size distribution (see Blanton 1976; M. Smith 1977:905) is not at all incompatible with the existence of a definite central place hierarchy. It should be noted in reference to Figure 2 that the southernmost arm of the lake was probably under *chinampa* cultivation, which implies that it was not a total bar to settlement (Parsons 1976a, 1976b).

The central place hierarchy was constructed in three general steps as follows:

1. At the time of the Spanish Conquest, the primary political unit in the Valley of Mexico was the city-state, governed by a *tlatoani* or political chief. There were 50 or so of these units in the valley in 1519, each consisting of a capital or central community housing 3,000–6,000 persons (*cabecera* in the Spanish terminology) and a number of outlying smaller dependent settlements (*estancias*). These political units are described in Gibson (1964:32ff.), Bray (1972), Sanders (1965:71), and Sanders and Price (1968:151–161); their effect on marketing will be discussed later. First, all communities supporting a *tlatoani* (as documented by Gibson 1964:ch.3) were placed in a single hierarchical level (level 4), while the smaller dependent settlements were

placed in a lower level (level 5). Three *tlatoani* towns—Mexicalzingo, Chiautla, and Tepexpan—were then demoted to level 5 because their estimated population sizes are much smaller than the other *tlatoani* towns. These estimates are 1,108 for Mexicalzingo (Blanton 1972:159), 125 for Chiautla (Parsons 1971:161), and 1,000 for Tepexpan (Sanders 1965:81). Sanders notes that “Tepexpan had a less urban appearance than either Chiconautla or Acolman” (both level 4 towns). It should be noted that the level 5 settlements listed in Table 1 do not constitute all the dependent centers in the area of analysis; a number of dependent centers were left out for reasons of space and clarity. These small settlements represent the basic units of rural residence and most likely did not have their own marketplaces. Nevertheless, their locations should conform to the rules of settlement location stated below.

2. Each of the top two hierarchical levels contains a single settlement: Tenochtitlan/Tlatelolco (considered as a single central place) is the primary central place in the valley, and Texcoco is the secondary. This placement is based on a combination of population size (Sanders 1970), political prominence (Gibson 1964: ch. 3; Davies 1973; Bray 1972), and, most important, commercial importance. I have already discussed the preeminence of the great market of Tlatelolco; after Tlatelolco, Texcoco had the market mentioned most commonly by the early Spanish observers. For example, Torquemada noted that the Texcoco market met daily (1969:559), and Cortés said of Texcoco that “there are very large markets” (1971:96; see also Gibson 1964:351, 355).

3. To complete the hierarchy, the third level was filled with four cities intermediate between Texcoco and the average *tlatoani* communities in terms of both population size (Sanders 1970: Tables 4 and 10) and political complexity (Gibson 1964:ch. 3). These communities are Amecameca, Chalco, Tlalmanalco, and Xochimilco. The resulting central place hierarchy (Table 1), though developed independently, is identical with that presented by Sanders (1970:449–450), except for Sanders’ placement of Ixtapalapa in level 3. I disagree with this, on the basis of small archaeological (Blanton 1972:156) and documentary (Sanders 1970:414) population estimates for the center, and I have placed Ixtapalapa in the fourth level.

Now, given the five levels in the central place hierarchy, Figure 3 depicts the ideal deductive model of such a settlement system. In this portion of the landscape, there are one highest level position, two second-level positions, six third-level positions, and so on. The rules that generate this  $k = 3$  model are that centers of the same level are distributed regularly over the landscape (it should be noted that higher order central places include the functions of lower-order central places) and that all centers are located equidistant from three centers of the next higher level. These rules derive from the behavioral assumptions discussed above (see Christaller 1966). My reason for choosing Christaller’s  $k = 3$  (“marketing”) model over his  $k = 4$  (“transport”) model is discussed in the conclusions.

Figure 4 depicts the composite central place model of Aztec settlement in the Valley of Mexico. It was produced by reading data on the actual settlements into the deductive model (Figure 3). First, Tenochtitlan/Tlatelolco was placed in the lone first-level position. Then the cities of Otumba and Chalco were placed in the two second-level positions (even though they are not second-level centers as originally defined; see below). Based on the locations of these three central places, the rest of the grid was filled in according to the two rules stated above. Xochimilco, Texcoco, and Chiconautla are distributed more or less evenly along the lakeshore, and they fit into the three third-level positions nearest to Tenochtitlan in the deductive model. Amecameca, another third-level center, fits nicely into a third-level position southeast of Chalco. Fourth- and fifth-level centers were then placed into appropriate positions in the central place model shown in Figure 3.

Two major types of deviation from the deductive model are evident in the hybrid settlement system shown in Figure 4. First, there are some empty positions, and second, not all centers fit into positions of the appropriate level. The empty slots do not represent a serious problem: settlements are obviously not going to locate in the middle of the lake, and large settlements are never found in the mountains. Therefore, the immediate “hinterlands” of Tenochtitlan, consisting mostly of lake, are empty, and the two third-level positions northeast and southwest of Chalco (as well as some lower-level slots) are empty because they fall in high mountains. It should perhaps be mentioned again that the lakes were very conducive to the transport of goods to and from the



markets, and the large number of settlements located along the shores supports the general argument for the importance of exchange in settlement location.

The other deviation from the ideal pattern—discrepancies between the central place hierarchy and the positional level in the deductive model—is more serious. These discrepancies can be seen by comparing the central place hierarchy of settlements (Table 1) with the ideal hierarchy of central place locations (Figure 3) as the two are expressed in the hybrid or composite model (Figure 4). All such discrepancies are listed in Table 1. Two of the most obvious examples of this are the second-level positions filled by third- and fourth-level centers (Chalco and Otumba). This is probably due at least in part to the tendency for centers near the peripheries of bounded central place systems to be reduced in size (Skinner 1977:282ff.) because their hinterlands are smaller than more central settlements of the same level; this factor would also account for the size of Coatepec, a fifth-level center occupying a fourth-level slot. In addition, political factors were probably important in determining the size of Chalco; this is discussed below.

As Table 1 indicates, there are a number of fourth-level centers that occupy fifth-level positions. This is almost certainly related to the ad hoc manner in which the central place hierarchy was constructed; except for Coatlinchan/Huexotla, those fourth-level centers placed in fifth-level positions all seem to fall at the smaller end of the size scale as far as level 4 settlements are concerned. Also, several of these communities (Coatlinchan/Huexotla, Cuitlahuaca and Culhuacan) were politically (and probably economically) more important in early Aztec times than in the late Aztec period under consideration here (Davies 1973). Such "out of phase" central places are found in most developing or intensifying market systems (see Crissman 1973, 1976), and it can be hypothesized that had Aztec society been allowed to continue its developmental trajectory unmolested (i.e., had there been no European penetration in Mesoamerica), these centers would have shifted down in the central place hierarchy over time.

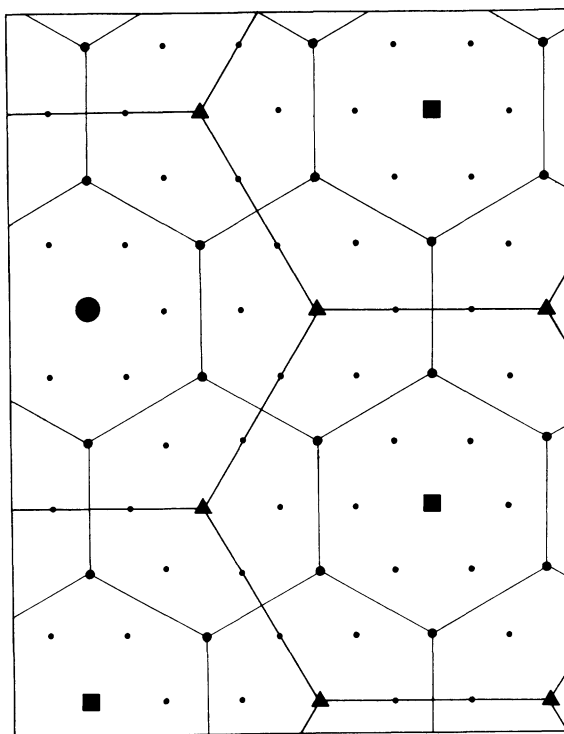


Figure 3. Deductive central place model. This shows the portion of an ideal  $k = 3$  settlement system that would correspond to the Valley of Mexico settlement pattern. The symbols (see Figure 2 for key) indicate positions in the ideal settlement lattice.

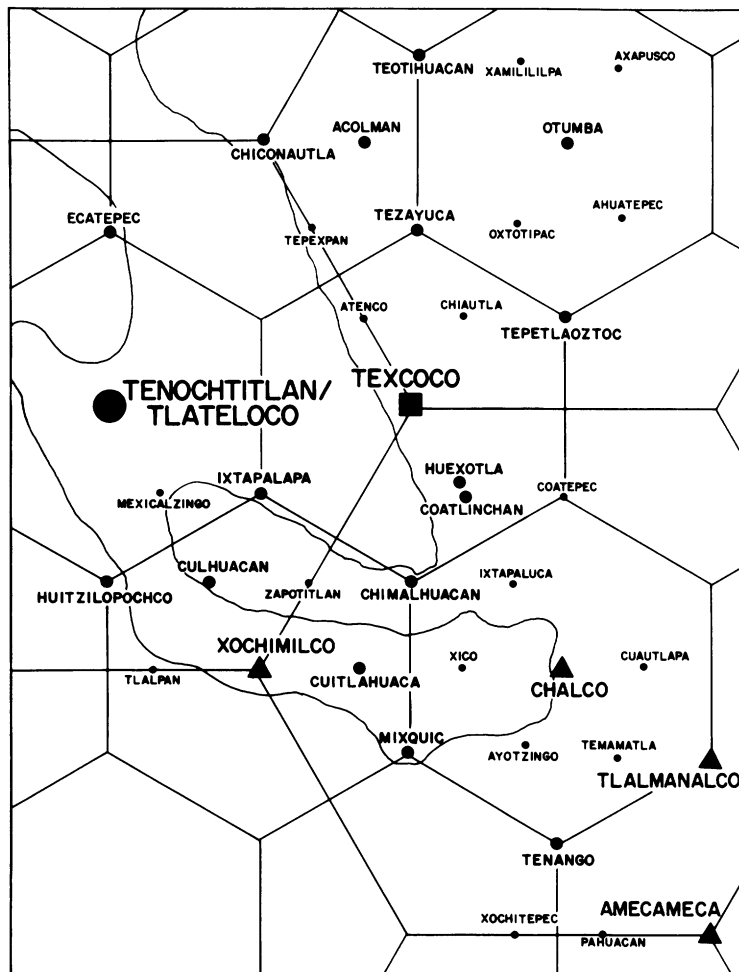


Figure 4. Hybrid central place model of the Aztec settlement system. The settlement hierarchy is taken from Table 1. It should be noted that there are some discrepancies between settlement hierarchy level (Figures 2 and 4) and ideal hierarchy position (Figure 3); these are discussed in the text.

If we had better data on the precise commercial functions (goods and services offered) of each market center, we might find that some of the centers placed in the fourth level actually had smaller markets than the others and should therefore be classified as fifth-level centers in line with their fifth-level positions in the central place marketing structure. Because such additional data are rare, the results of this analysis should be treated as hypotheses for further research. For example, consider the lower Teotihuacan Valley: Teotihuacan, Tezayuca, Chiconautla, and Acolman all had *tlatoani* and equivalent population ranges (Sanders 1965:77–85); yet Acolman occupies a less important position (fifth-level) in the marketing structure (Figure 4). We know ethnohistorically that Acolman had a famous dog market in Aztec times, and Durán states that “most of the produce, then, which went to this *tianguiz* [the Acolman market] consisted of small- and medium-sized dogs of all types” (Durán 1971:278). The combination of these two pieces of information might imply that, except for the dogs, the Acolman market was quite small and the people from the Acolman area traveled to Chiconautla, Teotihuacan, or Tezayuca for most of their marketing.

Chiconautla is a fourth-level center occupying a third-level position. This is most likely due to its

importance as a lake port; the Teotihuacan subvalley was one of the major trade routes leading out of the Valley of Mexico, and most trade from that route into Tenochtitlan would pass through Chiconautla. The *Relaciones Geográficas* note heavy cart traffic between Chiconautla and Mexico City when the lake levels were lowered following the Conquest (PNE 1905–1906: 173), and they suggest the presence of non-*pochteca* merchants in the Aztec town (PNE 1905–1906:172). Sanders (1965:81) states that Chiconautla “apparently was a major trade center for traffic from the lakes up the Valley of Teotihuacan and was located at a transportation break.” The position of Chiconautla in the hybrid central place model lends support to this interpretation; the city had a higher volume of exchange than the other level 4 centers and should perhaps be classified in level 3.

One important qualification of central place theory that is sometimes overlooked is that it does not purport to explain everything about the locations of market centers. As Christaller puts it:

The unexplained facts [i.e., deviations from the ideal model] must then be clarified by historical and geographical methods, because they involve personal, historical and naturally conditioned resistances—factors which cause deviations from theory (1966:5).

It was in this sense that topographic features were said above to have caused gaps in the central place structure. Similarly, there are noncommercial explanations for some of the discrepancies between hierarchical level and structural position. The most obvious example of this is the city of Texcoco: its size and importance (level 2) are greater than its location in the central place structure (level 3—determined solely by economic factors) would suggest (this was emphasized to me by Jeffrey Parsons, personal communication). This is probably due to the operation of political factors. Texcoco was the capital of the Acolhua empire and a member of the Triple Alliance; it was clearly the most powerful political center in the Valley of Mexico after Tenochtitlan (see, for example, Parsons 1971:213ff.; Corona S. 1976:99). Therefore, we can conclude that political factors were as important as economic factors or more important in explaining the size and importance of Texcoco. Similarly, political factors can account for the “misclassifications” of Chalco and Tlalmanalco (Table 1). Until the mid-fifteenth century, Chalco was a center of great importance in the Valley of Mexico, perhaps of the second level economically, in line with its second-level position in the central place lattice (Davies 1973:46ff.; Chimalpahin 1965). After its defeat at the hands of the Triple Alliance in the mid-fifteenth century, however (Davies 1973:90ff.; Chimalpahin 1965), Chalco’s economic and political status was much reduced; its *tlatoani* office or position was transferred to Tlalmanalco (Chimalpahin 1965:279). Hence the situation in Figure 4, where Chalco is less important than economic factors alone would predict, while Tlalmanalco is correspondingly more important.

These examples show that economic factors alone cannot fully explain the size and location of market centers in the eastern and southern Valley of Mexico; political and other factors must also be taken into account (see Conclusions). However, the basic (economically motivated) central place model certainly fits the data in an overall sense and provides a baseline from which the effects of other factors can be taken into account. As Christaller emphasizes (1966:4–5, cf. his quotation above; see also M. Smith 1977:904), a central place analysis yields two kinds of explanation for settlement size and location: “scientific” explanation (the rules generating the pattern) and “historical” explanation (factors causing deviation from the deductive model).

Before turning to the conclusions, some discussion should be given to the problem of why the central place model does not work for the northern and western Valley of Mexico while it does work for the eastern and southern valley. First of all, the settlement pattern data for the northern and western valley have not yet been published. The heavy urbanization and industrialization around Mexico City today make archaeological survey impossible; so there is little to go on for the area west of Tenochtitlan. For the northern Valley of Mexico, it is hoped that the forthcoming study by Sanders et al. (1978) will contain the settlement pattern data and analyses from the recent surveys of Sanders and Parsons. However, information currently available on site location (maps in Gibson 1964 and a preliminary map of Aztec settlements in the whole valley, kindly pro-

vided by Robert Santley) does not appear to fit a central place model. Neither an extension of the central place lattice shown in Figures 3 and 4 into the northern area nor alternative central place models of various scales could account for the actual locations of settlements in the northern area. I will suggest two possible factors to explain this situation, but clearly more data (both archaeological and documentary) are needed.

First, the northern portion of the Valley of Mexico appears to have been less heavily populated and was certainly less heavily urbanized than the eastern and southern valley. Gibson (1964: Maps 2, 3, and 4 and Table 3) shows fewer settlements in the northern valley in 1519 and a much smaller population than the rest of the valley in 1560. Sanders' tabulations (1970:Table 10) show that the population density around Cuauhtitlan was average for the valley as a whole, but that the Zumpango area had a lower population density (see Figure 1). Since the degree and importance of market trade are functionally related to the population and level of urbanization (Appleby 1976; Eighmy 1972; C. Smith 1974), marketing would be expected to have been less important in the northern valley and thus less likely to have been a major determinant of settlement location. Also, of the 12 Valley of Mexico towns listed as having *pochteca* guilds (see Berdan 1975:147ff.), only one (Cuauhtitlan) is north of the Ecatepec-Chiconautla line (dividing Lake Texcoco from Lake Zumpango-Xaltocan on the north), again pointing to a lower level of economic activity in the northern valley.

Second, because of the constriction in the lake between Ecatepec and Chiconautla and the position of the Sierra Guadalupe west of Ecatepec (Figures 1 and 2), the northern valley is somewhat separated geographically from the Lake Texcoco "economic heartland." The terrain west of the Sierra Guadalupe is much rougher than my maps would indicate, and if the Ecatepec-Chiconautla causeway was pre-Hispanic in construction (Palerm 1973:78ff., 154ff., 175-177), then canoe traffic, so important in the market trade through Lake Texcoco, would have been impeded between the northern valley and the central market system. Thus, for a number of reasons, it appears that the northern Valley of Mexico was less heavily "commercialized" than the southern and eastern valley and that, because of its relative geographical disadvantage, it would not have been as well integrated into the Tenochtitlan-centered local trade networks. These conclusions are tentative at this point, but they probably account for the failure of settlements north of Ecatepec-Chiconautla to conform to the central place marketing model.

#### CONCLUSIONS: CENTRAL PLACE THEORY AND THE AZTEC ECONOMY

Although the reconstructed central place hierarchy is not ideal, it has been shown to be good enough to use cautiously as a starting point in the analysis of Aztec settlement patterns in the Valley of Mexico. The purely deductive central place model shown in Figure 3 captures the major features of actual market-center location (Figure 2) without great distortion. Although some distances have been changed in going from Figure 2 to Figure 4, adjacency relationships among the settlements have been maintained in all cases, and the degree of fit is quite high. Deviations from the model can be accounted for by one of three factors: (1) topography; (2) inaccuracies in the initial hierarchy definition; and (3) the operation of noncommercial (historical, political, ceremonial, etc.) factors.

This overall conformation of Aztec settlement locations to the predicted central place model is not fortuitous: it strongly implies the operation of the commercial factors that, according to central place theory, produce such a pattern. This interpretation does not exclude the suggestions of Sanders (1965:83ff., 160ff.) and Parsons (1971:229) that agricultural considerations were also important determinants of settlement pattern. These factors provided a range of possibilities for settlement location within which commercial influences could then operate.

The results of this analysis fit well with the findings of an excellent recent study of the Aztec economy as reflected in archaeological data (Brumfiel 1976). Brumfiel presents convincing data documenting "an increase in the intensity of exchange on the inter-local level" from early to late Aztec times (1976:198) in the area of Huexotla (see Figure 2). The intensification of exchange can be seen as the primary factor in the emergence of the  $k = 3$  central place structure. As Brumfiel

points out (1976:209ff.), the increase in trading activity could have been due primarily either to *population growth* (thus favoring a "bottom-up" view of market system growth) or to the *increasing urbanization* in the Valley of Mexico (favoring then a "top-down" picture of intensification; see C. Smith 1974:191-196 for discussion of these opposing theories). Brumfiel found evidence that the growth of exchange in late Aztec times was primarily in terms of rural-urban exchange, the foodstuff provisioning of urban centers being the major driving force (1976:134ff., 157, 212ff., 223ff.); this leads her to favor the "top-down" model of market intensification (though population growth, of course, cannot be ignored as a contributing factor of secondary importance).

This increase in urbanization and in marketing activities arose in a context of relative peace and stability in the Valley of Mexico. After the Tepanec War and the formation of the Triple Alliance in the third decade of the fifteenth century, there appears to have been less fighting among the individual city-states than previously (Davies 1973:86ff.; Bray 1972). This "pax Azteca" (Zantwijk 1962) was certainly more conducive to local and regional exchange than the prior turbulent conditions were, and marketing seems to have increased greatly in importance after the formation of the Triple Alliance. As Bray (1972) points out, the political boundaries between city-states did not deter economic and general social exchange.

In this context, it is therefore interesting to note that similar cases of increasing urbanization and growing urban food needs have led to the growth of interlocking central place marketing systems in other agrarian states. Appleby (1976) provides a well-documented example from Puno, Peru, while C. Smith (1977:128) mentions a case in southern Ghana and discusses the process in general. This importance of urban food needs is a major reason why the  $k = 3$  central place pattern rather than the  $k = 4$  pattern fits the Valley of Mexico. As C. Smith points out, the  $k = 3$  pattern (based on Christaller's "marketing principle") is the most efficient system for predominantly rural landscapes and is especially effective in facilitating rural-urban exchange (1976:20).

It is significant that after several attempts I have been unable to construct any kind of coherent central place model of pre-late Aztec settlements in the Valley of Mexico (using a number of rough indicators for hierarchy definition). While peasant *markets* almost certainly existed before Aztec times in the valley (Durán 1967, II:49; Sanders 1965:106), large integrated regional *marketing* systems probably did not (see C. Smith 1974:193 on differences between markets and marketing systems). It was only with the intensification and expansion of the marketing system in late Aztec times that commercial factors became the dominant influences on settlement location, and as a result a classical  $k = 3$  central place pattern emerged.

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## TURRIALBA: A PALEO-INDIAN QUARRY AND WORKSHOP SITE IN EASTERN COSTA RICA

Michael J. Snarskis

*Turrialba, a multicomponent quarry and manufacturing site in eastern Costa Rica, has yielded in surface collections 18 fluted points, fragments, and preforms. Both North and South American paleo-Indian point types are represented. Also present are keeled scrapers, end scrapers with lateral spurs, large flake side scrapers, burins, knives, and large blades. Turrialba is as yet undated, but future excavations at the site will be crucial in understanding the diffusion and development of the fluted point tradition in the Americas.*

When compared with data from North and South America, evidence of the presence of early man in Central America is meager. In terms of MacNeish's four-stage classification of Early Man sites in the Americas (MacNeish 1976), only two Central American sites, Richmond Hill, British Honduras (Puleston 1974), and El Bosque, Nicaragua (Espinosa 1976), are possible candidates for inclusion in his first and second stages (40,000-20,000 B.P. and 25,000-15,000 B.P.), which are supposedly characterized by stone choppers, cleavers, hammers, unifacial tools, burins, and bone tools but lack projectile points. His third stage (15,000-11,000 B.P.), recognized by the presence of burins, blades, well-made end scrapers, and bifacial leaf-shaped points, is unrepresented in Central America. Only in MacNeish's fourth stage (13,000-8,500 B.P.), with its specialized bifacial projectile points (many fluted), well-made scrapers, and knives, does the number of Central American sites increase. Traditionally, this has been called the "age of the big game hunters" and is considered by some to represent the first major entrance of *Homo sapiens* into the New World (Martin 1973).

Isolated finds of the morphologically diagnostic fluted and/or fishtail projectile points used by paleo-Indian hunters during this stage have been reported from Panama (Sander 1964; Bird and Cooke 1974), Costa Rica (Swauger and Mayer-Oakes 1952), and Guatemala (Coe 1960). Los Tapiales, a paleo-Indian campsite in highland Guatemala, has yielded a fluted point base, keeled and lateral-spurred end scrapers, burins, and a few small blades, along with several other biface fragments (Gruhn and Bryan 1977).

The preceramic sites of Casita de Piedra and Trapiche Rockshelter in Panama (Ranere 1976), which were periodically occupied from 7000 to 2500 B.P., display a quite different lithic assemblage; it includes choppers, crude scrapers, wedges, edge-ground cobbles, nutting stones, grind-