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HOUSELOTS AT TIKAL GUATEMALA: IT'S WHAT'S OUT BACK THAT COUNTS

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INTRODUCTION

Although the archaeology of the «house» has long been a major focus in historical as well as prehistoric archaeology, attention to the gardens (e. g. Farrar 1998), yards and grounds surrounding each «house» has only recently become of primary importance (e.g. Allison 1999, Ashmore and Knapp 1999, Heath and Bennett 2000). Like the archaeology of Roman villas throughout the ancient empire, the archaeology of farmsteads in North America has rapidly become the focus of much historical research (e. g. Catts and De Cunzo 1999). The archaeology of these farmsteads, however, pays much greater attention to the spatial distributions of structure and of features rarely noted before. These trends also can be seen in the Maya area, and the results permit an extremely impressive expansion of our ability to reconstruct ancient Maya society.

BACKGROUND: COURTS, COURTYARDS, PATIOS OR PLAZAS

Over 100 years ago E. H. Thompson (1892) recognized that the vast numbers of small structures scattered throughout the Yucatan were residential in function. Some 40 years later Robert Wauchope's (1934: 158-160) research at Uaxactún, Guatemala confirmed the belief that the abundant low rectangular platforms throughout the Maya area must have had residential functions. In effect these early scholars were articulating the «principal of abundance» in recognizing the residential function of these small structures (see Becker 1979; Ashmore 1981a: 40-41). More important was Wauchope's subsequent ethnographic research (1938) that demonstrated the architectural relationships among the various structures within a modern Maya house complex. Wauchope's «houses» each consisted of a

cluster or aggregation of structures, with each of these structures serving one or more different residential functions within the group (cf. Schwartz 1990: 271, fig. 6, 4). Wauchope's observations had little impact on research strategies during the early period when excavations were conducted only with great difficulty and field efforts tended to be concentrated in the ritual centers of great Maya sites.

Following Wauchope's important work, Karl Ruppert (1940) noted that each cluster of structures at an ancient Maya site functioned as a single «house». The ethnographic studies that led to this conclusion reinforced the self-evident nature of the observation, although how a «cluster» is defined often varies (cf. Blanton 1993). The typical modern European concept of «house»clusters the rooms beneath one roof or beneath a series of contiguous roofs (Becker 1971, 1999). Since publication of the classic collection by Wilk and Netting (1984), many researchers active in the Maya area have developed considerable interest in «domestic groups» or what Hirth (1993a) describes as the household as an analytical unit. Of particular importance in this paper, and to these studies in general. is Hirth's recognition (1993b; see also Stark and Hall 1993) that «rank» and «socioeconomic status» can be infered from the archaeological evidence for these architectural groups without recourse to underfined terms such as «elite» or «royal» (see also Adams 1982). While such terms may be helpful in the development of models, more often they mask a lack of data as well as insight (see Wilk and Rathje 1982).

The Maya lowland «household» pattern involves the grouping of several structures around a single plaza. The importance of these domestic units has been noted by Hendon (1999). The clustering together of series of structure, with differing functions, resembles agrarian residential patterns seen throughout the world, and typified by farmsteads such as British *bawn* or the Swedish *gore* (cf. Fletcher 1983). Each of these buildings within this type of agrarian grouping has its own primary function, but they all are clustered together to form a single «farm» unit (Iglesias 1987, Becker Ms. B). To date no uniform or single «pattern» can be found for the vast numbers of household groups identified in the Maya realm. Although a site may have a dominant plaza plan associated with most of its residential groups (see Becker 1999), internal variation can be considerable and even proximal sites may have vastly different patterns of structure aggregations (Ashmore 1981b; cf. Becker In process; Sutro and Downing 1991). The extent to which these variations in structure aggregations reflect local cultural identifiers or ecological variability, or both, is overshadowed by the recognition that each of these plaza plans (building complexes, or structural clusters) relates in some way to an agrarian life-style (see also Ashmore 1988; Bullard 1960).

Attention, therefore, should be directed toward defining the borders of each of these agrarian land units (houselots) in this part of the Maya area (see Killion 1992b). In doing so one must hold clearly in mind the agricultural underpinnings of each of these complexes (plaza groups) that formerly had been viewed as

residential units. What Wauchope did not emphasize, and is missing from subsequent studies of Maya «houses», is the agrarian basis for Maya society —which requires that the storage of crops plays a vital role in the early examples of the household than did the sleeping arrangements. Storage buildings may not be as glamorous as temples or «palaces», but they are fundamental to our understanding of socio-economic processes at a site (see also M. D. Coe 1965).

When densely clustered building complexes are found at a site, recognition of separate «houses» within them is not a simple task. Thus Webster (1999: 22) suggests that the 10 separate patios, or clusters of buildings within Gr. 9N-8 at Copan (Sepulturas area) constitute «a major elite residence» (see also Webster 1998a). Whether or not these are separate «houses» or simply aspects of a single, large residential complex remains to be determined. Specific variations in residential patterning at Maya sites may prove to be more significant than other features of construction in the recognition of cultural patterns. To date we have no understanding of any rules governing the spatial relationships among the many groups of structures that are identified at any typical lowland site. The meaning of intragroup distances, some of which are very small and others much greater, remain as opaque as the reasons why some «houses» are large and complex (Webster's Gr. 9N-8 at Copan, Tikal's Barringer Group), and others have but a few very small structures (Tikal Gr. 7E-XV; see Becker 1982, also Becker In process). This problem of distances and relationships also reflects the fact that we know surprisingly little about individual buildings within most of these groups. Even those groups that have been relatively well studied rarely have even a single structure that has been excavated to bedrock.

David Webster's (pers. comm. 5 Oct. 2000) observation that research at Copan reveals the consistent bilateral asymmetry of structures is very important. This phenomenon is commonly noted by others (see Quirigua Str. 6, Becker 1972) but not emphasized in publications. Since the standard «excavation» technique for Maya buildings involves axial trenching, as defined by locating the front corners of the structure, asymmetries are rarely seen, and more rarely noted. Related to this lack of understanding of even basic aspects of individual structures is the limitation on predicting the physical depth of architectural groups (location relative to bedrock). At Tikal the vast majority of the structures in the 690 groups of buildings (Becker 1982) appear to have been built directly on the limestone bedrock. However, the structures in some groups are placed only on the latest levels of massive accretions involving vast and deep fills that completely entomb early levels of entire groups of structures, rather than simply rebuilding individual structures within the group. Laporte and Iglesias (1999) reveal an impressive example of this phenomenon in southwestern Tikal. Even Tikal Temple V (Str. 5D-5), long believed to have been built on a natural rise in the land, only recently was found to be the last major structure in an area with a long and physically deep architectural history (Laporte pers. comm. 5 Oct 2000).

A «FUNCTIONALIST APPROACH»

An insightful recent review of the «principal methodological and theoretical approaches that Mayanists can or have already taken to the recovery of meaning from Late Classic commoner houses» (Johnston and Gonlin 1998: 141-142) commonly begins with the circular reasoning that modest houses are those of commoners. While I accept the inference that there may be a direct correlation between Maya house size and wealth, I point out that wealth and social status are not the same (Becker In process). «Modest» is not defined in Johnston and Gonlin's well written review, but three approaches to the study of «houses» are outlined: cultural (or structuralist: the house reveals culture), social (defines household organization and economic adaptations), and functional (artifacts are endowed with social organizational meaning). While the theory is impressive, the utility of the first two approaches rests on archaeological recovery modes and techniques of analysis. The third, or functional approach clearly governs initial field research, and provides the basis for this analysis of plaza plans as a basis for planning research strategies at Maya sites.

As the archaeology of households, and the specific activities associated with them (cf. Allison 1999), becomes a more common focus for research programs, attention remains targeted towards the principal structures associated with the complex. This complex may be a group of 19th century farm buildings in Pennsylvania, or a household or other structural group at Tikal (see «plaza plan», Becker 1999) or other Maya site (see also Cieraad 1999). Recently the archaeology of formal gardens (e. g. Miller and Gleason 1994) has provided a view beyond the buildings (see esp. Killion 1992), but the search for other features provides the target towards which this paper is addressed.

Recent excavations beneath a covering of volcanic ash at Cruz Verde focused on the «house compounds», but general clearing revealed extensive systems of «canals» (possibly raised field features?) in the areas between the residential groups (Plunket and Uruñuela 1998: 295, fig. 6). Such inadvertant discoveries reveal the considerable potential for archaeological research in these neglected parts of «urban» sites.

BOUNDARIES: DEFINING THE HOUSELOT

In recent years studies of «boundaries» on all scales have become of great interest in archaeology. Anthropologists have long wrestled with numerous problems relating to cultural boundaries (cf. Barth 1969). Similar questions have arisen in archaeological circles much more recently as a result of growing interpretive sophistication on the part of excavators dealing with cultural data. Now we can turn our focus to the household level where we still lack significant

information on how artifacts are distributed between house groups, either in density or pattern, and at only a few rare sites do we have such information in the immediate area of residences.

During the 1970s archaeologists developed models relating to spheres of political influence using what commonly are called Thiessen polygons. These units were used to «define» areas believed to be discrete territories (e.g. Renfrew 1973), having derived from basic work on describing rainfall patterns (Thiessen and Alter 1911) using complex mathematical models such as those described by Voronoï (1908) and reconfigured by various scholars (e.g.Boots 1987). Renfrew's belief that these territories, delineated by V-T polygons, provides each chiefdom with ecologically diverse resources was one of the factors that led Mesoamericanists to apply these ideas in the New World. The launch of Landsat II (2 Jan. 1975) provided the EROS Data Center of the USGS with ERTS imagry including Central America that was utilized by some scholars , but with limited success. Many of the Maya city-states have been suggested as having control over regions that can be predicted by size of the central «city». The possibility that a much smaller scale version of this approach might be applicable within a specific site has been considered (Becker 1999), but not found to be useful.

Perhaps as important as the delineation of the margins of a single site (city or polity; Thomasen 1996) is the recognition of the culturally specific architectural grammars within each Maya city. These architectural grammars are the archaeologically recognizable ways in which various individual structures of a site are built, and the way that these recognizable types of structures are clustered into meaningful and predictable «groups» (Becker 1999). Thus the identification of «Plaza Plans» [hereafter PPs] specific to each Maya polity ("city») may be a critical means of understanding site-specific cultures (the culture, and possibly the dialect, associated with that specific site) within the Maya area.

Architectural elements visible from the surface have long enabled us to recognize ancient Maya houses, or groups, as distinct entities (Wauchope 1934). These structures are only the most visible aspect of these residential-agricultural complexes, or what Killion (1992) describes as the «structural core». Thus the «clear area» or surrounding «open» space around the «house» that was used by the residents of a group as garden or growing area (see Johnston and Gonlin 1998: 159) also merits our attention. The configuration of these areas, or «houselots», are more important in helping us to determine why some architectural groups are located extremely close together while many other groups are regularly spaced at consistent distances.

In 1962 I had strongly considered acting on the prescient suggestion made by Emil Haury when he visited Tikal that I excavate an entire Maya houselot down to bedrock. I was restrained by the time and costs involved. Since 1962 few others have undertaken such projects, reflecting the cost of this type of research (but, see Puleston 1983). The original field goals of E. L. Green at a small lowland Maya

site peripheral to Tikal, as a student trained by Haury, involved the excavation of wide areas down to bedrock. The vast labor requirements needed just to test the principal structures at that site ultimately reduced her goals (Green 1970). Excavations in Platform 34 at Cuello (Gerhardt 1988) provide some good views of a preclassic complex slowly being excavated to bedrock. However, as the basic costs of conducting field excavations have risen, the probability of any excavation to bedrock in the Maya area declines, but it remains an important consideration for research strategies in Petén.

Physical Evidence for House Lot Boundary Walls: *Albarradas*

Delineation of the borders for any specific house lot, or identifying a demarcator surrounding a residential group is a difficult task where forest cover is thick. As might be expected, the best studies of house lots, or *solares*, continue to derive from research in Yucatan (e.g. Fletcher and Kintz 1983; Con 1991). Perhaps the best review of this literature may be found in Goñi's study (1995), that includes an excellent summary of the history of research on *solares*. Goñi examines the stone boundary walls at five northern Yucatecan sites and finds that there are variations among the sites studied. Goñi (1995: fig. 3) shows that the data from Mayapan (see Smith 1962) reveals that each residential group is closely surrounded by its own boundary wall. This pattern (cf. Figure 2, below) leaves large open spaces between demarcated groups, or at least corridors which presumably permitted public passage (cf. Figure 3, below; see also Dahlin 2000, Dahlin and Ardren In process). Most important is that this pattern separates and segregates each house lot, leaving open spaces between them as bounded. This is very different from having contiguous units (cf. Figure 1, below). At Chunchucmil, a site that Bruce Dahlin (pers. comm. 5 Oct. 1999) believes «to have been a specialized trade and industrial center», property boundary walls have been identified within the city. These boundaries are notable because the city has streets reflecting an extremely dense urban population.

A parallel problem in the location of boundary walls also exists where there are large numbers of structures arranged in proximal or apparently abutting groups. Stone boundary walls separating architectural groups (*albarradas*) often are apparent at many Yucatecan sites where rainfall, and thus vegetation, is low (see Bullard 1954; Killion *et al.* 1989; Sabloff and Tourtellot 1991). House lot boundaries are distinct from site or city «walls» or defensive «barricades» such as the one well documented at Chunchucmil, Yucatan (Dahlin and Ardren In process). At Chunchucmil almost all of the residential groups are enclosed by an *albarrada*, most of the groups being contiguous or sharing a common wall (Model A). Some lanes (*callejuelas*) up to 4 m broad radiate from the site center, but they are without cross paths. Callejuelas such as at Chunchucmil are also noted at Dzi-

bilchaltun (Kurjack and Garza 1981: 297) and Cobá (Gallareta 1984), but are more commonly known from at Late Postclassic sites such as Mayapan and Tulum.

Bullard's early studies of boundary walls and their enclosed house lots at Mayapan are important, and have gathered considerable momentum since the work of Peniche and Folan (1978) delineating large block stone boundary walls at Cobá (see also Manzanilla and Barba 1990), and the research by Weeks (1980) in the Guatemalan highlands. However, although individual structures generally are visible and easily delineated through surface observation boundary walls may not be evident. Note should be made that at Cobá some household units do not have visible stone boundary walls, but cactus or other living boundaries may have separated these groups. In some cases, and at some sites, perishable materials may have filled in the gaps where walls appear to end (cf. Demarets *et al.* 1997). Herrera's (1601: 537) observations of small towns in South America notes that

> *«they are compassed round about with "cardones", and thornie trees for the warres that they had among themselves».*

And the footnote within this statement explains that *cardones* are:

> *«A kinde of thistle that groweth every stemme foure inches square, and as high as a man on horse backe,...»* [III. v. 898].

The use of living boundaries, so common in the post-medieval French and English traditions (cf. St. George 1990: 286), may have developed into formal hedges only after the 1500s in Europe Functional «hedges» could be used to divide areas within a farm complex, but would only be useful where the size and complexity of the farm unit were large.

The variability noted in the presence or absence of property walls at southern lowland Maya sites is particularly notable. Tourtellot (pers. comm. 1 Nov. 2000) reports finding «property walls» surrounding house lots at La Milpa in Belize but not at Sayil or Seibal. The property boundaries at La Milpa, called «berms» by the excavators because of their possible role in water or silt management, often consist only of long piles of limestone or chert nodules and flakes. Variant forms of property walls are related to «some elaborate patio groups on a few hilltops» (Tourtellot pers. comm. 20 Nov. 2000) but they do not appear to form closed units (see Tourtellot *et al.* 2000: fig. 2). This suggests to me that a Model C pattern (see Figure 3) may have existed at La Milpa.

At Seibal no clear evidence for property walls was found relating to house «parcels» (Tourtellot 1988: 305-306), but fence or retaining wall «foundations» were found connecting individual structures in residential groups (Tourtellot 1988: 218). These «local screen walls» (Tourtellot pers. comm. 20 Nov. 2000) are

common at Tikal and other Classic period sites (see Gr. 4H-2 in Figures 1-3), but are quite distinct from property boundary walls. What is important is the ability of the excavators at Seibal to recognize even these small features.

At Sayil, where soil cover is relatively thin, the excavators were surprised that property boundary walls were not evident (Tourtellot pers. comm. 20 Nov. 2000). Possibly *albarradas* at Sayil were of living hedges.Tourtellot and his colleagues did find some small walls extending from the rear of houses or from various platforms, but they did not form enclosures. What they may have been seeing could be the Model C version that appears in Figure 3 below. At Sayil and other sites walls may have been dismantled at a later date, or even during recent history (cf. Killion *et al.* 1989).

At Cobá Benavides and Manzanilla (1987: 24) indicate, through a map inset by Garduño (1979), that at least some houselots are contiguous (Type A). Benavides (1987) provides an excellent review of domestic architecture at Cobá, with a focus on the variety of activity areas that can be found within the boundaries of a houselot. The boundaries warrant further attention. What we do see of the houselots at Mayapan and also at Cobá (Fletcher and Kintz 1983; cf. Sheets 1992) suggests public or communal ownership, or at least public use, of much of the land surface. Therefore I term this mode the «Commons» model. I note that this pattern would be particularly suited to a socio-political system in which a central authority such as a «king» held lands in common for the «state». Goñi (1995) points out that at San Gervasis, as indicated by Sierra Sosa (1986), houselots appear to be contiguous (Becker Model A, see Figure 1). Goñi also notes that contiguous houselot units also appear to be used at Playa del Carmen (see Silva and Hernández 1986) and possibly at X'caret (Con 1991). I predict that the contiguous houselot pattern, the boundaries of each being predicted by «Thiessen» polygrams, will be found to apply among the several groups studied by Becker (1999) at Tikal. However, at this time I cannot predict if this pattern or any single pattern of houselot demarcation will apply to all parts of the extensive Tikal polity.

In the Petén rain forest construction details for individual structures can be inferred by surface observation only by the most experienced mappers (see Carr and Hazard 1961), and can be confirmed only through excavation. At sites such as Tikal, where even rubble and stone were valuable commodities, bush or brush boundaries separating household groups may have been the norm. Laporte (pers. comm. 5 Oct. 2000) notes that the type of fencing used may depend on the terrain. Living fences would be suited to flat places, but stone terracing on inclines both helps define borders as well as to improve conditions for agriculture. As Laporte points out, in the Peten large areas such as around Tikal have only 20cm. of soil cover, which needs management as careful as that involved in the selection of plants grown on it.

Wauchope (1938) went to Chan Kom in Yucatan to study the «contemporary» Maya house. There he seems to have found the typical example to have had a

sharply rectangular border, probably derived from colonial ideas of boundaries. In Peten, houselot borders have not been sought by archaeologists. I would expect that these boundaries, in general, were marked only by plants, and these would appear archaeologically only in high ground where ditches or a series of holes would have been dug into the limestone bedrock to give root space to these plantings. Using plants for fences in the lowlands would be in keeping with F. Wiseman's concept of an «artificial rainforest» or a «managed mosaic» (Fedick 1996; see Webster 1998b). Such fencing would allow stone and other building materials to be used in the extensive fills needed to construct the impressive and large Late Classic period buildings.

In situations where discrete architectural groups cannot be recognized by visual inspection, excavations should be concerned with clarifying relationships among structures. Defining groups, and inferring the locations of group boundaries, may provide clues to agrarian behaviors within the so-called «urban» core of these «cities». The nature of the pattern of agriculture conducted by the residents of individual houselots, addressed by King *et al.* (1999), is critical to infering populations and population densities at these sites.

Puleston and Callender (1967) recognized a huge «site boundary» wall that appears to border the northern margins of Tikal (see also Puleston 1983). Of interest and concern to others has been the relatively short distance covered by this construction, and a short section that exists elsewhere at the site. This impressive wall feature on the north of Tikal may have been meant to amaze travelers and merchants entering the «city» from Uaxactun, and also may have been the strongest point of a living defensive system of trees, or perhaps a palisade system (cf. Becker Ms. B). While the question of city boundaries remains open, the extent of any defensive system associated with a site would be important in our interpretation of the nature and extent of Maya «warfare» (see also Demarest *et al.* 1997).

LOOKING: WHAT WE CAN EXPECT TO FIND OUT BACK?

Searching for features in an area behind the house clusters in an ancient Maya city may turn up almost anything. Iglesias (1988) chanced upon an impressive sheet-like midden containing an array of materials that cannot be described simply as trash. Even understanding the nature of the adjacent residential group may not help decode the significance or origins of this «problematical deposit». Thus our search is limited by modern cultural perameters regarding what we expect to find on a houselot as well as the archaeological evidence for what has been found in the past. The importance of recognizing individual habitation units (residential groups) and the functions for the separate structures within them has been pointed out for many years (see Manzanilla 1987). As noted earlier, Benavides (1987, also Barba and Manzanilla 1987) examines activity areas within the residential groups at

Cobá. Benavides's (1987: 56) emphasis on «kitchens» is important here because this function commonly is ascribed to small structure «behind» the major constructions of each residential group. Since we may infer that every residential group had a kitchen, the focus of this paper will be on those structures and activity areas less commonly considered by «household» archaeologists.

Barba and Manzanilla took the study of household units to the next level by examining the Classic period activity areas associated with every part of these residential areas at Cobá. They consider not only features within the houselots, but features beyond these units such as water storage areas, *sascaberas*, «milpas» and wells (1987: 70-71, 81). These are in addition to note of roofer areas of all kinds that are distincy from sleeping structures and kitchen structures already noted. A vast range of possible individual structures that relate to «industrial» as well as to domestic or agrarian functions must have stood near, but not been included as part of the «principal» structures of the complex (plaza group) representing most Maya houses. Barba and Manzanilla (1987) offer the best summary of these many aspects that comprise each residential group. Groups of structures that served as royal residences and administrative buildings, as well as communal mens' houses (Copan Str. 22A: see Cheek 2000) can be inferred to be associated only with the administrative-ritual center of large sites. Yet even these complexes had numerous peripheral support buildings. A wide range of buildings and other features may be found at even the smallest of Maya sites. The goals of these studies of specific parts of a Maya household thus can be divided into 3 categories involving structures and identifying features listed as A through H, below:

1. Those for which we already have evidence (A and B).
2. Those than can be reasonably inferred (C-G).
3. Those that may not exist, but should be sought (H, see also I and J).

A. Sweathouses

Sauna-like constructions are known from some Maya sites where they are built into the large structures, but free standing examples are less easily identified. These often are refered to by the Spanish *temazcal*, from the nahuatl term *temazcalli* (tema=bath, calli = house: Cresson 1938: 90). These have been described as a «*casilla como estufa donde se bañan y sudan*» (see Alcina *et al.* 1980; Molina 1944). Since Mason (1935), Cresson (1938), and Wauchope (1938) pioneered studies of these interesting features there has been a long hiatus in their investigation. With the exception of a brief note by Kidder and Shook (1959), nothing was done until Alcina Franch and his colleagues reopened the subject (see also Barba and Manzanilla 1987: 80-81), followed by the important ethnographic work of Blake and Blake (1988).

Child and Child (1999) continue their useful study of sweatbaths at Piedras Negras, and a Preclassic example may have been located *circa* 1999 at Cuello in Belize in the Platform 34 complex. A sweatbath has been suggested for Room 2 in Group 3 at Copan (Cheek 2000). At Tikal only 2 sweathouses have been noted: Str. 5E-22 (Jones 1996) and another buried intact under the north side of the platform supporting Str. 3D-43. The latter, excavated in 1984, is vaulted and similar to Str, 5E-22 but with a bee-hive shaped cover over the fire pit and holes *circa* 22 cm. in diameter. Laporte (pers. comm.) says that he heard that the curved walls as well as the vault were smoked, but he never visited this excavation. The structure buried below Str. 3D-43 also has been interpreted as a «kiln» (see in Becker Ms. A). Numerous functions have been suggested for sweatbaths, including ritual preparation of men for ceremonies, etc. Carman (1991) offers some very useful data on who among the Nez Perce used sweat lodges and why they were used.

B. *Chultunes:* Storage pits, caches, charnel pits and cesspits

Pits cut into the natural bedrock in Peten, and bottle shaped pits elsewhere, generally are assumed to have served various storage functions (see Smyth 1989, 1991; Winter 1972: 137-138, 154-157). *Chultunes* at Tikal, and storage pits in general, often are converted to tomb chambers (cf. Becker 1992). In at least one case at Tikal I believe that a *chultun* (Ch. 5G-15: Becker 1999: 70-71, fig. 64) was used to «relocate» a disturbed and very rich preclassic burial. Storage pits used for foodstuffs and other items are reused as trash pits throughout the world.

The distribution of those *chultunes* now known at Tikal has been plotted and they have been demonstrated to be widely dispersed. However, examples are known only in the many cases where they have been evident from the surface, or where they have been discovered during excavations incidental to other goals, or in rare cases where small sections of the site have been taken to bedrock. No attempt at sub-surface instrumental survey has been made, and no specific pattern of distribution is now known. I suggest that chultunes within or near architectural groups served as food storage units, while those most distant from the structures of any group are more likely to have been charnel houses, cesspits, etc. (cf. Dahlin and Litzinger 1986).

C. «Kilns» and ovens: Predicted fine ceramic production associated with Tikal Gr. 4H-1.

Despite all we know about Maya ceramics, and inferences regarding the houses of potters (Becker 1973), pottery production sites remain elusive. Lucero (1992) addressed this specific and interesting problem in the Maya lowlands (cf.

Bernardini 2000). Since no actual kiln sites had then been identified, Lucero suggests that sherd densities might provide clues to locations where possible candidates, or at least firing locations, might be located. Group 4H-I at Tikal (Becker 1999) incorporates huge middens composed almost exclusively of high quality Classic Period fine painted ceramics. The extent and depth of one of these middens is so great that it formed the entire foundation for Str. 4H-2 in this group. The enormous volume of these fine painted wares, plus a large constellation of other evidence (Becker Ms. A) indicates that the residents of this «house» were the producers of this pottery. The adjacent *bajo* could provide both the clay as well as the fuel for this production of fine pottery (cf. Harrison 1978). Data on the prevailing wind direction might be useful in locating firing stations associated with Tikal Gr. 4H-I. The location of the possible firing site has intrigued me for 40 years, and recent research has «refired» my interest (Becker Ms. A).

Note also should be made here of *hornos* that served in charcoal and in lime production (Barba and Manzanilla 1987: 81). While aspects of these structures may seem far removed from those needed to fire ceramics, they fall within the continuum of such constructions.

D. **Menstrual huts** (cf. Galloway 1997)

The recent focus on the archaeology of women has provided mechanisms by which specific structures or parts of structures can be associated with the activities of women. Galloway (1997) directly addresses the question of menstrual houses in southeastern North America. The Maya the ethnographic record needs to be reviewed for clues that are relevant to the lowland zone. Quite possibly this approach will tell us where to look, or how to interpret data that we already have.

E. **Sheds for Beehives and Animal Pens** (cf. Barba and Manzanilla 1987: 81)

Wauchope's (1938) ethnographic research identified a shelter that covered the skeps or hives for the family's bees. Such simple shelters, providing the hives with shade and protection from the rain, may be relatively invisible (see also Kintz 1990: 12-14), or indistinguishable archaeologically from a variety of other sheds and small structures associated with a farmstead. Stingless bees were one of the very few domestic «animals» kept by the Maya. Dogs, and possibly ocellated turkeys, also were kept (Bronson 1978). Moholy-Nagy (pers. comm.) notes that several other scholars suggest that young deer may have been raised within household groups. Barba and Manzanilla (1987: 77) note the presence of such animals, and also (pp. 107-109) describe stone bins or pens that were built against

stone boundary walls, using the *albarrada* as part of the enclosure. Dogs and other animals could have been kept in these enclosed area, and thus at a distance from the humans occupying the house complex.

F. Kitchen Gardens

The idea of the Classic Period Maya as swidden horticulturalists had been doubted for decades before Bronson (1978) became one of the first to explicate the possible agricultural systems that could have been used in their forest environment. High-density populations are not common within traditional tropical forests. Turner (1979) was one of the first to address this question in the Maya area from an «evolutionary» perspective, inferring that early settlements in the Maya lowlands may have used swidden but that intensification required the development of a much more sophisticated system.

Barba and Manzanilla (1987: 77) discuss kitchen gardens (*huertos*) at length and discuss some functions such as growing herbs. Others have suggested that these gardens may have been used as locales for producing seed for maize as well as other crops. Doolittle's (1992) review of this subject, although focused on northwestern Mexico and arid lands in general, is particularly important for his suggestion that gardens may be vital for seed production; even for crops such as maize that is grown as a major food crop in large fields far from the houselot. Doolittle's ethnographic data (1992: 78-89) are essential reading both for information on seed processing as well as for data on garden forms and their spatial relationships, both ancient and modern, in the Valley of Sonora, Mexico.

«Garden» archaeology at European and post-Contact North American sites focuses on the formal layout of high status and ornamental gardens, and less commonly on medicinal herb gardens. From Pompeii (Jashemski 1990, 1999) to the gardens of colonial governors in New Jersey and elsewhere, the goals of research may vary considerably, and many of these methods and concerns have been applied in the Maya region (Killion 1992c). Killion (1992a) reviews the— literature and summarizes contemporary and prehistoric data on «settlement agriculture» for Matacapan, Veracruz. Killion's (1992a: fig. 6-2) house lot model appears to reflect post-Contact boundary systems and not those noted in other figures (e.g. 6-3 and 6-4). Still, these are important data.

Distinguishing between kitchen gardens and the other plots of cultivated land that surrounded a Maya house complex has been achieved through chemical studies (cf. Fedick 1998). Chemical or organic residues, and even plant silicates, survive differentially in these contexts as indicated by recent studies (e.g. Ball and Kelsay 1992). Chemical analysis has identified garden areas within houselots at at Cobá with great accuracy (see also Barba and Tovalin 1987). This line of research is facilitated through the study of ethnographic data (e.g. Killion 1992a). In her

specific study of kitchen gardens Kintz (1990: 14) discusses the *solar* ("yard», or «house lot» as translated by Alexander 1999: 78) as it functioned at Cobá *circa* 1980. The enclosed houselot enabled bee skeps, chickens, turkeys and even fruit trees to be contained within a bounded entity belonging to the extended family (Kintz 1990: 12-14). However, the modern people of Cobá had developed a much more Spanish settlement pattern, with segregated orchard plots (Kintz 1990: 16) and a quadrilateral village plan. Even the specialist curer at Cobá who «cultivated» medicinal plants near his house (Kintz 1990: 20) may be following a European pattern of herb production modeled after the formal medicinal herb garden and not the gathering techniques that may have been used by the ancient Maya (cf. Schwartz 1990). Alexander's (1999) examination of house lots in Yaxcaba, Yucatan during the period from 1750 to 1847 suggests that the Spanish pattern of land use had displaced local traditions very early in the colonial period.

Plants grown in such «dooryard gardens» (Anderson 1998: 291), like the kitchen gardens of Europe and North America, would be inhibited in their production by proximity to high forest. I suggest that growing such plants, or maintaining a kitchen garden, within a plaza or in the areas near the household structures would be more a probable technique. The presence, or absence, of such gardens may be factors in the locations of courtyard groups, with those with large gardens needing more space than those with small or no gardens. I believe that organic trash was fed to animals or recycled into these gardens.

Probably the best explanation for the way in which the ancient Maya produced sufficient food resources to sustain relatively large populations is Fedick's (1996) «managed mosaic» thesis. Fedick's model perceives the tropical canopy of the forest to be transformed into a garden-like agricultural system (cf. Anderson 1998: 291). But the tropical canopy maintains a covering that is not conducive to the growth of numbers of plants at ground level. Anderson (1998: 300-310) provides an impressive list of plants recently noted as being cultivated in Chunhuhub, while citing Rico-Gray *et al.* (1990) as the most thorough of the recent accounts of Maya house gardens in Yucatan.

The modern use of «milpa» agriculture in central Peten, with small «milpas» located near the villages (6 to 18 km) and larger «milpas» generally from 9 to 12 km from the towns (with the exception of Flores, which had been surrounded by large «milpas»), may reflect a Late Post-Classic development in the Maya area, and certainly a population far less than even the lowest population estimates for the Classic Period. Schwartz determined that making «milpa» is a project that each family undertakes separately, with a father and his unmarried sons acting as the core of the workforce. «Grown» (married) sons make «milpa» independently, but Schwartz (pers. comm.) reports the presence of «conjoined milpas» where a father and son will cultivate contiguous areas, the periphery of which is bounded by a low border of brush. Their work treats the area within the boundary marker as a single unit, but a cognitive distinction (only) regarding ownership is main-

tained between «regions» within the apparently single unit.

The modern pattern of land use around Cobá is far from the 16th century «Garden cities of the historical literature (See Kintz 1990 In process). However, the archaeological evidence requires careful examination to permit distinction between what may be a raised garden plot surrounded by a stone wall, and a small platform for a structure. The Enclosed garden would, Kintz suggests, have almost rockless soil, while a platform would be filled with chiche, a rubble fill including some soil (Kintz pers. comm. 11 Aug. 2000). Kintz also notes that log borders, intact or split, could be used as a border for a raised garden, in which case the archaeology would reveal only a mound of relatively stone-free rich soil. Stones and ceramic debris may reveal path locations, as has found to be the case in colonial Pennsylvania. Broken pottery is not simply thrown out the «back door» but is deliberately deposited along pathways to provide drainage and reduce mud transport during the wet season.

G. Cementeries: Where are they burying the dead?

Most lowland Maya sites have an interesting lack of a known or designated cemetery area, and multiple burials are infrequently known (see Welsh 1988: 36-37). Groups of burials are so unusual that each new example is of considerable interest (e.g. Healy *et al.* 1998). At some sites, and in some groups within individual sites, the Maya interred many of their dead as subfloor burials within a specific structure (e.g. Tikal Str. 4F-4: see Haviland *et al.* 1985). The majority of ordinary Maya burials are found associated with fills used in buildings, other constructions, or in middens adjacent to houses (Becker 1986). In addition, a specific mortuary complex associated with high status individuals at Tikal (Becker 1971, 1999) has been found at other lowland sites (Becker 1972, 1982). This high status mortuary complex appears related to ritual caching also found associated with construction (Becker 1992). In one way or another these family members are reincorporated into the lineage by their interment within their residential area. Others may have been buried out back, but we have yet to look for them.

In estimating the average numbers of residents in a typical household at Tikal scholars often arrive at the magic number 25, not far removed from the figure that ethnographic accounts indicate. A family of this size can expect to have an annual mortality rate of *circa* 2 per year, of which half will be *perinatales* and *juveniles*. Thus we would expect that a residential group would be generating some 200 burials per century. The architectural history of most groups at Tikal often extends for 400 or more years, and the ceramic evidence for occupation easily double that period of time. Yet nowhere in these groups do we find the 1,000 burials that might be expected, even considering the numbers of disturbed burials that are detected in construction fills (Moholy-Nagy pers. comm.).

Mortuary complexes around the world commonly exclude from formal burial areas the remains of perinatals (Becker 1997). These tiny bodies often are buried in specially designted zones. At Maya sites there is a nearly complete absence of perinatal skeletons within the architectural complexes. By clearing a houselot to bedrock we may recover evidence for the disposal of these small bodies, and perhaps others, out behind the structures that served as the family residence. Not generally considered as a likely possibility is the use of a formal burial area by the Maya. Agriculturally productive land is valuable, and was even in land rich colonial America. A colonial «family burial ground» for the Taylor family, used from *circa* 1751-1865, was enclosed within a stone fence about 10 m^2. This secular cemetery in Westtown Township, Chester County, PA not only served the members of this farm family, but also attracted the dead from a number of local farm families, most of whom had land holdings of about 100 hectares. The dead in this small plot were interred one on top of the other, the coffins being stacked 4 or 5 deep and so tightly clustered that the heads and feet of many of these bodies had been cut through to inter another person. Even where large plots of land are available, burials may be clustered, and I suspect that this was the case with the Maya.

The management of the tropical rainforest of the southern Maya lowlands requires efficient land use in order to sustain the populations of the Classic Maya period. The incorporation of burials into construction fills provides a land conservation measure. However, the separate and often individual burials common at Tikal and other sites may only reflect the places that we happen to be excavating. We also know of numbers of cemetery-like clusterings of burials at various Maya sites. Sullivan (1995: 172-173) found 12 separate burials in a single cluster in a Preclassic context at Colha, Belize and he refers to others at Altun Ha and Cuello. Becker (1999: 24-39) notes an unusual and complex cluster of bodies in Str.4H-4 at Tikal, which is particularly interesting because it appears to date to about the same period (transition from Early to Late Classic) as a multiple burial from Caledonia, Belize (Healy *et al.* 1998). Other examples of multiple burials in a single chamber or area from various sites probably remain to be published.

H. Washing Areas (see Barba and Manzanilla 1987: 77-79)

I. Privies: What did the Maya do? (cf. Wheeler 2000).

Since plant compost, organic trash of any type and also human waste were products that need to be recycled in a tropical agricultural system, some sort of privy system may be expected. These may have been linked with chultunes, and the testing of these structures merits attention with a program of testing distinct from any heretofore proposed.

J. Other: Vacant Terrain and Its Uses

Bennett Bronson (Ms.) studied areas at Tikal where no structures were apparent. The results indicate that activities were widespread in parts of the polity in which few if any structures could be detected. This is in keeping with aspects of «gardening» or agriculture suggested by Thomas Killion *et al.* (1989) that householders did intensive inter-cropping «in town» while also maintaining fields or «gardens» in the areas on the margin of a city (see also Hayden and Cannon 1983). The effects of this system would allow for dense habitation at a site center.

AGRICULTURAL TERRACING

Water control and conservation, by directing runoff to aguadas (Culbert *et al.* 1997, Fialko n.d.) appear to have been significant aspects of many lowland Maya sites. Agricultural functions in Maya gardening also have been explored (A. Chase and Chase 1998). Pool's (1997) limited testing of 3 preclassic «houselots» in the Gulf Lowlands are said to provide indications of nearby agricultural fields. Whether this is self evident, or seen in contrast to slash-and-burn agriculturalists is not explored. Long ago Chisholm (1968) demonstrated that «agricultural» populations rarely cultivate lands located more than 2 kms. from their villages. I suggest that this is only common among dense populations or «village» agriculturalists, and does not apply to shifting cultivators (see Schwartz 1990).

The decision to use raised fields, terraced gardens, and other systems of land management in association with houselots also depends on local constraints and conditions. Raised fields suggest the use of agricultural processes *outside* the «residential» zone —or in areas that do not have houses on a «houselot».

PLANTS AND ANIMALS

Recent ethnographers, as indicated above, have identified an impressive variety of plants now grown in association with «milpas»s in Yucatan and Peten (see also Atran and Ucau Ek' 1999; Schwartz 1990, also pers. comm.; Terán *et al.* 1998). These scholars provide clues to the wide range of plant resources that were grown during the Classic Period, and how these plants were intercropped. Intercropping provides a low density for any single plant species and these variations in plant populations have the important function of reducing insect predation. Insects that specifically target one type of plant are deterred by the low densities found in individual houselots. When plants are in a monocrop field feeding and breeding becomes a simple process for plant pests. Plants such as bottle gourds (Becker Ms. C), huano palm for building thatch, and other useful species that are

still gathered, where they exist, can be grown as part of the mosaic that makes up a single houselot's production.

Masson's (1999) studies of animal remains at Laguna de On, Belize, and comparisons with other Maya sites, provide a number of important insights into the differential use of game animals. The possibility that domestic fowl were raised within the houselot is noted above. The hunting of wild animals, like the gathering of plants from beyond the inhabited areas, is a matter relating to bajo utilization and exploitation of resources discussed elsewhere (see Becker 2000).

DISCUSSION

Maya urban centers evolved to provide services for the people who chose to live there as well as for the rural population. Most of the occupants of these central zones were themselves living a largely rural life, but within the core area that provided political organization beyond the kin group, organized defense, and offered ideological cohesion and reinforcement to an increasingly diverse population. The occupants of a residential group and its houselot were largely self-sufficient members of a single kin unit, integrated into an ecological mosaic such as described by Potter and King (1995). The relatively limited data on markets among the Classic period Maya (see Jones 1996) has led P. Rice (1987: 77) to suggest that the market system was not strongly developed (cf. Potter and King 1995: 23-24). The extent to which formal markets operated within Maya sites may reflect the position of individual cities in the regional economy. Major cities might be expected to have had large and frequent markets, held at locations marked by formal and specific structures (cf. Jones 1996). Moholy-Nagy (In process) concludes that major cities in central Peten, such as Tikal, probably had developed complex market systems by the middle Preclassic, as suggested by the spatial distribution of artifacts and the quantities of imported materials. Smaller sites had less developed, and therefore less easily identifiable markets.

At present no fence line of any type delineating a houselot has been identified from any Classic period Maya site in the southern lowlands. The evidence from Yucatan, however, strongly reinforces the inference that they existed. Several different variations in the pattern of boundaries between these households have been postulated. The type of materials used and the size of barriers between groups may not only reflect site dynamics (public *versus* private lands, evolving socio-political complexity) but status or even cultural variables within the city.

The Group 5G-I at Tikal is the largest of 9 located on a small peninsula and also the only one with a large temple that appears to relate to the entire «*barrio*» as opposed to being a shrine specific to an individual group (Becker 1999). Also in Gr. 5G-I are the only two structures within these 9 groups with a form that suggests administrative or ritual functions (Strs. 5G-4 and 5G-9); what some would

call «palaces». While these factors alone reveal a great deal about social organization on this peninsula, verification of these relationships needs to be sought by other means. DNA studies of the skeletal population might provide one possibility. Another approach mighht be through the study of boundary walls, in order to determine if the separation of Gr. 5G-I from its neighbors exists and if that separator is different from the kinds of boundaries that delineate (if they are found) other groups on this peninsula. These boundaries, in turn might profitably be compared with systems used elsewhere at this same site.

Elsewhere at Tikal the size and type of boundary (fence) line might be sought, with consideration of their relationships to group size, «palace» form, group mortuary patterns, etc. These many simple details of household organization may shed as much light on the socio-political organization as a classic Maya site as any study of the great buildings and rich burials.

Houselot studies also provide reinforcement for earlier «low» population estimates for ancient Maya sites. The 690 architectural groups at Tikal, the majority of which were «household groups», provide the basis for a realistic calculation of population. Even if each of these 690 groups in the 4 km^2 of mapped Tikal were occupied, and each household averaged some 25 people, the population for the site could not have exceeded 17,250. With the «sustaining area» population included (see Puleston 1983), the Classic Period polity that we call Tikal could not have included more than 25,000 people. Further data on each household reinforces this estimate.

THE THREE MODELS

The three possible types of houselot delineators suggested here reflect the variety of organizational systems that can be applied to land use systems (cf. Stark 1998). Model A (Fig. 1) is what I call the «Contiguous» or Voronoi-Thiessen Type (V-T). This assumes a closely integrated, kin related community in which the members have free and unrestricted access to passage as well as the resources owned by the kin group. V-T units also should be «weighted» using factors such as group size. Larger numbers of structures in a group, or greater surface area of the structures, may be a factor in predicting locations of boundary lines (see Boots 1980; Brassel and Reif 1979). Fence lines in this case simply provide reminders of land holdings and barriers to animals —either keeping them in or out. This sytem also requires the least material and upkeep needed to maintain borders. The Contiguous Type, like Model C (Figure 3), enables us to explain which chultunes can be associated with specific residential groups.

Model B (Fig. 2) is the «Commons Type». Model B is socially exclusionary for each group, but provides extensive «public» land, the resources of which can be shared in common. This model may be interpreted to suggest that the re-

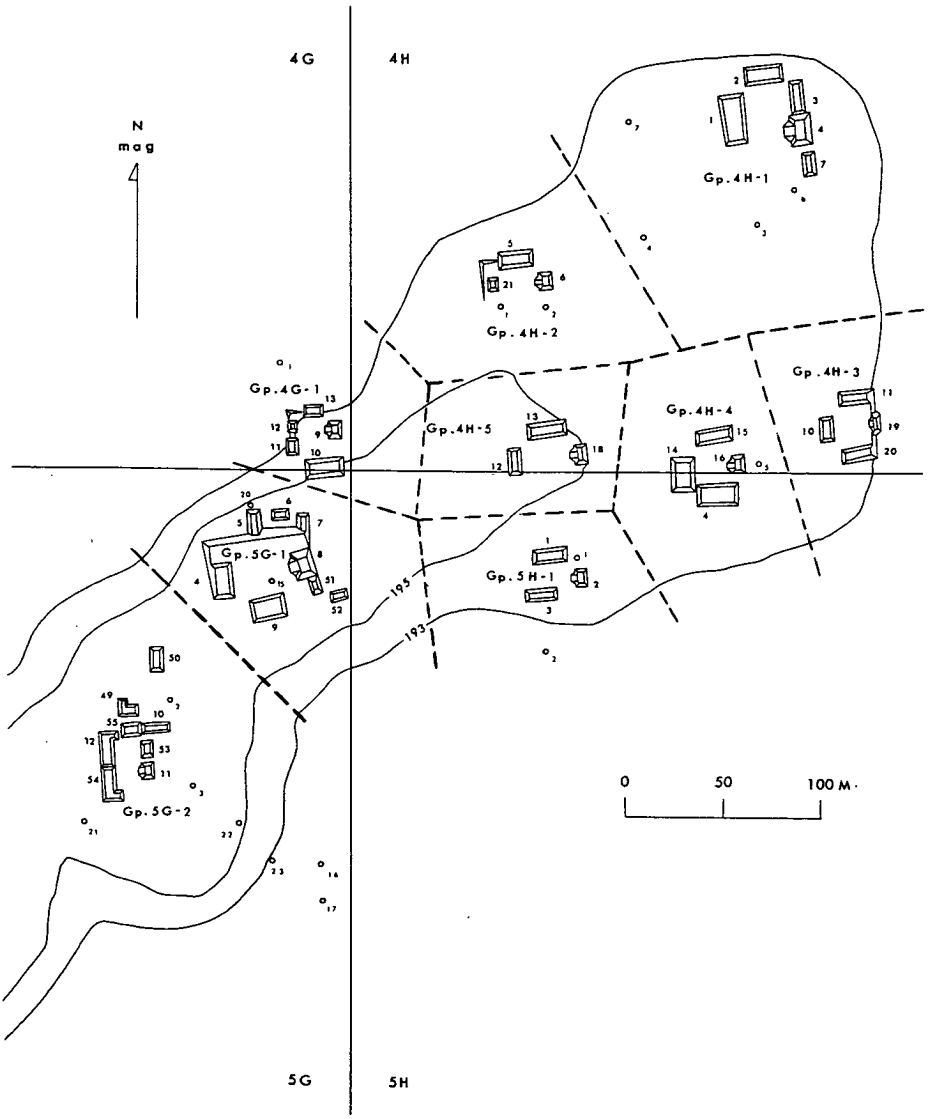

FIG. 1.—Tikal, Groups 4G-1, 4H-1, 4H4, 4H-5, 5G-1 and 5G-2. Model A: Contiguous (Thiessen) Types (adapted from Becker 1999: fig. 1).

sidents of each specific group are NOT closely related to their near neighbors. Where chultunes cluster near the architecture of a group they may predict that Model B would be found. This sytem also might be indicative of low population

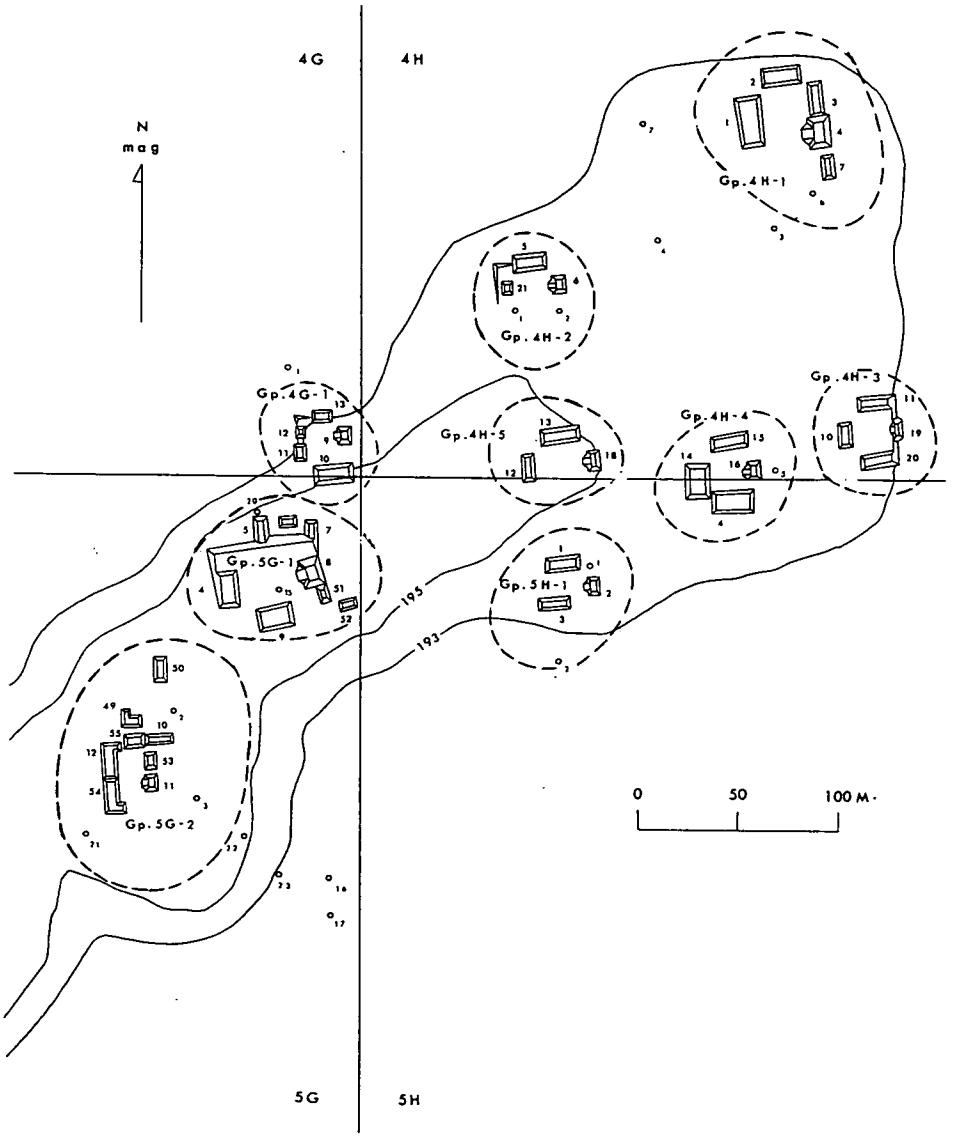

FIG. 2.—Tikal, Groups 4G-1, 4H-1, 4H4, 4H-5, 5G-1 and 5G-2. Model B: Commons Type (adapted from Becker 1999: fig. 1).

density. I would predict that this model is NOT the type that will be found associated with the 9 groups here used as a basis for testing these models (see Becker 1999). The Commons Type may, however, be found to exist elsewhere at Tikal —particularly where PP2 and PP3 groups are proximal, or where a single PP2 groups exists surrounded by PP3 or other types of groups.

Model C (Fig. 3), or the «Open Type» is an «intermediate» form. This enables us to predict associations between groups and chultunes that are found at a distance from any architecture. These could still be located within the compound of an Open Type arrangement. This «model» would be relatively expensive, in terms of costs to erect and maintain the boundary. However, it a living boundary is employed, the value of the resources generated may in fact favor such a system.

Fences and boundary markers may have multiple functions, as can be seen in modern American suburbs. In Europe and parts of Latin America property lines are often delineated by walls and fences that appear designed to «keep people out». They also serve to note the extent of private property holdings, and thus connote social status. The elaborate nature of the walls also can, in themselves, be items of conspicuous consumption. Fensing can also be used to control animals, keeping livestock inside a specific area. Thus in the Maya area the eggs, chicks, feathers and other resources of turkeys would be available only to the owners of these animals. The converse also may be true. González *et al.* (1998: 557-561) provide an important list of the wildlife that now may damage «milpas» in the lowland Maya region. Their perception of fencing would be related to the management of these animals and to limit the damage that they could cause to crops. Were this a major concern at Tikal during the Classic Period we would need to postulate a fourth model (D) for the bounding fences on the peninsula that we have taken for the application of these ideas. The fourth model would be at least a varient of A and C, with a fence surrounding the entire peninsula to keep wildlife from entering these houselots. These would close the theoretical lines that now (Figures 1 and 3) extend into the bajo. If any of the animals noted by González and his colleagues (1998) commonly range through the bajo areas, then the various types of plants intercropped by the residents might require protection.

Alexander and Canché (1998), in an excellent study of group form at Isla Cilvituk, Campeche, also address the nature of barriers (*albarradas*) at the site. Alexander and Canché (1998: 136, fig. 4) note that the barriers appear not only *between* groups, but in other complex forms that may reflect plantings or animal control within the group. This observation, so important to settlement studies in general, is particularly significant because Alexander and Canché (1998: 137) draw the conclusion that the settlement pattern at Isla Cilvituk is like those seen in Central Peten.

At Tikal, as elsewhere, each family (household group), or lineage, may have linked the resources of their houselot with those of their kin, in most cases supplementing these resources with bajo products. Beyond this economic base, the

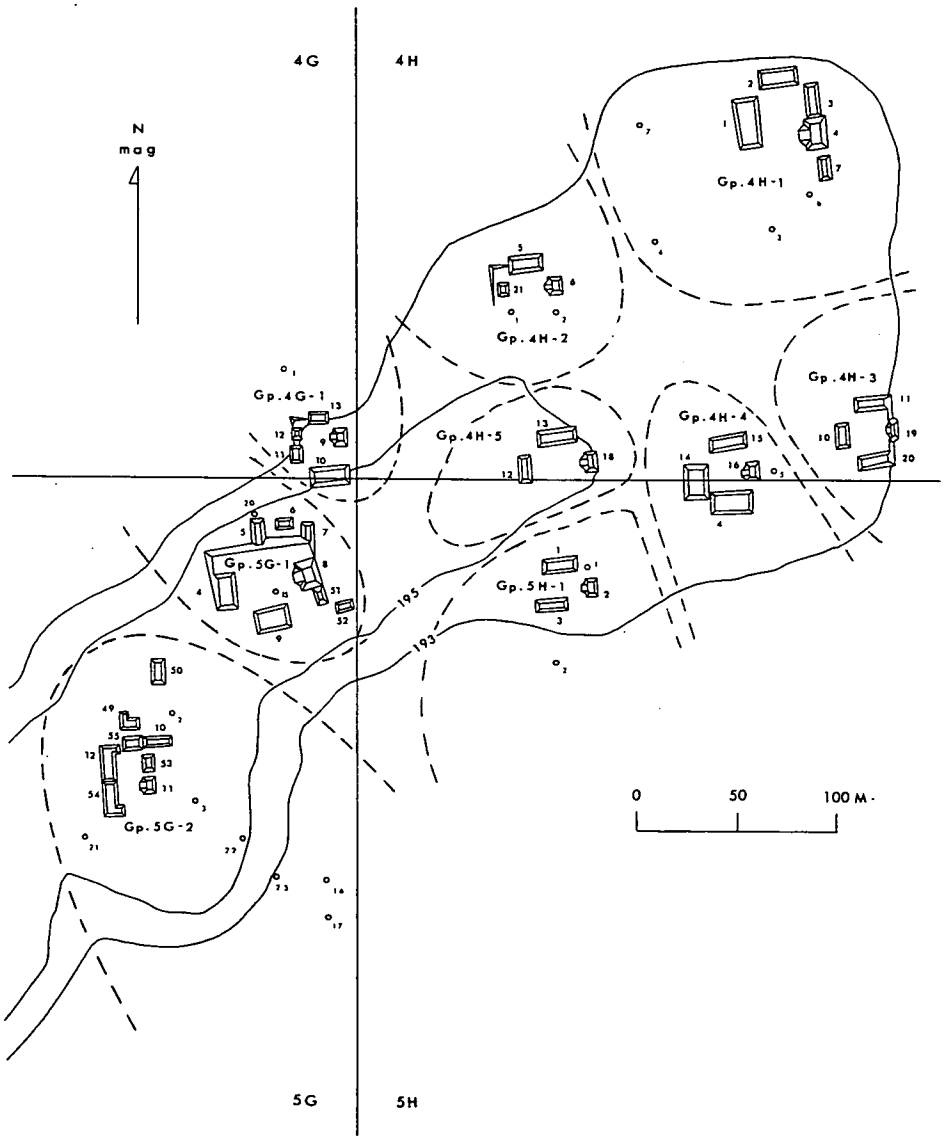

FIG. 3.—Tikal, Groups 4G-1, 4H-1, 4H4, 4H-5, 5G-1 and 5G-2. Model C: Open Type (Intermediate Model) (adapted from Becker 1999: fig. 1).

few imported luxury goods (high quality stone, jade) may have been secured through the marketing of surplus food, woven cotton goods, forest products from the bajo, or any of the many products identified in the much later tribute lists known from the Valley of Mexico.

The evidence from excavations in Gr. 4H-1 at Tikal reveals evidence indicating that fine pottery was a local product, and suggesting that pottery may have been among the exports from the site. Most if not all types of fine wares were made within the Gr. 4H-1 complex. These goods may have sustained a thriving economy with a very shallow base — an economy easily disrupted by warfare or any number of factors that disturb the socio-economic balance of any region. Replication experiments to reveal techniques of potter firing have not been undertaken by scholars interested in the processes used to produce these wares, except perhaps by a vast array of forgers. The discovery of precolumbian kilns seems to be unreported from any part of the New World. Finding such ancient facilities such as the trench kilns reported by Blinman and Swink (1997) greatly enhance our understanding of production details that may yield clues to Maya ceramic technology. The findings associated with Tikal Gr. 4H-1 provide important hints regarding where we might look to discover evidence of ceramic technology in the Maya lowlands during the Classic Period.

CONCLUSIONS (Directions for Future Research)

These ideas provide us with a vast array of projects for field research that do not involve the excavation of large structures or the search for elaborate and rich burials. Principal among the projects suggested by this research is the excavation of trenches between groups. The location and definition of the nature of boundary markers through tracing them will reveal a great deal regarding the relationships among residential units at a site. In the source of this research random testing «out back» may reveal much of what we have theorized in this paper. The location of specific features, such as kilns (see Becker Ms. A) requires consideration of specific factors that might influence placement. A more clearly defined set of tests directed at determining chultun functions also is recommended.

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